PRINCIPES

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THE INTERNATIONAL PALM SOCIETY

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Front Cover

Nikau palms on Chatham Island, New Zealand. See pp. 145–147. Photo by Dick Endt.

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Principes, 42(3), 1998, p. 123

Editorial

July brings you an article about the use of palms in fishing, several intriguing tales about palms in their native habitats, and some reviews of the rapidly increasing literature about palms.

Fishing, using traps made of palm materials, has been a critical part of the lives of people along the Amazon River for thousands of years, and is still important to many. Francisco Guánchez and Gustavo Romero have observed this practice first-hand, and present an analysis of the palms and how they are used in Amazonas state, Venezuela. Their illustrations show the ingenuity of design using palm materials.

Five papers in this issue deal with certain palms in their wild habitats, providing insights into their ecology, or uses, or cultivation. Paul Craft describes his exciting adventures encountered in searching for the elusive *Thrinax ekmaniana* in Cuba. What a spectacular palm it is, and how wonderful it would be to be able to grow it. Fortunately, it appears that conservation efforts may help to protect this palm in its rugged natural habitat on karst limestone. Wendy Walker and Larry Dorr note how the very popular triangular palm, *Dypsis decaryi*, is used and appreciated by the Tatsimo ethnic group in its native habitat in Madagascar. Francis Kahn and Jean-Jacques de Granville report the rediscovery of a palm after 120 years. This represents an important new record for French Guiana, the more so since *Astrocaryum minus* is endangered. Dick Endt, in another fascinating account of a palm in its wild locality, describes a beautiful form of the Chatham Island nikau palm, at 44 S latitude, the last southern outpost for palms. Finally, J.-C. Pintaud, who is studying the palms of New Caledonia for his doctoral thesis has found and described three new species of *Burretiokentia* with Don Hodel. These are elegant palms, certain to be very desirable for cultivation. *Principes* is now an accredited journal for the publication of new plant names, and we are happy to present these three new species.

A brief report on the accreditation process seems in order. The naming of new species of any plant requires that certain rules are followed. These are laid down in the *International Code of Botanical Nomenclature*, which to many may appear as a dry legal document but is, nevertheless, an essential tool. If a species is to be validly named, then the publication has to follow the rules laid down in the *Code*. A recent recommendation, endorsed at the last International Botanical Congress (where the *Code* is always discussed and, if necessary, modified) is that new names should be registered with a central body, an office of the International Association of Plant Taxonomists in Berlin. The aim is that such registration will help the international botanical community be aware of what is going on in the world of taxonomy and nomenclature and, ultimately, help to maintain nomenclatural stability. Botanical journals are being invited to register with IAPT to become accredited journals for the publication of new plant names. We are proud that *Principes* is now, as of this issue, such an accredited journal.

As usual in our July number, Andrew Henderson provides an annual listing of books and papers on palms that have appeared over the last year. We also provide reviews of a book and an international workshop on Lethal Yellowing.

Please note that in the April issue, Rodrigo Bernal should have been given credit for his striking photo of blue tanagers visiting an infructescence of *Aiphanes aculeata*, which adorns the back cover.

As we prepare this issue we look forward to the Biennial in Thailand. This promises to be a really splendid affair. See you there!

JOHN DRANSFIELD
NATALIE W. UHL

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President's Note

Greetings and hello from San Diego, California. It has certainly been a busy summer for me. The weather is getting warmer and the palms are growing. For those of you in the Southern Hemisphere, I hope your winter has been mild. For you Northerners, I hope your weather is warm and balmy like we're having here in San Diego.

When you get this message, we are going to be very close to the 1998 I.P.S. Biennial in Thailand. It starts on September 11 in Bangkok. If you've procrastinated and still want to go, it might not be too late. Contact Allen Meeting Management or myself immediately. You can also get information on the I.P.S. Home Page (see below). Many volunteers have spent countless hours of preparation to make this Biennial unforgettable.

For those of you who haven't visited it yet, the newly designed I.P.S. Home Page is fantastic. It is offered as a free service to everyone worldwide with an interest in palms. This is one of the things that your dues help fund. It was recently designed and implemented by Jana Meiser and Lynn McKamey, both members of the Society. It is easy to navigate and has lots of interesting information about palms and the I.P.S. It is also the mechanism for subscribing to and participating in two very valuable services. First is the I.P.S. List Server. This is a service that places you in daily communication with palm people across the planet. A topic is suggested and immediately there are responses from all over the globe. It is active, informative and lots of fun. You will receive daily e-mail messages from other subscribers. You can add your comments about any palm subject. With flash sessions scheduled whenever you want them, it just takes minutes to receive your messages from the list server. This service will enhance your knowledge about palms. Another forum of the Home Page is the I.P.S. Bulletin Board. This presents ongoing discussions on anything having to do with palms. Messages are chronologically logged so you can read everyone's comments in order about a given subject. Other interesting things on the Home Page are color images of palms, information about your fellow members and I.P.S. activities, and books for sale by the I.P.S.

If you have a computer and an internet service, it's simple to access the Home Page. The address is http://www.palms.org and once you are there, follow the simple directions on how to become a subscriber to the list server. And it's just that simple. With the list server, you won't have to surf the net to find palm information; waves of palm information will be splashing at you automatically every time you log on! Our thanks go out to Jana and Lynn for their recent work and also to Jim Cain, our Past President and present Corresponding Secretary, who was the original motivation for this service becoming reality.

Enough for now. I'm hoping to see many of you at the Biennial. We'll have a good report in *Principes* soon for those of you who couldn't attend.

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New Species Described in This Issue

Burretiokentia dumasii Pintaud & Hodel
Burretiokentia grandiflora Pintaud & Hodel
Burretiokentia koghiensis Pintaud & Hodel

Principes, 42(3), 1998, pp. 125–135

Palms and Amerindian Fishing in Amazonas State, Venezuela

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Fishing has always been an important activity in most human societies, and currently provides close to 24% of the protein consumed by people worldwide (Sahrhage and Lundbeck 1992). It is particularly critical for tropical forest cultures (Clay 1990, Royero 1994). While fishing methods in marine ecosystems have changed dramatically in the last 50 years, in continental waters, however, fishing methods have not changed much, particularly in tropical regions. To quote Sahrhage and Lundbeck (1992), "...the method[s] of fishing have not, in principle, changed much over thousands of years. Most gear, such as hooks and lines, fish fences, traps and baskets, and various types of fixed and towed nets, are based on primeval types of fishing instruments...."

Palmae is one of the plant families most widely used in the tropics, particularly in the Amazon basin (Balick 1984, Corner 1966, Ortíz 1988). Palms are sources of food and materials for house construction and tool and handicraft making. Because they have fibrous, relatively straight, and flexible stems and petioles, as well as large leaves with numerous leaflets and abundant fruits, palms are the most important plant source of materials for making fishing utensils.

The present work is an overview of the role of palms in subsistence fishing. It does not intend to provide social or anthropological aspects for each of the materials, objects, and techniques described; but rather, tries to deepen our ethnobotanical understanding of the species of palms, the parts used, and the methods and ways in which they are used for fishing. We present information about fishing utensils and techniques in which the native palm species are directly or indirectly used by different indigenous groups from Amazonas state, Venezuela. This information has been derived from more than 10 years of field experience by the authors in the region, a period of time during which palms received special attention, primarily with the Piaroa, Puinabe, Guahibo, and Yanõmami Indians. The field data are complemented by a comprehensive bibliography.

Amazonas state, Venezuela

Venezuela's Amazonas state is situated between 0°40′ and 6°15′N and 63°20′ and 67°50′W. It occupies 180,145 km^2, an area about the size of North Dakota and roughly ten times the size of Switzerland. About 90% of its total area is occupied by forest and 8% by savanna vegetation. Roughly 45% of the state land surface is protected, including the Upper Orinoco-Casiquiare Biosphere Reserve that occupies 83,830 km^2, an area roughly 1.5 times the size of Costa Rica, and all tepuis within the state limits (Huber 1993). Geologically, Amazonas state is on the Guiana Shield and, phytogeographically, in the western Guayana province (Huber 1994).

Amazonas state has an intricate fluvial network characterized by large rivers such as the Orinoco, Ventuari, Ocamo, Padamo, Guainia-Rio Negro, Siapa, Atabapo, and Sipapo. One also finds lowland plains that are flooded most of the year, including large lake-like bodies of water

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1. *Attalea racemosa* (center) and *A. maripa* (above right) in a vegetation island on granite outcrops in northwest Amazonas state Photograph by F. Guánchez.

that are connected to the main course of rivers all year round or only during the high water season.

Amazonas state is rich in fish species, as it shares a large portion of the fish fauna of the Amazon River basin, the richest in the world. There are 14 orders, 56 families, 561 genera, and more than 2680 fish species represented (Smith 1981, Val and Almeida-Val 1995).

The rivers in southern Venezuela can be classified in three categories depending on the geological origin of the soils and vegetation of the terrain they drain. Black water rivers (e.g., Atabapo, Cunucunuma, Río Negro-Guainía, and Sipapo), clear water rivers (Cataniapo, Cuao, and Ventuari), and white water rivers (Orinoco). Black and clear water rivers usually drain old, oligotrophic soils and have low pH, with low values of suspended sediments and nutrient contents. White water rivers originate in the Andes and, in contrast, have nearly neutral pH values, and high levels of suspended sediments and nutrient levels (Fitkau et al. 1975: 289, Weibezahn 1990). The different types of water are significant because they are indicative of the palm flora in a particular region. Moreover, since they differ in nutrient content and transparency, they also determine the variety of fish and their biomass, and therefore the fishing gear and methods employed by the native inhabitants.

During the rainy season, extensive forest areas are shallowly flooded. As the waters rise, many species of fish abandon the river course and migrate into the flooded forest to take advantage of newly available food resources as well as breeding habitats. Fishing is poor during this period, as fish are dispersed over a large area and volume of water (Goulding 1980, Meggers 1971). The logistics of fishing are complicated by the larger fishing area as well as by the submerged obstacles in the flooded forest. In contrast, during the dry season, fish are concentrated in a smaller area and volume of water, where they are more accessible to fishermen. Fishing efficiency increases accordingly.

The groups of Amerindians

The total population of Amazonas state is ~100,000 inhabitants, 50% of whom are Amerindians belonging to 14 ethnic groups: Yanõmami, Guahibo (Hiwi), Piaroa (Uwotuja), Yekuana (Ye'kuana, Maquiritare), Curripaco, Baré, Baniva (Baniwa), Piapoco (Tsatse), Sanema (Sanuma), Puinabe, Warekena, Hoti, Yabarana, and Panare (E'ñapa) (Signi 1988). The most numerous are the Yanõmami (13,000), Guahibo (9970), Piaroa (9964), Curripaco (2603), Ye'kuana (2381), Piapoco (1283), Baniva (1192) and Baré Indians (1136) (Oficina Central de Estadistica e Informatica (OCEI) 1995).

Fishing is a primary subsistence activity in some of these ethnic groups, such as the Makiritare (Wilbert 1966), Piaroa (Manzutti 1988, Wilbert 1966), and Puinabe (Triana 1985) indi-

2. *Euterpe precatoria* (left) and *Mauritia flexuosa* (center) in gallery forest in northwest Amazonas state. Photograph by F. Guánchez.

ans. In other indian groups, such as the Yanõmami, fishing is considered to be a secondary activity (Anduze 1982, Cocco 1972).

The current inhabitants of the upper Rio Negro (Baníba, Baré, Curripaco, and Guarequenas) depend on farming and fishing to provide most of their diet. In oligotrophic ecosystems such as those present in this area, fish are the main source of protein, even though fishing efforts are high and yields low (Clark and Uhl 1987); in the most isolated villages, fishing provides up to two-thirds of the total animal protein consumed. The absence of large fish in these areas forces fishermen to depend on the capture of smaller species, a situation to which they must adapt their fishing techniques.

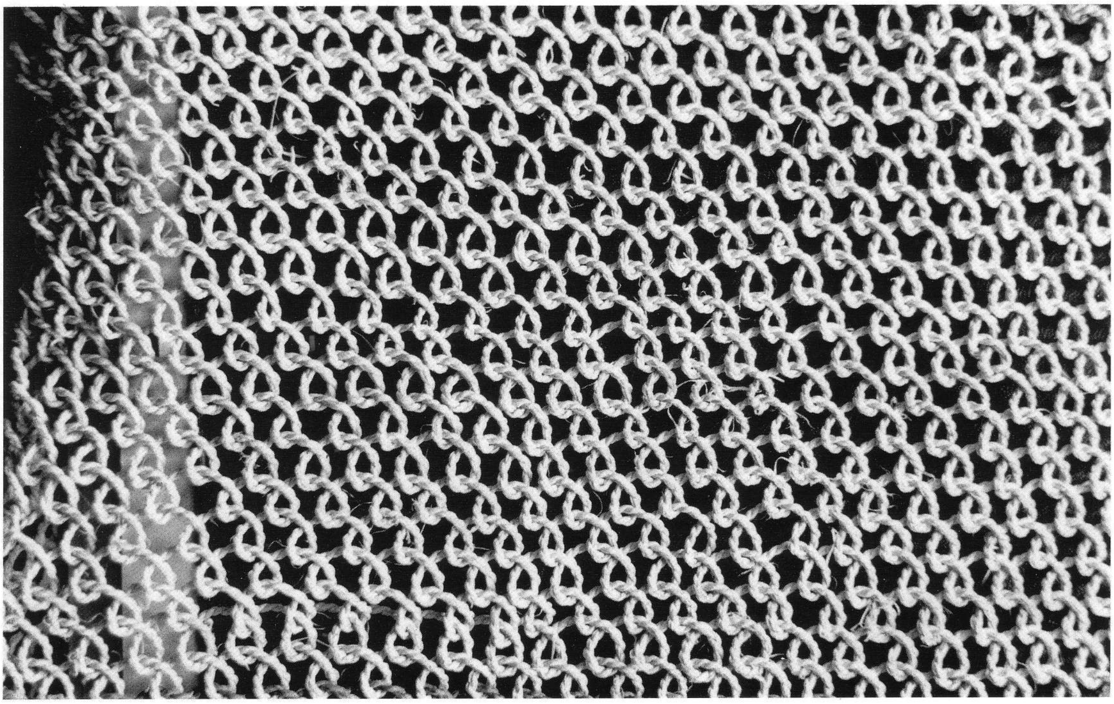
The most complete study to date of Amerindian fishing techniques in Venezuela was carried out by Manzutti (1988), who worked with Piaroa (Uwotuja) indians. This ethnic group lives mainly in forested areas. Manzutti described 17 different fishing techniques. Cocco (1972) and Finkers (1983) provided a detailed description of the social aspects of fishing among the Yanõmami. In this group, however, fishing is not a primary subsistence activity (Anduze 1982, Cocco 1972). Anderson (1978) complemented Cocco's work by presenting a complete description of the use of palms by the Yanõmami in Brazil, and Balick (1980) described the use of palms by the Guahibo in the Colombian llanos (Guahibo indians live primarily in savanna habitats), including some of their uses in fishing. Although both Anderson's (1978) and Balick's (1980) studies were conducted outside Amazonas state, they nonetheless provide information on the two largest indian groups of the state, as well as descriptions and common names that we believe are part of the indian culture.

Palms used

In Table 1 are presented the palm species, habitats, and parts of the palm used in fishing in southern Venezuela; and in Table 2 are presented the indigenous names of the palms.

Patterns of usage

Because of the fibrous nature of their tissues, palms traditionally have been sources of materials for many fishing utensils. Clark and Uhl



3. Woven hand net made with strings from the twisted epidermis of the youngest *Mauritia flexuosa* leaf. Photograph by F. Guánchez.

(1987) stated that the seven most important fishing tools in the upper Rio Negro are spears, spearguns, trot lines, drift lines, poisons ("barbasco"), set lines, and traps. Using these tools, the local inhabitants are able to catch >100 species of fish belonging to >24 families. Of the tools described by Clark and Uhl, palms are used for spears (bows and arrow tips), trot line (fishing line), drift line (buoys made from the petioles of *Mauritia flexuosa,* and fishing lines made from leaf fibers, both materials rarely used locally), in fish poisoning (hand nets made with strings from the twisted epidermis of the youngest *Mauritia flexuosa* leaf (Fig. 3), and rafts made from the petioles of same species), set and trot lines (string made from leaf fibers, now rarely used because of the availability of nylon), and finally traps, in which palm materials play the most important role. In addition, the authors have observed repeatedly Piaroa indians using *Oenocarpus* spp. leaves to wrap fish before they are smoked (Fig. 4). We have also seen smoked fish wrapped in this fashion being sold in Puerto Ayacucho, the capital of Amazonas state.

Baskets and weirs

The most important use of palm parts for fishing in Amazonas state (primarily stems, petioles, and rachises) is as the basic structural elements for making conical baskets, traps, and weirs. The species most widely used for this purpose seems to be *Iriartella setigera.* The stems of this palm are split lengthwise in segments 1–3 cm wide, and these are tied together with the roots of *Heteropsis* spp. (Araceae) to form a fishing fence (Delascio 1991, Rodríguez 1995; personal observation). Occasionally, rope made from the fibers of *Leopoldinia piassaba* are used to tie the stem segments. Shorter segments (30–50 cm) are often tied together to cover fish placed in the bottom of dugout canoes to protect the day's catch from the sun (personal observation). The sectioned petioles of *Attalea maripa* or *Leopoldinia piassaba* are also used to make fences, as well as baskets and traps. Short-lived damming and channeling fences can be made from palmate leaves of regularly arranged, rigid leaflets: the species most commonly used are *Attalea racemosa* and *Oenocarpus bataua.*

The weirs and fences used to direct the flow of fish are generally made from the leaves of *Attalea racemosa, Oenocarpus bataua,* or *Leopoldinia piassaba*; occasionally they are made from longitudinal sections of the stem of *Iriartella setigera.* These stem sections, however, are used primarily to make fish traps.

Traps

Fishing traps used by Amerindians of Amazonas are here classified as passive or active. Passive traps are the most widely used, and consist of a rigid structure into which the fish enters, attracted by bait; or guided by the current and by fences fixed to the river bottom. Fishing with these traps and fences is generally done by positioning in the mouth of the river, creek, or rivulet a fence or a "stopper" (Fig. 5) that can be as wide as 50 m (Manzutti 1988, Fig. 6); these are placed when a rapid drop in water level is expected. The fences are fixed to the bottom in such a way as to direct the flow of fish to one or more points where cage-like traps are set, so that fish can easily enter but cannot easily leave. Once trapped, the fish remain alive for several days, and are taken out as needed using an arrow or a spear.

The size of the fences and passive traps can vary greatly. They are placed in the mouth of creeks or medium-size rivers, in arms of larger rivers, or in flooded areas. In the last case, sticks and poles are used as fences (Triana 1985), and the passive traps consist of elongated baskets known as "cacures," in which small fish are trapped.

Active traps function through a tension-based mechanism released by a trigger. The tension is supplied by a bent branch or stem close to shore. In basket-based traps, the trigger is activated when a fish pulls the bait tied to the inside of a conical basket made from the stems of *Iriartella setigera* or petioles of *Attalea maripa.* When the tension is released, both the basket and the fish are pulled out of the water; the fish can be retrieved from the basket later. This type of trap is known as "wibrg" in Puinabe. Other active traps also take advantage of the tension provided by a bent stem or branch, but have only a piece of string and a baited hook. The string may have been made from palm fibers in the past, but nowadays it is made from artificial fishing lines. The basket-based trap has three important advantages over other active traps: it does not require a fishing hook; the fish is removed entirely from the water, where it is protected from other fish or other animals (usually aquatic arthropods) that could damage it; and basket-based traps have a high rate of success, whereas hooks may miss, or in other traps, the bait may be consumed without activating the trap. Basket-based traps do have a drawback: they have to be checked at least twice a day to keep the catch from rotting. Active traps are used mainly in slow-moving waters or in flooded areas.

The basket-based active trap has been cited by Crevaux (1883), Koch-Grünberg (1971–1924, 1979), Triana (1985), and Rollero (1994), who described details of its workings. It is difficult, however, to understand the functioning of the trap based on these descriptions (including ours) alone, a limitation that prompted us to include here a detailed line drawing (Fig. 7).

Rafts and buoys

Guahibo indians use the petioles of juvenile plants of *Mauritia flexuosa* to make small rafts used to collect stunned and dead fish from small lagoons where they have poured fish plant poison known as "barbasco" (Balick 1980). Quantities of these petioles are lashed together, and the fisherman float on this platform to spread the barbasco and scoop up the fish.

Nets

Indians use both hand nets and large, weighted fishing nets. Hand nets are used to capture small fish or to collect dead fish from bodies of water where indians have poured barbasco (Balick 1980, Rodríguez 1995). A hand net has two parts: the frame or support, and the net itself. The frame is made from a bent piece of wood (Signi 1988) taken from the aerial roots of epiphytic *Clusia* spp. or *Norantea guianensis* Aubl. The root is cleaned, and then heated over a fire and twisted into a circle. The two ends are tied together and used as the handle. The frame is sometimes made from flexible wood taken from the stems of *Geonoma deversa* (Balick 1980). Yekuana indians make the net from the fibers of a cultivated plant, "Kurana" (*Ananas lucidus* (Baker) Miller, Bromeliaceae). Guahibo and Piaroa indians, however, weave their hand nets with fibers obtained from the tender leaves of *Astrocaryum* sp., and *Mauritia flexuosa* (Fig. 3). Koch-Grünberg (1917–1924, 1979) found similar hand nets among other indian groups in the Amazon River basin.

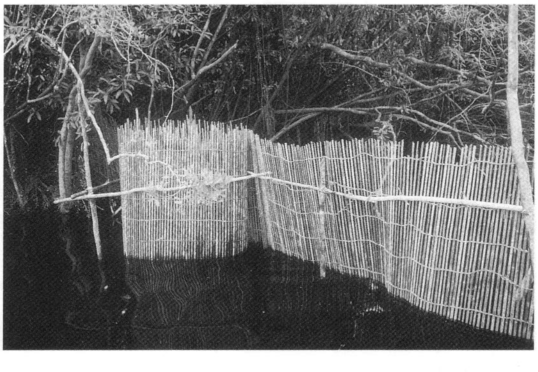
Another type of fishing basket, known as Käwi'ta, is made from twisted fiber of "chiquichiqui" (*Leopoldinia piassaba*): it has the shape of a truncated cone and a handle made from the same material (Signi 1988). These baskets are 36 cm high and 20 cm in diameter (Signi 1988).

Before the introduction of synthetic fibers (e.g., nylon), large regular and casting fishing nets were woven with string made from *Astrocaryum* spp. and *Mauritia flexuosa.* Smith (1981) reported the use of nets made from "tucu" fibers (*Astrocaryum* spp.) in large ships navigating up and down the Amazon River; the catch was used to feed the passengers and the crew. Nowadays, however, these nets are made from artificial fibers.

Lines

In the past, as with large fishing nets, strings made with fibers of *Astrocaryum* spp., *Mauritia flexuosa,* and *Ananas lucidus* were used as fishing lines. Currently, however, they are rarely

4. Fish wrapped with *Oenocarpus* sp. leaves before and after smoking. The wrapping also serves to protect the fish during transportation. Photograph by G. Romero.



5. Fishing fence used as a passive trap or "stopper," made from split stems of *Iriartella setigera* with a cage-like fishing trap at one end of the fence. Photograph by G. Romero.

Table 1. Palm species and their parts used in fishing by Amerindian groups in Amazonas state, Venezuela.

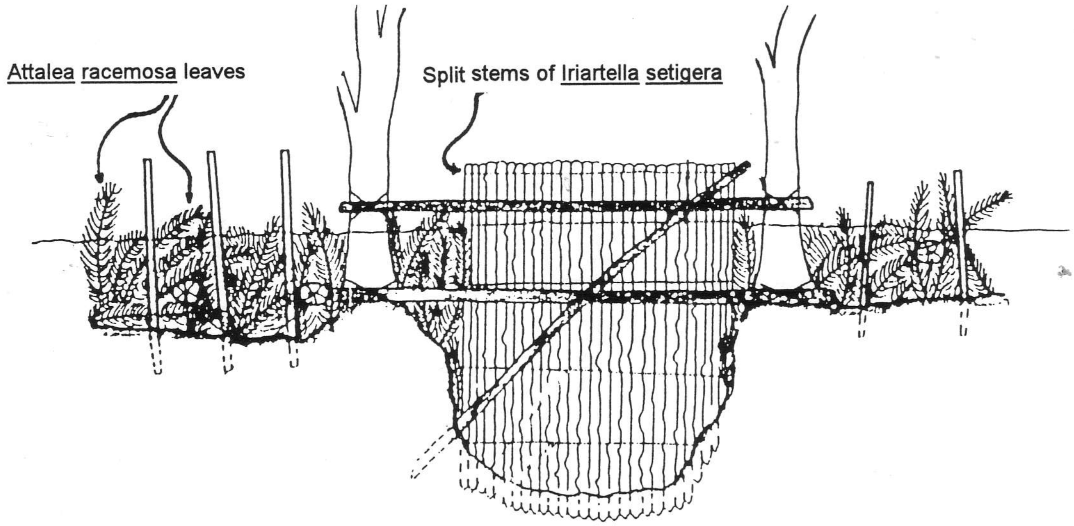
Species[1]	Subfamily, Tribe, Subtribe[2]	Habitats	Part(s) Used	Article(s) Made
Astrocaryum aculeatum G. Mey.	Arecoideae, Cocoeae, Bactridinae	Disturbed habitats around abandoned Amerindian settlements.	Fiber from young leaves	Fishing string
Astrocaryum chambira Burret		Disturbed habitats around abandoned Amerindian settlements.	Fiber from young leaves	Fishing string
Astrocaryum gynacanthum Mart.		Very common and abundant in lowland rain forest on terra firma.	Fiber from young leaves	Fishing string
Astrocaryum jauari Mart.		Very abundant and common along forested margins of larger rivers.	Fruits	Fish bait
Attalea maripa (Aubl.) Mart. (Fig. 1)	Arecoideae, Cocoeae, Attaleinae	Well-drained soils, in gallery forest, the periphery of savannas, and particularly abundant in disturbed habitats.	Petioles, larvae found in fruit	Fences, baskets, arrow tips, and fish bait for traps
Attalea racemosa Spruce (Fig. 1)	Arecoideae, Cocoeae, Attaleinae	Understory of open forest or in pasture lands in disturbed habitats.	Mature leaves	Fishing fences
Bactris gasipaes H.B. and K.	Arecoideae, Cocoeae, Bactridinae	Always cultivated and often found around abandoned indian settlements. This is the only palm cultivated by the indians of this region.	Stem wood	Bow and arrow tips
Euterpe catinga Wallace	Arecoideae, Areceae, Euterpeinae	Upper part of flood plains.	Fruits	Fish bait
Euterpe precatoria Mart. (Fig. 2)	Arecoideae, Areceae, Euterpeinae	Lower part of flood plains and by the side of rivers.	Fruits	Fish bait
Geonoma deversa (Poit.) Kunth	Arecoideae, Geonomeae	Understory of well-drained, dense lowland forests.	Stem	Frame for hand nets
Iriartella setigera (Mart.) H. Wendl.	Arecoideae, Iriarteeae, Iriarteinae	Understory of lowland forest <1000 m altitude.	Stem wood	Poles for fences, cacures, arrow tips
Leopoldinia piassaba Wallace	Arecoideae, Areceae, Leopoldiniinae	In dense stands in the upper part of flood plains in podzolic soils associated with Amazonian caatinga forest.	Fibers and leaves	Fishing string and fences
Mauritia flexuosa Linn. f. (Fig. 2)	Calamoideae, Lepidocaryeae	Widespread in the Amazon and Orinoco River basins, in saturated and/or seasonally flooded soils.	Petioles, fibers from young leaves, and fruits	Buoys, balsas, fishing string, and nets
Mauritiella aculeata (Kunth) Burret	Calamoideae, Lepidocaryeae	In large populations in the sandy flood plains of black water rivers.	Fruits	Fish bait
Mauritiella pumila Wallace[3]		Upper part of flood plains in savannas and open forest.	Fruits	Fish bait
Oenocarpus bacaba Mart.	Arecoideae, Areceae, Euterpeinae	Widespread and frequent in lowland, well-drained rain forest north of the Amazon River.	Stem and fruits	Bow and bait
Oenocarpus bataua Mart.		Widespread in well-drained and upper flooded plains of the Amazon and Orinoco basin <1000 m altitude.	Stem, leaves and bait	Bows, arrow tips,
Socratea exorrhiza (Mart.) H. Wendl.	Arecoideae, Iriarteeae, Iriarteinae	Locally frequent in small populations in lowland forests <1000 m altitude.	Stem wood	Bows and arrow tips

[1] Names based on Henderson (1995).
[2] Classification based on Uhl and Dransfield (1987).
[3] This is a species similar to *M. aculeata* but differs in several important features, such as being solitary, and having smaller stems and leaves.

Table 2. Common names of palms used in fishing in southern Venezuela.

Scientific Name/ Ethnic Group	Criollo	Baniva	Baré	Kurripaco	Guahibo	Panare	Piapoco	Piaroa	Puinabe	Warequena	Yanomami	Yekuana
Astrocaryum spp.	Cumare	Dumestri		Kumaria	Kumari	Amankayo'		Yarí	Kumaki		Akiwato, Uri Xohomo, Ai-amo, Mahã Kareshi	Kumadi, Wuaju, Zawara'-si
Astrocaryum jauari	Albarico											
Attalea maripa (Fig. 1)	Cucurito	Alitsi	Okalisi	Kwéterri	Najjarebo	We'sae		Wä'chä	Waibi	Okarisi	Kereshi kësi, Okolaxi	Washa
Attalea racemosa (Fig. 1)	Mavaco	Ekuru		Kuiapé	Mavako			Kusi, Ku'si				Mavako
Bactris gasipaes	Pijiguao	Wepi	Bubi	Pipirri	Jipiri			Pajare, Pajarí	Muri	Pipiri	Rasha, Lasa	Fijidi Jijiri
Euterpe catingae								Mana'ka				
Euterpe precatoria (Fig. 2)	Manaca	Mana	Manaka	Manáke	Manakai	Anku'		Neneä, Nene'a	Yot-pigot	Manaka	Waima, Maimal, Manaka kési	Wajü
Geonoma deversa	Molinillo										Wanama, Miyoma kë henaki, Misikiri, Pafa kë-si	Manasa
Iriartella setigera	Mabe, Cerbatana	Mawi		Máwi	Liwai			Yuruwäna, Yurua	Te yon		Yoroama	Yuduwa, Widima Iuruha
Leopoldinia piassaba	Chiquichiqui	Malama	Titía	Maráma	Sikisiki		Maráma	Marama	Maramaká	Malama	Reae kë-si	Madama, Marama
Mauritia flexuosa (Fig. 2)	Moriche	Tewi	Iseguí	Itéwi	Inojo	Ankayano	Idew	Warí		Itebi	Eteweshikë-si Liökoho	Ku'jai, Kuia Cuhuai
Mauritiella aculeata	Morichito							Uriá			Dorea	
Mauritiella pumila	Morichito sabanero							Siná				
Oenocarpus bacaba	Seje chiquito, Sejito, Macaba	Upeli		Púperri	Ojjou			Pjo ü puori	Yium		Haprua massi, Hokoma	Kuhëdi
Oenocarpus bataua	Seje grande, Kurumo	Yäu	Guaramo	Punáma	Ojjou			Bareu puori, Isoi	Wo	Yaro	Hoko kë maki' Kujedi, Konani Hoko	Kudai
Socratea exorrhiza	Macanilla, Cola de pava	Upa	Kuba	Púpa	Misiboto		Po'a	Poabä,	Kupa		Yei, Manaka	Kuhaka

Names adopted from Anderson (1978), Boom (1990), Civrieux (1957), Civrieux and Lichy (1951), Delascio (1992, 1991), Fuentes (1980), Lizot (1991), Masutti (1987), Signi (1988), Triana (1985) and notes of the authors.



6. Schematic illustration of the fishing fence used as a passive trap or stopper. From Mansutti 1987.

used because of the wide availability of synthetic fishing lines that are both stronger and resistant to rotting.

Weapons

Hard tissues of palms (stems and petioles) are used to make fishing weapons such as bows, bow strings, and arrow or harpoon heads (Anduze 1982; Cocco 1972; Koch-Grünberg 1917–1928, 1979). Bows are made mainly from the stem of *Bactris gasipaes, Socratea exorrhiza,* and *Oenocrapus* spp. (Anderson 1978, Cocco 1972). Bow strings are sometimes made from fibers of *Astrocaryum* spp. or *Mauritia flexuosa.* The preferred fiber, however, is extracted from the leaves of *Ananas lucidus* (Cocco 1972). Arrow and harpoon heads are made from the stems of *Astrocaryum* spp., *Bactris gasipaes, Iriartella setigera, Oenocarpus* spp., and *Socratea exorrhiza* (Anderson 1978, Cocco 1972).

Arrow tips are made from the stems of *Bactris gasipaes, Socratea exorrhiza, Iriartella setigera, Oenocarpus bacaba,* and *Attalea maripa.* They are tied to one extreme of a dry cane, *Gynerium sagittatum* (Aubl.) Beauv. (Poaceae) using a string made from the fibers of *Ananas lucidus* (Cocco 1972), "cumare" *Astrocaryum* spp. (Smith 1981), or "moriche," *Mauritia flexuosa* (personal observation).

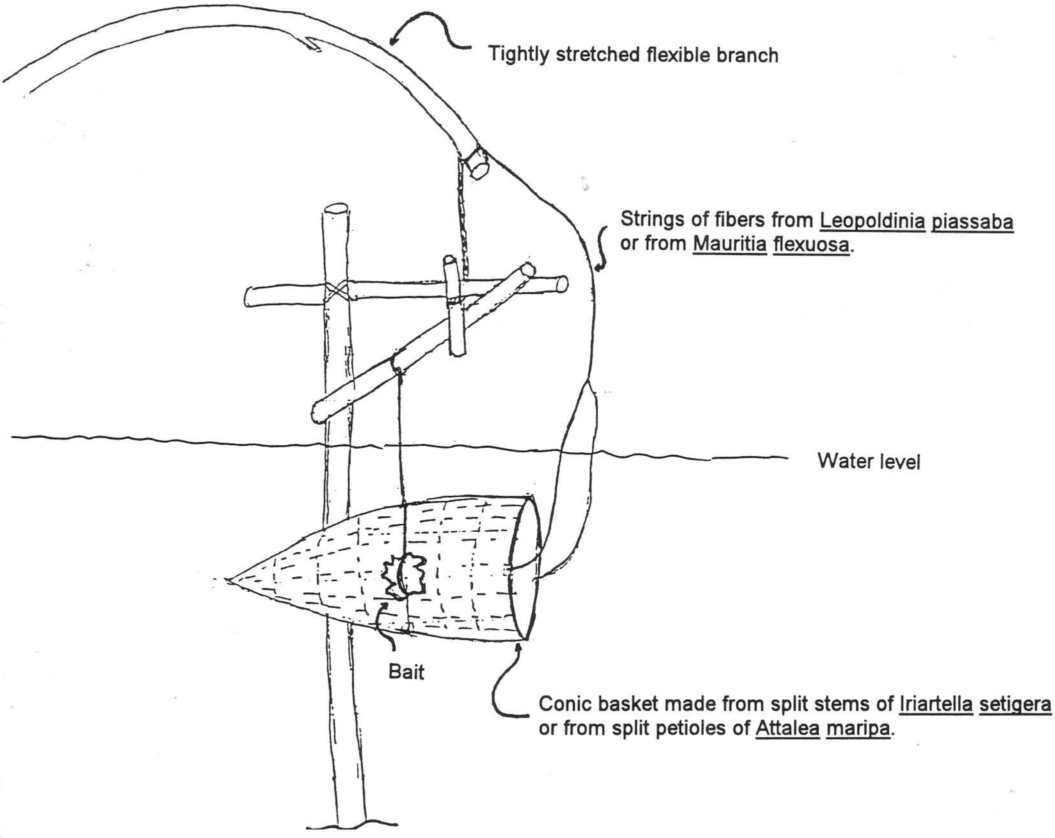
Among the Yanõmami, the arrow tips used for fishing are known as "rakukëmasi." They are sometimes polished and sharpened wood chips made from the petioles of *Attalea maripa*; they are apparently used to catch small fish (Cocco 1972).

Fish bait

The fruits of many palms, or larvae found therein, are used to bait hooks and fish traps (Rodríguez 1995; personal observation). Fish are important fruit-dispersing agents for palms: Goulding (1980) reported the presence of fruits of *Euterpe precatoria* and *Bactris maraja* in *Colossoma bidens*; those of *Astrocaryum jauari* in *Colossoma bidens, C. macropomum* and *Brycon* sp.; and those of *Oenocarpus bacaba* in *Brycon* sp. According to Goulding (1980), *Colossoma* and allied genera consume large amounts of palm fruits, and are perhaps their most important dispersal agents.

Discussion

The utilization of palm materials can be combined in different ways depending on the ethnic group and its habitat, including such variables as the water chemistry (clear, black, or white waters), and the water level and other physical characteristics (e.g., rising vs. falling water level or slow vs. rapid current) of the river(s) where they fish. Another important factor is the availability of suitable palm species. As Anderson (1978) stated, "In tropical South America, the



7. Schematic illustration of an active trap known as "wibrg" in Puinabe. Drawing by F. Guánchez.

general cultural levels are determined historically rather than by the local plant resources, for no fundamental culture traits appear to depend directly on the botanical environment. Tropical South American indians show exceptional ability to discover substitutes wherever a vegetal species is lacking."

Thus, as the "ideal" palm species become scarce it may be replaced by another, often less-suitable species. Therefore, although we cite the traditional or most commonly used palm species for a particular piece of fishing gear, the reader must keep in mind that it might occasionally be made from other species of palms—or even of other plant families, particularly other monocots (e.g., Aracea, Marantaceae, and others).

Currently, most indian groups in Amazonas state (including those that have been traditionally nomadic) are settling down in towns and villages serviced by government agencies. This process may have been triggered by the desire of the regional and national governments to provide services to indian communities. The price tag for such services is much lower for sedentary than for nomadic indian groups (Signi 1988). Signi (1988) points out that, in the case of Guahibo indians, fishing has become more and more important as they become settled in permanent villages, particularly as game animals and other sources of protein are depleted in the surrounding habitat. This may be a general tendency in the region; hence fishing may become one of the most important subsistence activities in Venezuela's Amazonas state.

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Principes, 42(3), 1998, pp. 136–139

A Note on Indigenous Uses of *Dypsis decaryi* in Southern Madagascar

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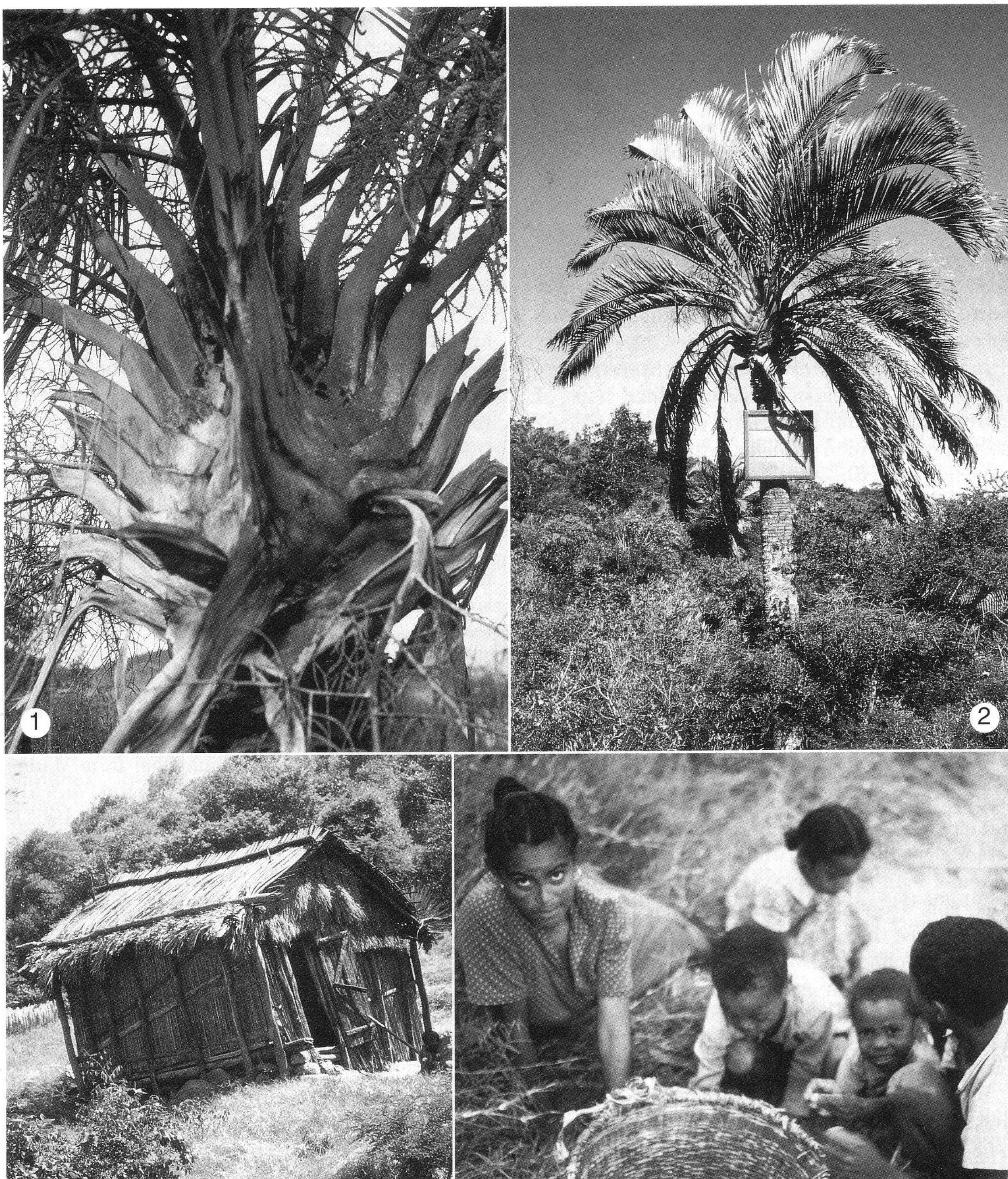
Despite now being fairly well known in cultivation, the Madagascar "triangle palm" *Dypsis decaryi* (Jum.) Beentje & J. Dransf. (formerly known as *Neodypsis decaryi* Jum.) is very narrowly restricted in its native range in southeastern Madagascar (Fig. 1). It is known principally from parcel number 3 of the Andohahela nature reserve (Réserve Naturelle Intégrale d'Andohahela), a 500-ha portion of the reserve that was established by the French colonial government in 1939 specifically to protect this palm species (Fig. 2). Parcel number 3 is just west of the village of Ranopiso and about 40 km northwest of the provincial capital of Fort Dauphin. More importantly, and perhaps explaining the triangle palm's narrow range, the palm is found in an area of transition between the spiny forest to the west and the humid forest to the east. Isolated individuals of the palm exist beyond the reserve borders for several kilometers, but the number of palms outside the reserve continues to diminish. Dransfield and Beentje (1995:187) recently estimated that a mere 1000 trees exist in the wild.

During the course of anthropological field work, one of us (WW) lived in various Tatsimo villages in southern Madagascar from 1994 to 1996. While the focus of this field work was to compare Tatsimo or indigenous concepts of nature to Western ideas regarding conservation, there was ample opportunity to observe how villagers interacted with specific plants in their environment. The local population of the Tatsimo ethnic group, which inhabits the perimeter of parcel number 3 of the Andohahela reserve, places its own value on trees of *Dypsis decaryi*, which they know as *làfa*. Although recent studies (Ratsirarson 1993, Ratsirarson et al. 1996, Ratsirarson and Silander 1997) of the population biology and conservation of *D. decaryi* have alluded to this, few detailed descriptions of Tatsimo or other indigenous uses of the palm exist. Oliver (1886:83) included *làfa* among the native plants used for making rope and twine, but he neither identified the plant nor provided details as to its provenance. Decary (1964) simply noted that the leaves of *D. decaryi* were formerly used for thatching roofs, while Dransfield and Beentje (1995:187) reported without elaboration that the leaves are used for thatching, the fruits are eaten by children, and the fruits were formerly used to prepare a fermented drink. Presumably the sources of Dransfield and Beentje's information were local contacts whom they interviewed in 1989 and 1992 when they collected herbarium material in the reserve and Ranopiso. In addition, they noted that almost all the seed of *D. decaryi* now is harvested for export to satisfy the horticultural trade (and undoubtedly to create a source of cash income for those living near the reserve). We can confirm that the Tatsimo indeed use *D. decaryi* for the construction of houses, as a source of food, and more recently, as a commodity. That the economic value assigned to this palm has changed over time, in large part due to the palm's status as a protected species, is an important, and usually neglected, piece of information to add to a broader understanding of the history of conservation and human–environmental relations in Madagascar.

The Tatsimo villages that now surround parcel number 3 of the Andohahela reserve were first established at the turn of the century. Families moving up from the southern coast, some 20 km away, in search of new lands for farming and cat-



1. The Madagascar "triangle palm" *Dypsis decaryi*. 2. *Dypsis decaryi* marking the boundary of parcel number 3 of the Andohahela reserve. 3. A Tatsimo house thatched with *Dypsis decaryi*. Note the palm behind the house and the maize (corn) drying in the sun. 4. Tatsimo children eating the fruits of *Dypsis decaryi*, which they have gathered in a basket.

tle grazing, were the pioneers. These settlers used the wood of *Dypsis decaryi* for the construction of houses. The outer walls of their traditional one-room rectangular houses (normally 3 × 4 m) were made of palm planks that villagers valued for their physical characteristics. These planks are very light and durable when dried, they are porous and "breathe" well in the hot climate, and they are labor effective, since the trees are easy to fell. The petioles and leaves of the palm were used to thatch the roofs (Fig. 3), providing shelter from the sun and protection from the misty rains that fall during the winter months of June to August. Beyond their utilitarian merits, the palm trees also created a valued sense of egalitarianism and uniformity among the Tatsimo. They provided villages with a shared raw material that villagers transformed into an aesthetic and an architecture characteristic of this particular corner of Madagascar.

The 1939 French colonial decree that created the Andohahela nature reserve also established a new set of rules that forbade the cutting of *Dypsis decaryi* within the reserve boundaries. More recent state forestry regulations have made it mandatory for people to get permits to cut trees for construction. In many cases the permits must be purchased, and so wealth and access to money have increasingly become factors determining the types of houses being constructed, and have had an impact on other community and personal values as well. Although houses thatched with *làfa* leaves are cooler, corrugated iron roofs are sought today for their durability and because they constitute evidence of wealth. A *làfa*-thatched house, ironically, has now become a sign of a person or family without means. At the same time, the ability to gather palm leaves has also been hindered by the fact that few palms remain outside of the reserve.

While *Dypsis decaryi* is less frequently used now by the Tatsimo for construction, it continues to be used in another and rather different way. It is a favorite sweet and snack for children and occasionally adults. Young boys who tend to the family cattle, head each morning into the hills and collect large baskets of the fruits (during the months of January–March). The small green fruit, which is about the size of a large marble, has a smooth, thick epicarp that peels away to display a thin, custard-like mesocarp covering the fibrous endocarp. Children either gnaw on the fruit as a snack (Fig. 4), or bring home the baskets of fruit and empty them into a large rice mortar. Small amounts of water are added to the mortar, and as the fruits are pounded, the epicarp separates and the custard-like mesocarp is loosened and mixed. After all the fruits have been opened and thus processed, the mixture is served in large bowls and eaten with spoons. It tastes like a sweet vanilla-coconut custard.

In the past 10 years, a new source of demand for *Dypsis decaryi* has been created that extends well beyond the reserve's meager boundaries. With the growth in popularity of *D. decaryi* as an ornamental, villagers have often been approached by outside middlemen to collect the seeds for overseas markets. In 1995, the price received per large basket of seed (roughly 2 kg) was 2000 FMG or 50 cents US. This is a phenomenal price when compared to the price of rice, the staple crop in Madagascar, which at the same time sold in local markets for 500 FMG per *kapok*. (A *kapok* is an unusual, but fairly standard measure throughout Madagascar for dried rice. Often an empty tin can, a *kapok* is more or less equivalent to an 8-oz cup.)

We do not know when *D. decaryi* was first introduced into cultivation. The first herbarium specimens date from 1928 and the species was first described in 1933. The Fairchild Tropical Garden in Miami acquired material from Madagascar in July 1947 and the palm quickly showed its ornamental potential (Read 1961). Collections in other botanical gardens such as the Longwood Gardens, Kennett Square, Pennsylvania, can be traced to material provided by Fairchild. It is only in recent years that seed of *D. decaryi* has become more widely available in the horticultural trade.

Western interest in *Dypsis decaryi,* whether it be for its conservation or horticultural potential, is but one recent development in the history of this species as it relates to both the human and natural environment. What is remarkable is that not only are the small native populations of *D. decaryi* in Madagascar affected by the use the Malagasy make of the palm, but also that foreign definitions of the value of the palm and the proscriptive behavior patterns that are dictated by conservation concerns have an impact on the cultures and societies of the area. As we have tried to suggest with this example, the history and social aspects of plants, while often neglected by botanists and conservationists, are, or should be, very much part of the ethnobotanical and conservation picture.

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PALM LITERATURE

PROCEEDINGS OF AN INTERNATIONAL WORKSHOP ON LETHAL YELLOWING-LIKE DISEASES OF COCONUT, ELMINA, GHANA, NOVEMBER 1995. S. J. Eden-Green and F. Ofori (eds). Natural Resources Institute, Chatham, UK. 1997.

As a past chairman of the now-defunct International Council on Lethal Yellowing. I am aware of the benefits of international conferences and happy to review this workshop. A workshop is an opportunity for scientists working on these diseases, and for administrators responsible for dealing with the social and economic consequences, to record research and experience that would not be published in scientific papers. These particular proceedings are interesting reading and a valuable reference. The information is, however, two years old.

The papers presented describe much information that is already well known to those of us involved in Lethal Yellowing (LY) but the basic facts listed below bring us up to date, inform us on how much progress has been made with this difficult problem, and enable us to determine the next steps.

LY-like diseases are caused by phytoplasms (previously known as mycoplasma-like organisms or MLO) in the phloem. The incubation period for Caribbean LY ranges from 3–9 months in young coconut palms to 7–15 months in mature palms.

The symptoms briefly comprise (a) yellowing or browning of fronds commencing with the oldest, (b) abscission of immature nuts, (c) necrosis and drooping of young inflorescences, (d) necrosis and wilt of the "spike" (youngest frond), and (e) death.

The vectors of phytoplasms are phloem-feeding leafhoppers and planthoppers. The vector of LY in Florida was found to be *Myndus crudus* van Duzee, which is common in coconut areas and breeds on the roots of several tropical lawn grasses. One might comment that searching for the vector(s) of other LY-like diseases of coconut is very onerous and not likely to lead to a cure. LY does not appear to be transmissible in coconut seeds.

LY-like diseases have so far been found in the Bahamas, Belize, Cameroons, Cayman Islands, Cuba, Dominican Republic, Ghana, Haiti, Jamaica, Kenya, eastern Mexico, Mozambique, Nigeria, Honduras, Tanzania, Togo, and mainland USA. History indicates that more countries will soon be added to this list, e.g., the Ivory Coast and Nicaragua. Of importance but seldom mentioned are countries where LY-like disease DOES NOT occur, e.g., Benin, Sao Tome, the Ivory Coast, St. Lucia, Costa Rica, Puerto Rico, and the Pacific coast of Central America. Such countries might constitute a source of coconut germ plasm without the taint of LY-like disease, provided that no other coconut disease or pest is present.

Diseased palms exhibit many physiological and biochemical abnormalities, some of which have been studied historically as causes of the disease and are still being studied. However, it seems probable that these abnormalities are caused by the disease rather than causing it.

(Continued on p. 144)

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The Centre for Economic Botany at Kew

Research into useful and potentially useful plants has been undertaken at the Royal Botanic Gardens, Kew since its earliest days. Indeed, it could be argued that the initial establishment and growth of Kew were as much thanks to an economic interest in useful plants as it was a desire to create a beautiful garden. The first official Director of Kew, Sir William J. Hooker, understood only too well the importance of plants to society and in 1847 established the Economic Botany Collections to "render great service, not only to the scientific botanist, but to the merchant, the manufacturer, the physician, the chemist, the druggist, the dyer, the carpenter and the cabinet maker and artisans of every description, who might here find the raw materials employed in their several professions correctly named."

The collections were originally on display in the world's first Museum of Economic Botany, which opened in 1847. In the mid-1980s the collections, comprising nearly 75 000 specimens, were removed from display and stored in the newly constructed Sir Joseph Banks Building, named after Kew's most famous economic botanist and its (unofficial) director from 1773 to 1820. The Banks Building also houses the Centre for Economic Botany (CEB), which was formed in 1994 to co-ordinate all Kew's scientific efforts relating to plant use. The collections include a wide variety of material ranging from unprocessed, herbarium-type specimens, to processed items and artefacts, and from wood samples to plant material preserved in spirit. Hours are easily spent browsing through the collections, which include 1 676 palm accessions, in the discovery of all manner of weird and wonderful plant products and artefacts from around the world. One cannot fail but to be amazed by the diversity of uses to which plants are put, and the cultural diversity and human ingenuity that underlie this creativity and inventiveness.

From the earliest days of the collections details of each new accession were painstakingly written out in large, leather-bound ledgers, which together made the Museums Catalogue. Although all information included in the Museums Catalogue was transferred in 1986 to the computerized Economic Botany Collections Database (which records details of the origin, manufacture, taxonomy, geography, uses, and vernacular names of new accessions), the dusty, hand-written ledgers are still a useful resource, not to mention a fascinating insight into the history and spirit of the first days of economic botany and plant-hunting. These catalogues are filled with descriptions of palm artefacts given to Kew by famous plantsmen such as Joseph and William Hooker, Richard Spruce, J. W. H. Trail, and William Griffith. The first catalogue begins with a description of the donation of "the extensive private collection of Sir W. J. Hooker which he has presented to the Garden consisting of fruits dry and in spirits; seeds; specimens of woods; stems of palms and tree ferns; drugs; resins; specimens of Proteacea; collection of fungi; and a collection of drawings etc."

Opening another catalogue at random to the year of 1852 shows accessions given by Price's Patent Candle Company of "samples of palm (carnauba palm, *Copernicia prunifera*) and cocoa nut oil in a raw state and in different stages of preparation for the manufacture of candles...," and by Richard Spruce of "mat made at Myobamba in the Peruvian Andes of the young fronds of the Muriti palm (*Mauritia* sp.) and a magueira (hammock) made by Indians on the Rio ?Mapo, of the young fronds of the Tucúm palm (*Astrocaryum aculeatum*)." An entry from December

1874 records the accession of palm artefacts from India donated by a Dr. Thwaites including a "squeezer made of *Calamus rudentum* used by native doctors to extract oil from medicinal seeds, a stand for curry and rice pot made of *Calamus tenuis,* a bag for extra fish hooks made of the leaves of *Borassus flabelliformis* and a broom made of strips of the leaves of *Corypha umbraculifera.*"

Complementary to the Museums Catalogue is the CEB's Economic Botany Bibliographic Database, which contains over 150 000 literature references to uses of plants from around the world (excluding major crop species). Each new bibliographic reference is included with selected key words (relating to geography, taxonomy, use, and/or properties), which act as pointers to that reference in the future. Key words help to make the database a unique resource by enabling instant and flexible access to detailed information using a range of identifiers. A general enquiry using the key words "palmae" identifies 1 235 bibliographic references dating back to the late 19th century, many of which are found in the Economic Botany Library in the CEB. A search using the key word "*Hyphaene*" generates a list of 88 references relating to *Hyphaene* taxonomy, ecology, and utilization.

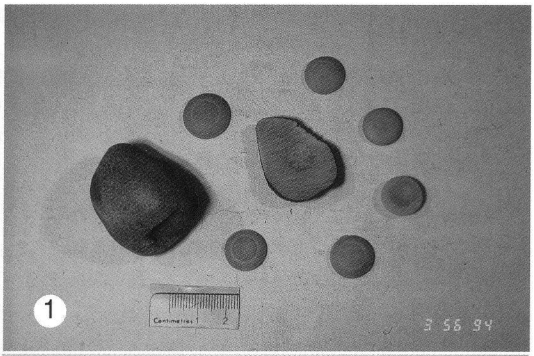
The CEB is also the home of the Survey of Economic Plants for Arid and Semi-Arid Lands (SEPASAL), which is a major database focusing on the uses of over 6 000 dryland species, mainly from the tropics and subtropics. The database records scientific and vernacular names, distribution, environmental tolerances, uses, plant descriptions, cultivation and production details, and reference sources and palm species, such as *Phoenix dactylifera, Borassus flabellifer, Livistona carinensis* and *Sabal uresana.*

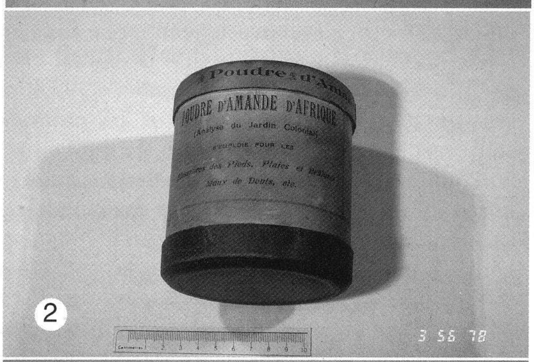
Given the unique collections and information resources at CEB it is not surprising that it is able to provide comprehensive and authoritative answers to all manner of questions concerning economically important plants. On average, 700 enquiries are answered each year from botanists, economic botanists/ethnobotanists, archaeologists, anthropologists, NGOs, commercial companies, and members of the public. By running the enquiry service the CEB is encouraging dissemination of useful information to those who most need it. The service also increases CEB awareness of new projects and ventures (academic, commercial or development-oriented) involving plant use, and this knowledge can be useful in directing economic botany research objectives. For example, a spate of totally unrelated enquiries on African *Hyphaene* has highlighted the need for a taxonomic revision of the genus for which funding is currently being sought.

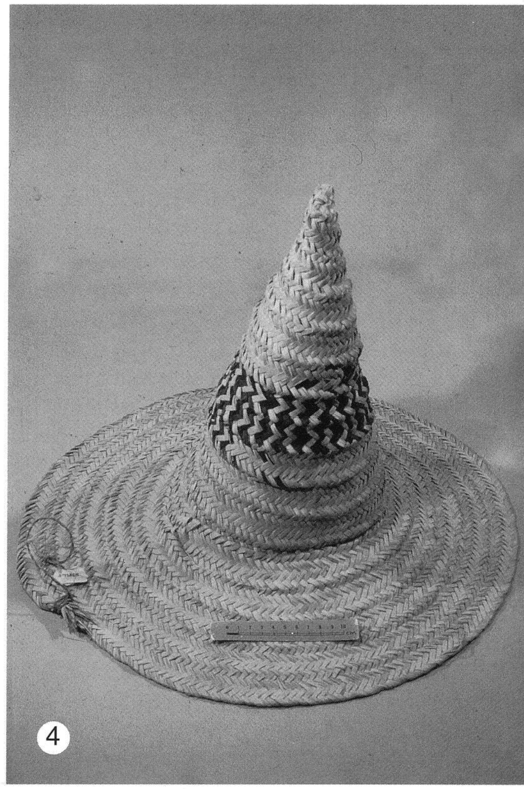
Update and Review of Palms in the Economic Botany Collections at the CEB

As with all museum collections the Economic Botany Collections must be regularly reviewed and updated in a systematic manner so as to enhance their intrinsic value and maximize their usefulness. From June to September 1997 I undertook a review and update of all palm resources at the CEB, including the collections and related databases, to ensure that all palm information is in line with modern taxonomic understanding of the family. By working systematically through all these palm resources, I was afforded a unique opportunity to evaluate the palm collections with the intention of improving the accuracy and accessibility of all palm information and identifying any important gaps in the Collections and associated data.

Over the 150 years of their existence new accessions to the collections have been accumulated in an eclectic and nonsystematic manner. As botanists and others travelled the world in search of new plants, they collected artefacts and other economic botanical data alongside herbarium material and therefore it is not surprising that palm species across the family are unevenly represented by specimens in the collections. Certain genera and species are well represented, in some cases excessively so, but others are conspicuous by their absence. Typically, species with a long history of utilization and economic importance have been repeatedly collected. For example, there are many (very similar) specimens of *Areca catechu* (the betel nut), *Metroxylon* spp. (producing sago), *Daemonorops* spp. (producing dragon's blood resin), *Elaeis guineensis* (oil palm), *Cocos nucifera* (coconut), and *Phoenix dactylifera* (date palm). Similarly, unusual, eccentric, or rare species are also well represented. For example, there are multiple accessions of the huge fruit and woven artefacts from the leaves of the double coconut (*Lodoicea maldivica*) from the Seychelles. However, the degree to which palm species are represented in the collections does not always reflect







1–4. A variety of uses of *Hyphaene* (doum palms). *H. thebaica* (1) buttons made in Sudan from sliced endosperm used as vegetable ivory (donated 1924), (2) a medicinal powder made in Africa from ground doum nuts used to treat foot and tooth ailments (donated in 1915), (3) a toy made in Nubia (Egypt) from two doum fruit (donated in 1927); and *H. petersiana*, (4) a hat made in Yemen from the split leaves (donated in 1997).

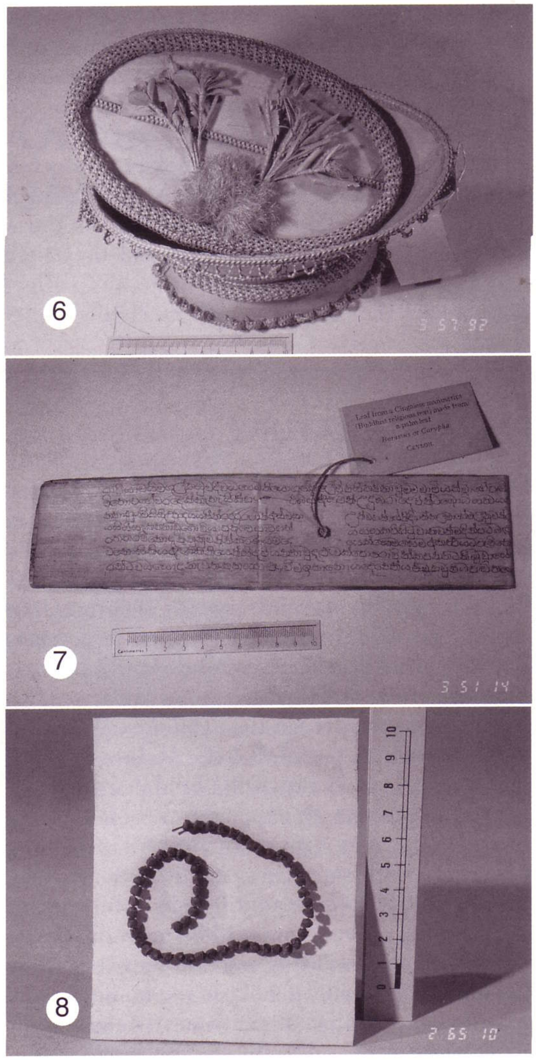
their economic importance relative to other species. Most notably, species of the rattan genera are poorly represented by artefacts, despite their immense importance throughout southeast Asia. In general, rattan species are represented in the collections by lengths of raw cane with little associated ancillary information. Many of these specimens are of doubtful importance because they cannot be identified to species. The collections in no way reflect the wide range of rattan products in existence, nor the diverse technical and cultural knowledge associated with their manufacture.

Nevertheless, of the 189 palm genera currently accepted (J. Dransfield, personal communication), 125 are represented by specimens in the collections. The absence of some of the 65 genera is explained by the fact that uses have not yet been recorded for them; however, there are other genera for which uses are well-known but no representative specimens have ever been collected. This is a reflection of the manner in which the economic botany specimens have been collected over the years.

Collection of Economic Botany Specimens

Traditionally, specimen collection at Kew has been determined by taxonomic criteria rather than those of economic botany, such that eco-

5. A vegetable ivory model of a temple (donated in 1865 and of unknown origin) carved out of the nuts of *Phytelephas macrocarpa*.



6–8. 6. A box (donated in 1873) woven in the Seychelles from the finely split petiole of the leaves of *Lodoicea maldivica*. 7. Leaflet strips of the palmyra palm (*Borassus flabellifer*) used as the pages of a Hindu book from India. 8. A necklace made of date palm (*Phoenix dactylifera*) flowers strung on thin strips of date palm leaflets, excavated from a grave at Hawara in Egypt and dating to the Graeco-Roman period (donated in 1888).

nomic botany accessions have been seen as "extras" rather than primary research foci in their own right. Recent years have seen a massive increase in economic and ethnobotanical research, perhaps due in part to the increased global awareness of the importance of, and links between, biological and cultural diversity. This shift in focus may herald changes in the specimen collection criteria such that the specific collection of economic botany specimens is given the important status it deserves. Limited resources dictate that all new accessions are specifically collected to satisfy criteria as defined by research foci. The recent review of the palm collections in the CEB has identified taxonomic and geographical gaps in the collections and there now exists a "collection hit list" of those genera and species not represented in the collections by artefacts. This list will be of use to any palm botanist or ethnobotanist on future collecting trips.

Before advocating an increase in the collection of economic botany specimens, there are two key issues that must be raised. First, it is important that collection criteria and methods are defined and standardized to ensure that all new artefact collections are accompanied by notes, photographs or drawings, vernacular names, and details of utilization. This kind of information markedly increases the research value of an artefact. Second, herbarium specimens acting as identification vouchers are, ideally, collected with new artefact items. Voucher specimens can be used to check the taxonomic identity of those plants used to make an artefact and they both validate and add research value to any collection. Where the collection of herbarium voucher specimens is not possible then identification of the plants used to make an artefact is dependent entirely on the quality of information gathered at the time of collection.

[Hew Prendergast, the leader of the CEB at Kew, is currently formulating a collecting policy for the Economic Botany Collections at Kew (of which palms are only a small but significant part) and would welcome comments on this paper.]

PALM LITERATURE *(Continued from p. 139)*

Certain other species of palm are affected lethally by LY-like diseases, although the sequence of symptoms may be different from those seen in coconut; particularly susceptible are *Veitchia merrillii* and most species of *Pritchardia* which have been used in LY research, notably determination of the vector, and should be considered for inclusion in resistance trials.

The host range is not the same for all the LY-like diseases. In particular, the Malayan Dwarf, which has been shown to have high resistance against Caribbean LY, appears to be fairly susceptible to LY-like diseases in Africa. In fact, Eden-Green states, "Strains of the pathogen may vary in their virulence to different palm species and host range studies would be a useful way to characterize them." It is also of interest that the Tanzanian Tall coconut appears to have geographic strains that show some disease tolerance, whereas other strains are very susceptible.

The phytoplasm cannot be cultured outside the palm. If phytoplasms can exist in the osmotic pressure of palm phloem, it is hardly strange that they cannot be cultured at ambient pressure. I happily remember an ICLY conference where Harries issued each participant with an inflated balloon to demonstrate this. Axenic culture of LY-like phytoplasms would enable us, among other things, to test routinely the resistance of young plants by inoculation, with great advantage to farmers. This might be expensive but surely warranted for palms that may live and produce for 50 years or more.

Large-scale multiplication of resistant palms for eventual planting by farmers would also be possible if cloning of the coconut could be achieved. The research at London University, which has been proceeding for some years, has made progress recently, although only with zygotic tissue, and "it is unlikely that commercial production could be developed within at least five years."

DNA probes and polymerase chain reaction assays have rendered our knowledge of LY-like diseases much more specific. LY in different Caribbean countries has been shown to be caused by the same phytoplasm, which is different from the phytoplasms in LY-like diseases in Africa; phytoplasms from East Africa appear to be similar to those in West Africa. Non-LY phytoplasms in putative insect vectors can be distinguished from LY phytoplasms. We may assume for the moment that host susceptibilty is the same for the same phytoplasm. If local environment influences resistance levels of different coconut strains differently, it seems that this can at present by determined only by field exposure to the disease.

Control of LY-like diseases means reducing the percentage of palms affected on a permanent basis since there is no recovery as there might be from a leaf-spot, although Harries noted a small number of Panama Tall palms and their hybrids in Jamaica, which temporarily partially recovered. Removal of palms with symptoms has been tried as a disease control in some countries without any clear effect, probably because of the long incubation period. Tetracycline has been used in several countries to implicate phytoplasms as the cause of LY-like diseases, but only in Florida as on-going protection of amenity plans by licensed operators. Insecticidal control of the vector also is to some extent effective but not practical. Current research in Florida seeks lawn

(Continued on p. 148)

Principes, 42(3), 1998, pp. 145–147

The Chatham Islands: Home of the Most Southern Naturally Occurring Palm in the World, *Rhopalostylis* "Chatham"

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Imagine the vast open Pacific Ocean, far to the south at 44°S latitude and some 850 km to the east of New Zealand. This region is known as the Roaring Forties, that part of the Pacific often swept by gales. During the rather bleak winters drift-ice can sometimes be seen being tossed around in a towering swell. It is here, in the middle of a vast expanse of ocean that the Chatham Islands are situated, not exactly the kind of place associated with the image of palm fronds and sandy beaches. It is rather surprising perhaps to know that in protected valleys the climate is mild, allowing plants to grow not usually associated with these latitudes.

In this lonely group of islands a native species of palm occurs. How it ever got there is a riddle. Known on the island as the nikau palm it is closely related to the New Zealand nikau palm *Rhopalostylis sapida*. There is some doubt whether the Chatham Island form represents the same species. Current taxonomic studies will decide its true identity in the future.

Although part of New Zealand politically, the Chatham group of islands has its own identity. The isolation of these islands created an independent society of people who have fashioned an existence around the available resources on the islands. Most of the forest land has been converted to pasture lands. Fishing is a major industry. All modern needs are imported, the only links with the islands being by aircraft from New Zealand. In addition there is a monthly freight service by boat.

The group consists of four principal islands—Chatham, Pitt, South East, and Mangere. There are a group of smaller islands and rocky outcrops, which all form part of the so-called Chatham Rise below the Ocean. Contact with the outside world is only possible through Chatham Island, the largest in the group, some 90,000 hectares in size. As twenty percent of the island is covered in water, it is in effect a large lagoon surrounded by mostly flat land with stunted vegetation. Small volcanoes break this flat treeless landscape. Forests at one time were extensive, particularly near the coast. Very little is now left of the original forest cover; what is left continues to be destroyed by grazing stock and opossums.

Little regeneration of forest is taking place. The New Zealand Department of Conservation has set aside several remnant forest areas as reserves. It is rather satisfying to see that where stock is fenced off, regeneration of forest occurs. Unfortunately these efforts, although very commendable, are too little and too late. However, it is only because of these conservation efforts that some remnant populations of the Chatham Island nikau still exist on the Islands.

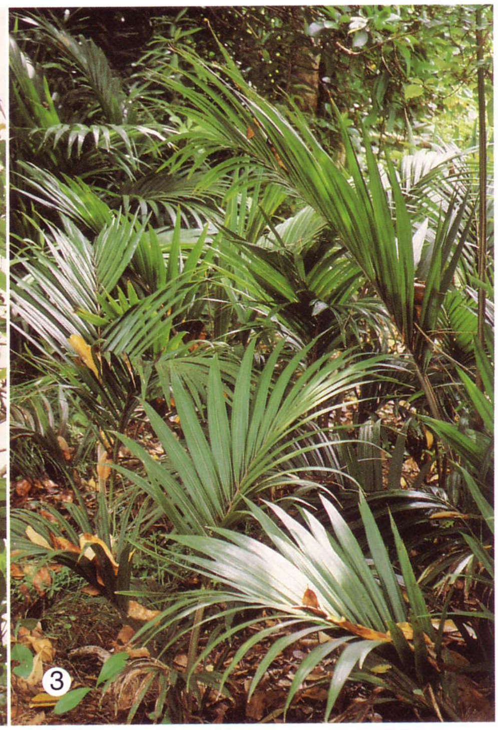
The Chatham Island nikau warrants special attention because of its beautiful shape and form. To my knowledge this palm has never been recognized in New Zealand as a palm worthy of cultivation. In Europe, however, the Chatham Island nikau was recognized as being suitable as an indoor palm. It was available in the trade before 1928. The palm in its juvenile form is very graceful. Its branches are elegantly curved, and its leaflets very wide and shiny green in appearance. The stem is solidly rooted unlike *Howea*, which often has unstable stems susceptible to bending over. Furthermore, the nikau grows well indoors. In its mature form the palm takes a characteristically shaving brush type appearance, much like the other forms of nikau found in New Zealand. The palms observed on the Chathams grow as tall as 15 m. Young mature

1. Nikau palms on Chatham Island, New Zealand. 4. The southernmost palms in the world—nikau palms on Pitt Island, Chatham Islands. The photo shows a valley filled with palms. It would be most unusual to see such a great number of large nikaus in New Zealand.

palms produce copious amounts of comparatively large, bright red seeds. The large size of the inflorescence dictates the similarly large crownshaft, a notable feature of the palm. The stiff leaves on the mature palms provide excellent protection for the young developing leaves within the crown of leaves. Frequent strong winds would damage these palms otherwise. Most palms show little wind damage. In spite of the cold latitude in which these plants grow there is no evidence of frost damage. This does not mean however that this form of nikau is more hardy than other forms. Frost tolerance ranges to $-4°C$ Beyond this temperature leaf damage will occur.

My wife and I visited the Chathams last January (1996) to see for ourselves these last remnant forests where the nikau palm occurs. The flight to the Islands takes almost two hours from Wellington to Waitangi, Chatham Island. Arriving at the Chathams one can see the vague outline of the island partly shrouded in mist, miles of deserted coastline, endless beaches, low scrub and clearings, and here and there small volcanic mountains long since silenced. A lonely airstrip in the middle of nowhere greeted us on arrival. A reception building and an adjacent hangar were all that showed us any signs of human activity. A half-hour ride brought us to Waitangi, the cultural center of the island. Most of the islanders, a mixture of Polynesians (Maori and part Moriori) and Europeans congregate at the hotel to mix socially in the pub, providing a great chance for us to meet the locals.

We were able to visit the only place on the island where the Chatham Island nikau grows in any quantity. A small reserve, situated on a gently rising slope near the base of a volcanic outcrop, gave us a chance to observe the nikau firsthand. The reserve is fenced off from stock. In contrast to the surrounding countryside this re-

2. Close-up of a mature nikau, Chatham Island. 3. Regeneration of nikau palms on Chatham Island.

serve was a cool forest haven. Weka birds scurried around on the forest floor and fantails darted among the trees. The tops of the trees were taking the brunt of the wind, while for us it was a fascinating walk among the forest trees, only a remnant of what was once common on the Chathams. Nearly all the nikau palms were growing on open ground, forming an open canopy (Fig. 1). Most of the palms were tall, around 10 m in height. The palms were in good health, many showing a good crop of seeds (Fig. 2). However, regeneration was absent. Only on the edge of the broadwood forest itself was vigorous regeneration of palms was evident (Fig. 3). Beyond this reserve no further palms were seen; few if any can possibly stand up to the harsh climatic conditions without the shelter of companion trees.

My objective in this trip to the Chatham Islands was to see the most southern occurring native palms in the world. In order to find these one has to travel farther south to the adjacent Pitt Island, some 40 km southeast of Chatham Island. It can only be reached by an infrequent air service dependent on suitable flying conditions, a rather hit and miss kind of schedule. The one major stand of nikau palms is on the southern end of the island, the only part that shows any verdant vegetation, most of the area having long been cleared of forest to make way for pastoral farming. It was rather surprising to discover this green valley after walking through scrubby stunted fernland. Palms could be observed on the distant sky-line, but it was not until we entered the valley itself that the magnitude of this reserve was realized (Fig. 4). In contrast to the reserve on Chatham Island there was little remnant forest left. The palms themselves were the dominant species with low shrublike undergrowth of mainly tree ferns (*Dicksonia* sp.). Much of the undergrowth was damaged by pigrooting and the grazing of sheep, still taking place in this reserve. The palms were all very tall, 15 m or more, all of about the same age, my estimate about 200 years. Palms were senile, showing little flowering or seed set. No young palms were seen. Nevertheless the reserve is impressive, a pleasant valley filled with nikau palms, a subtropical haven, the last southern outpost of palms, and all somewhat unreal. The South Pole is the nearest landmass south of this spot. Why should nikau palms grow in such an isolated lonely place at 44°S 18′S latitude?

PALM LITERATURE *(Continued from p. 144)*

grasses and ground covers unattractive to the vector(s) for breeding to reduce disease spread.

Genetic resistance to the diseases is the only current solution, and a good one since resistance does exist and can be introduced relatively painlessly to farmers simply by offering improved planting material at coconut nurseries. The characterization and collection of coconut varieties and their testing for resistance involve large-scale and long-term field exposure to the disease; this requires funds, know-how, time, safeguarded land, and commitment. A number of resistance trials have been established, notably in Ghana 10 years ago, Tanzania from 1980 to 1988, Jamaica in 1962–1964 and again in the 1970s, and recently in Mexico.

As Coconut Research Director in Jamaica from 1962 to 1981, I was fortunate to be associated with the LY-resistance research carried out first by Whitehead, then by Harries, and more recently by Been and Steer, resulting in proving the resistance of the Malayan Dwarf and later (1974) the Maypan F1 hybrid. Ashburner and Been calculate from the Jamaican data narrow-sense heritability of LY resistance between 0.72 and 0.79, underlining the effectiveness of selection for resistance, and describe how reciprocal recurrent selection can be used for long-term improvement of resistance. In the 1980s, hybrids between Malayan Dwarf mothers and four other talls (Bouganville, Thailand, Cambodia, and KarKar) were also issued to farmers.

In Ghana, Sri Lanka Green Dwarf and Vanuatu Tall are so far showing resistance, although the numbers are small (also some crosses with Malayan Yellow Dwarf). Sri Lanka Green Dwarf could be a mother for hybridization considering its precocity, short stature, and large number of nuts, but lacks the recessive color marker of red and yellow dwarfs. Doubtless it is already being planted out in future hybrid seed gardens.

No mention was made at the workshop of methods of distinguishing coconut varieties for the purpose of resistance testing, method and quantity of collection, precautions to avoid introducing a new pest or disease, siting of resistance trials, or options for field layout. Planting large plots of each test variety or parallel rows or single-palm plots may well affect losses to disease, not to mention the frequency with which known susceptible strains are positioned; very large blocks of a partially resistant variety may survive better than mixed plantings. Unfortunately, several of the resistance trials planted in Ghana some 10 years ago have yet to have disease affect them. In Florida, the landscaping industry transplants large coconut palms either from containers up to 25 gallons or from a field nursery, and it would thus be possible to delay siting and planting a resistance trial for 2–4 years.

The only report to the workshop that deals at any length with rehabilitation of disease-affected coconut fields is that by Steer, Coconut Industry Board, Jamaica. This organization has a majority of grower-elected board members, together with board members appointed by government; the number of votes for any grower is calculated from the quantity of coconuts delivered by the grower, and the Board is funded by a tax on the edible oil and soap industry. I believe that only a policy-making entity of this type is able to get long-term research done and transmit research results into scientifically based and adequately funded rehabilitation. As a result, millions of resistant seedlings have been planted and brought into bearing; to quote Steer, "By 1988, existing copra driers were having difficulty in coping with the volume of nuts."

I should at this point step outside this review and warn enthusiastic palm growers not to secretly import palms from other countries or other states without thoroughly investigating the transmissible pests and diseases there. Eden-Green lists a number of non-LY-like diseases, e.g., Tatipaka Disease and Kerala Wilt in India, Vanuatu Wilt, Cadang-cadang in the Philippines, Tinangaja in Guam, Hartrot in Trinidad and northern South America, Leaf-scorch in Sri Lanka, and several minor diseases, including Socorro Wilt, Malaysian Wilt, and Natuna Wilt.

From my above comments on this workshop, it must be clear that I have only very briefly summarized the presentations (308 pages) and I may well have omitted some vital points. Persons may obtain a copy of the Proceedings from The Publishing Manager, Publications and Publicity Services, Natural Resources Institute, Central Avenue, Chatham Maritime, Kent ME4 4TB, UK for $60 or £35.

David Romney

Coleccion Bimilenario el Palmeral Historico de Elche by Francisco Pico Melendez. Published by the Ajuntamiento de Elche. 187 pp., in Spanish with no English summary. 2000 pesetas.

This book is concerned with the history and production of "white palm", a product derived from the leaves of *Phoenix dactylifera*, the date palm, in the city of Elche, located in southeastern Spain. White palm refers to the young tender blanched palm leaf, bleached with legia (a soap product), and preserved with sulphur. White palm was being processed at least 300 BC according to drawings on Iberic pottery. Later white palm was incorporated into Christian practices where it became an important element in Palm Sunday ritual.

Today, white palm from Elche is exported around the world to be blessed and distributed in Catholic churches as the central symbolic element on Palm Sunday. In general Catholics are presented on that day with an entire white pinnate blade. However, white palm can be crafted in a variety of beautiful shapes, figures and designs, usually with a Catholic motif.

During the last few years the number of palm orchards as well as the number of individual palms have been decreasing considerably in number, mainly because of urbanization. The main reason this book was published was to call attention to a dying tradition and industry of the date palms. The city of Elche is not only protecting the extant palm orchards, but also has laboratory facilities to promote and speed up the production of new plants of *P. dactylifera*.

The text is organized into five concise sections beginning with a discussion of the origins of the palm trees in Elche. Here the author suggests Elche as part of the natural distribution of *Phoenix dactylifera* based on palm fossils of pinnate leaves of Phoenicites, the apparent ancestor of *Phoenix dactylifera* as well as fossilized seeds of *P. dactylifera* found in SE Spain and in the South and NW of France.

The author is quite knowledgeable about the archeological history of the area. The longstanding importance of *P. dactylifera* for the inhabitants of the ancient Elche is clearly documented back to the third century BC based on the archeological evidence such as drawings of pinnate palm fronds on pottery. Following this discussion, the author provides an excellent description of the origin, processing, and types of white palm. The author highlights the importance of the white palm for Palm Sunday and describes the many hours of work put into arrangements of white palm, each of which may be considered a work of art.

The third section is devoted to the history of the only remaining 12 palm orchards in Elche. The author even provides a count of the number of palm trees in each orchard. Finally there is a discussion of the problems that the white palm industry is facing and solutions that the city of Elche is implementing to save this important traditional regional industry.

(Continued on p. 159)

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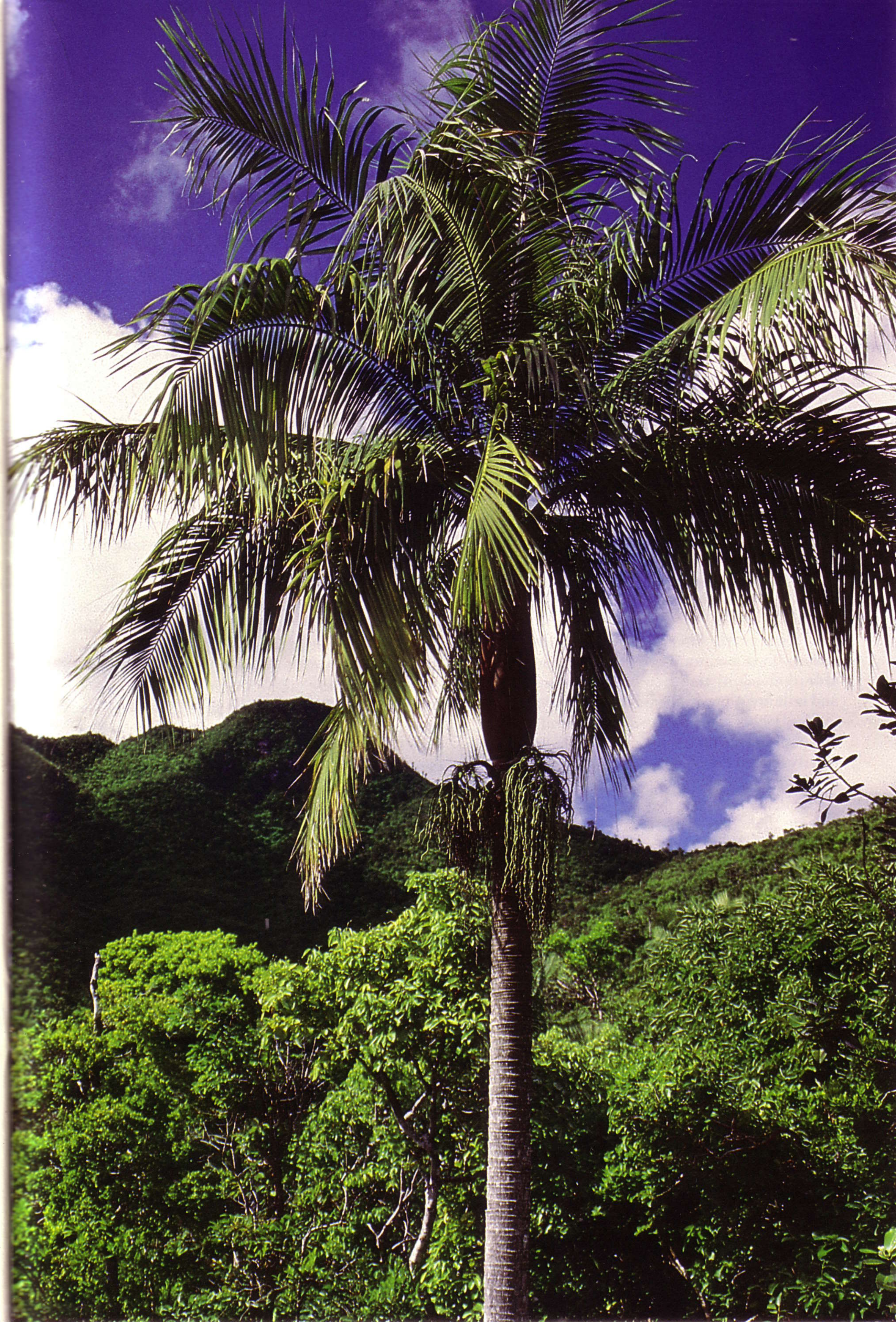
Left
Coccothrinax spissa L. H. Bailey

When one thinks of *Coccothrinax*, one usually envisions small, slender-stemmed, delicate palms. The stout, usually fusiform (spindle-shaped) trunks of *Coccothrinax spissa* seem out of character for the genus, but they are chief among this species' many charms. This species seems to be endemic to the southern Dominican Republic, near the city of Baní, although it may occur elsewhere on the island of Hispaniola. Its leaves are harvested for fiber (the individuals in this photograph have had some leaves removed), but the species is apparently not threatened. This photograph was taken near Baní in August, 1996.—Scott Zona

Right
Acanthophoenix rubra

This variable species is endemic to Mauritius and Réunion islands of the Mascarene archipelago. Lowland palm savannas of both islands were cleared in the 17th century, restricting *Acanthophoenix* to high elevations and steep slopes. Once thought to be nearly extinct in the wild on Mauritius, two healthy populations were discovered recently. One of these is in a hunting reserve on the eastern part of the island, which contains the individual in this photograph. The population contains approximately 50 adult plants, growing on steep hillsides. They are regenerating naturally, and several seedlings and young trees occur in the locality. Regenerating populations are still frequent in the highlands of Réunion, where the species is more widespread and morphologically diverse.—Carl E. Lewis



Principes, 42(3), 1998, pp. 152–155, 160–166

Three New Species of *Burretiokentia*

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Burretiokentia vieillardii, one of the most common and widespread palms in New Caledonia, is well known to palm botanists, horticulturists, and growers. It occurs almost from one end of the island to the other, seemingly wherever one enters the forest, and often forms large, gregarious populations. It is a common and popular palm, cultivated in many places around the world. Although New Caledonia had been extensively explored for palms from 1960–90, only one additional species in the genus, *B. hapala,* was discovered. After 30 years of palm exploration, it seemed unlikely and really unimaginable that additional, new species were hidden and still unknown in the island's forests.

The 1990s ushered in a new era of interest and exploration for palms in New Caledonia. Led mostly by local palm enthusiasts, three additional new species of *Burretiokentia* have been discovered, and it is with great pleasure that we present them here.

While conducting extensive searches for rare and unusual palms in the botanical sanctuary of Montagne des Sources, Raymond Lavoix, nurseryman and palm collector in Nouméa, stumbled across one of the new species, *Burretiokentia grandiflora* in a remote area well off a seldom-used trail, high above the valley of the Rivière Bleue. Gilles Pierson, a member of Association Chambeyronia, the New Caledonia Palm Society, later found it on a well-used trail along the upper Rivière Bleue. *B. grandiflora* is remarkable for its large inflorescences and flowers.

Perhaps the most astonishing discovery was *B. koghiensis.* It was found in a well-known and easily accessible forest just a short 15 minutes' drive from Nouméa at the popular tourist site at Auberge du Mont Koghi. Even more remarkable is the fact that the individual from which the type specimen was collected is on a paved trail and marked with a posted sign numbered #83 on a self-guided nature walk! For decades botanists and palm collectors confused it with *B. vieillardii* which grows nearby. Only when members of Association Chambeyronia brought persistent attention to several critical characteristics did botanists scrutinize it more closely and determine it to represent a new species.

Finally, there is *Burretiokentia dumasii,* found by ORSTOM botanist Jean-Marie Veillon and government forester Serge Blancher while they were botanizing in Nodéla Valley in west-central New Caledonia. Veillon thought it was the same as *B. koghiensis,* but careful examination of inflorescences and fruits showed that it too, was a new species.

Just when it seemed we had them all, we were dropped by helicopter into a beautiful, pristine, remote, hidden valley in the Forêt de Saille, south of Thio, in June 1996; and there, staring us in the face, was still another, apparently different *Burretiokentia.* Unfortunately, we need additional material of this last *Burretiokentia* for critical analysis, so we are unable to place and/or name it at this time.

What we now know is that there are at least three and perhaps four new, distinctive species of *Burretiokentia,* all of which are more closely related to each other than to the previously described *B. vieillardii* and *B. hapala.* The three new species share several characteristics which separate them from *B. vieillardii* (Table 1), and are restricted to very small, isolated populations on soils derived from ultramafic rocks. That the widespread *B. vieillardii* is found near or with

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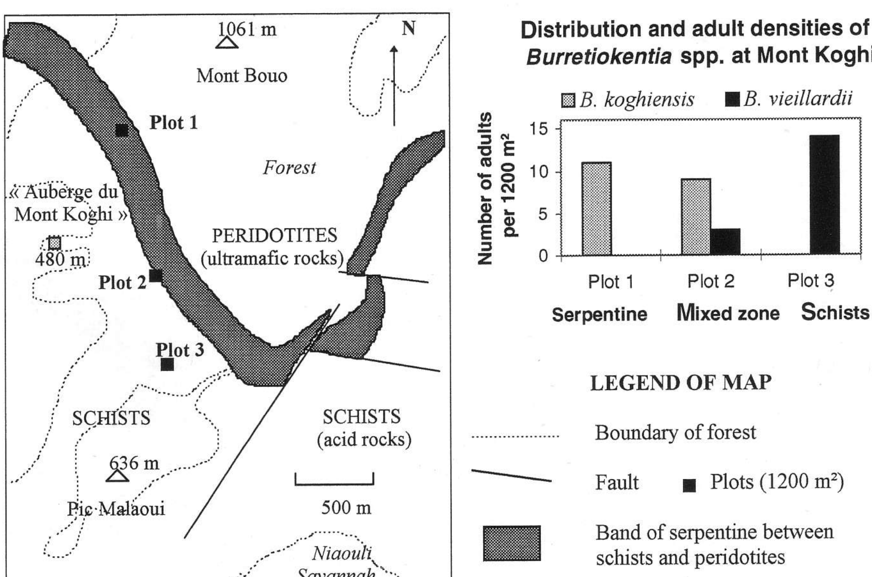
Table 1. Major differences between Burretiokentia vieillardii *and the new species.*

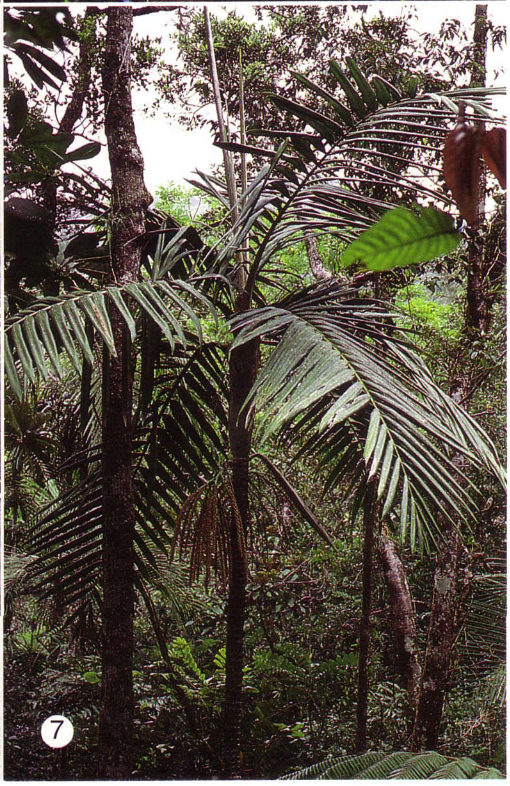
Characteristics	*Burretiokentia vieillardii*	All New *Burretiokentia* Species
Crownshaft	Prominent, leaf sheaths barely splitting opposite petiole.	Less prominent, leaf sheaths splitting deeply opposite petiole.
Shape of leaf sheath	Rounded or slightly costate apically along petiole axis.	Costate to keeled.
Indument of leaf sheath	Brown tomentum.	White tomentum.
Insertion of leaves	Spirally arranged.	In five ranks.
Secondary veins	Very prominent abaxially and densely covered by reddish-brown, often bullate hairs.	Scarcely prominent and with sparse, brown-centered, white-margined scales.
Indument of prophyll and first peduncular bract	Glabrescent to brown-tomentose.	White-floccose.
Second peduncular bract	Small, slightly or not exceeding peduncle.	Large, much exceeding peduncle.
Inflorescence indument	Glabrous to shortly brown-tomentose.	Glabrescent to white-greyish.
Phenology	Regular, flowering and fruiting year-round.	Seasonal.
Ecology	Widespread in rain forests on schistose or ultramafic rocks, 400–1300 m.	Always very local, restricted to ultramafic rocks at 200–1000 m elevation.

these new species and was confused with them probably explains why they were unrecognized until very recently. With the discovery of these new species and an understanding of their restricted, localized distribution, we think *Burretiokentia* may now be the most promising palm genus for new discoveries in New Caledonia.

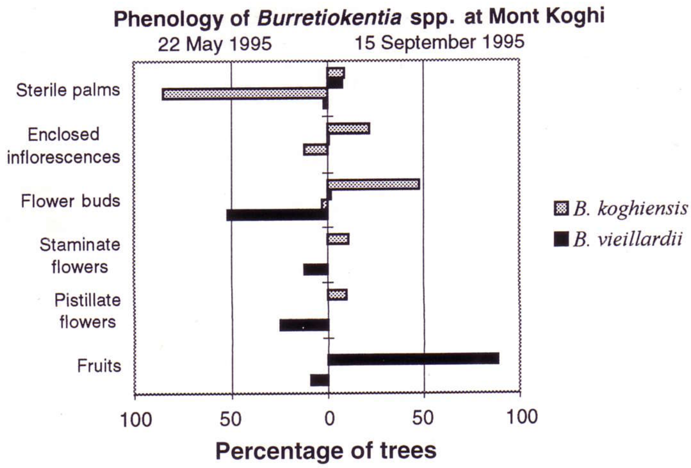
(Text continued on p. 160)



1. Distribution and adult densities of *Burretiokentia* spp. at Mont Koghi.



8. Infructescences with immature fruits at the same stage. Left: *Burretiokentia vieillardii;* right: *B. koghiensis.* Mont Koghi, 500 m (Photo J.-C. Pintaud).



2. Phenology of *Burretiokentia* spp. at Mont Koghi.

←
4. *Burretiokentia koghiensis* Habit, Mont Koghi, 500 m. (Photo D. R. Hodel). 5. *Burretiokentia koghiensis.* Open, white-to-mentose leaf sheaths and immature fruits. Mont Koghi, 500 m. (Photo J.-C. Pintaud). 6. *Burretiokentia dumasii.* Habit, Nodéla valley, 600 m (Photo D. R. Hodel). 7. *Burretiokentia grandiflora.* Habit, upper Rivière Bleue, 200 m (Photo J.-C. Pintaud).

Principes, 42(3), 1998, pp. 156–159

In Search of *Thrinax ekmaniana*

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I have long been intrigued by the palms of Cuba. Virtually all the species of palms native to Cuba seem to flourish in our South Florida landscape, only 95 miles (145 km) to the north. The diverse genera that make Cuba their home include *Acoelorraphe, Acrocomia, Bactris, Calyptronoma, Coccothrinax, Colpothrinax, Copernicia, Gastrococos, Gaussia, Prestoea, Pseudophoenix, Roystonea, Sabal,* and *Thrinax.*

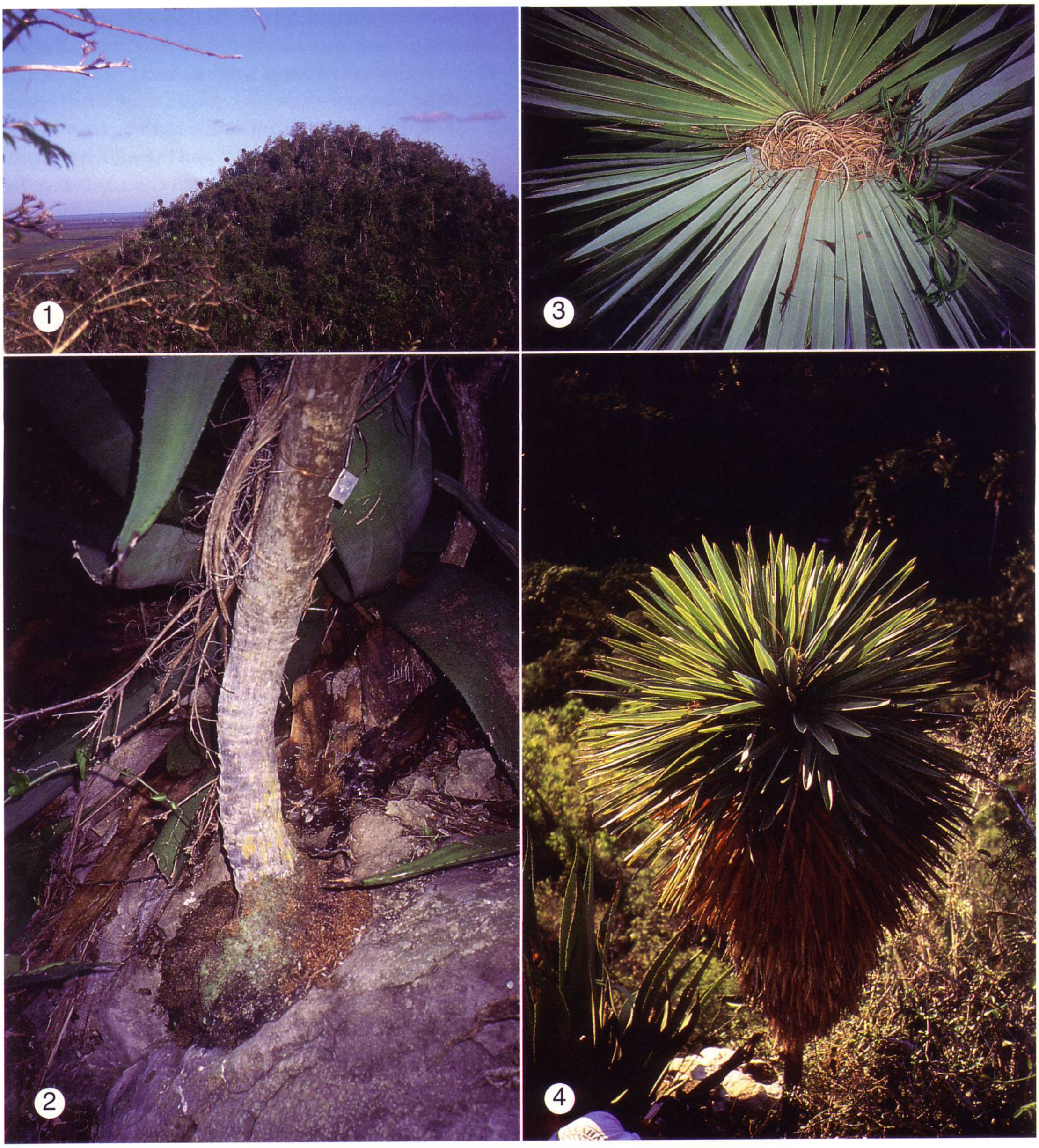
Cuba is a much larger island than most people realize, 720 miles (1 150 km) long and averaging 50 miles (80 km) wide. It is a remnant of South America that broke off and drifted north into the Caribbean, allowing an interesting combination of South American and Caribbean flora to become established. There is a wide variety of habitats, ranging from savannas to 3000 foot (1000 m) mountains. Soils can be sand, rich clay, solid limestone, or serpentine—a cocktail of minerals which is toxic to most plants, but home to some unique palms. Rainfall varies due to mountain ranges that run through much of the land. There are sandy beaches and rocky coasts with sheer cliffs. All these factors create a land of many different habitats, each with its own group of unique species.

Information on the palms of Cuba is sketchy at best. One has to rely on the works of Hermano Leon, Seifriz, Borhidi, Muniz, Dahlgren, Glassman, and others; most of the papers are 35–60 years old. Some species are well-documented in these few research works, but most have not been completely described. Keys for identification, adequate descriptions of most species, and good photographs are all lacking.

Armed with the research I could find, I traveled to Cuba in the summer of 1994 with some fellow International Palm Society members to see what we could discover. It was a trip of only one week, as we did not know what to expect but wanted to get an idea of conditions on the island. We traveled mostly in western Cuba, in the province of Pinar del Rio, where we saw *Colpothrinax wrightii, Sabal maritima, Gaussia princeps, Calyptronoma plumeriana, Coccothrinax miraguama* var. *arenicola, Acoelorraphe wrightii, Copernicia curtissii,* and others in their natural habitats. It was an exciting trip, and we learned just how big a country Cuba is. We realized that several trips would be necessary to see all of it and to rediscover all of the palms.

I had heard of *Thrinax ekmaniana,* but had seen little reference to it, let alone a description or picture. It does not exist in any botanical garden outside of Cuba, and is not in cultivation anywhere. When it first became available in 1995, I bought a copy of Andrew Henderson et al.'s *A Field Guide to the Palms of the Americas.* While glancing through the photos, I came across the picture of *Thrinax ekmaniana* and was immediately struck by its unique beauty. I knew then that I would have to try and find this species on my next trip. The information on its location was not particularly helpful, described only as a single limestone hill or *mogote* in Las Villas, a large area in north-central Cuba. We had just been through the Los Organos mountains, a range of mogotes 100 miles (160 km) long, so the thought of actually locating this palm without more detailed information seemed daunting, much like finding the proverbial "needle in a haystack."

It was not until the fall of 1995 that I returned to Cuba, and although I wanted to see *T. ekmaniana,* the unlikelihood of actually finding that single mogote was intimidating, so I decided against spending too much time in search of it. Some fellow palm enthusiasts and I wanted to spend most of our time looking for *Copernicia baileyana* and *Copernicia fallaense* to try to determine if there are any differences between these two species. I traveled through the area of where *T. ekmaniana* appeared to be on a location map some Russians had put together in the '70s, but became quickly frustrated by all the mogotes, and pushed on to locate the *Coperni-*



1. Limestone mogote where *Thrinax ekmaniana* lives. 2. Base of trunk of *Thrinax ekmaniana* showing the limestone rock where it grows. 3. Close-up of fiber attached to leaf petioles of *Thrinax ekmaniana*. Appears as thatch or "hair." 4. *Thrinax ekmaniana*.

cias. Although a successful trip in other regards, it confirmed that finding *T. ekmaniana* would be extremely difficult.

About eight months passed and I returned once again, determined that this was going to be the trip to locate the elusive *T. ekmaniana*. Again, three of us started out from Havana very early one morning, heading east along the north coast, quickly passing the areas we had previously checked out. We crisscrossed new terrain over rough dirt roads, trying to catch a glimpse of the palm on a distant hill. We passed other interesting species but kept on, determined to find *T. ekmaniana*.

The morning passed, and the roads seemed to develop larger and larger potholes that made driving at times a nightmare. We found a hotel out in the middle of nowhere, and had the best beans and rice ever. Feeling renewed, we bounced down the road further, straining our eyes to see the elusive *Thrinax ekmaniana*. The mogotes became smaller and fewer in number. By mid-afternoon, we had come upon a flat plain with no hills to be seen in any direction. We had long passed the area pinpointed on the map as the location for *T. ekmaniana*. The main road had taken us inland, so we scouted dirt paths out toward the coast to see if there were any hills there.

The afternoon waned, but the landscape had not changed. Everywhere it was flat. It was beginning to get late, and we still had a long way to go to get to our hotel for the night. We were quite disappointed, assuming we had somehow missed that single mogote. The sun was beginning to cast long shadows, so we went faster to reach the hotel before dark.

One thing we had learned about traveling in Cuba was not to travel at night. There are too many bicycles, horse-drawn carriages, and vehicles with no lights, as well as people walking on the road. Cows often decide the road is a good place to sleep; there are always vehicles parked there and, of course, absolutely no street lights. This obstacle course is hard enough to navigate during the day, let alone in the dark.

We were resigned to the idea that we would again not find *Thrinax ekmaniana*, when suddenly to our left the faint outline of three mogotes appeared. We immediately stopped and piled out with our binoculars. On one side of one hill we could make out what looked like small lollipops sticking up above the rest of the vegetation. I knew we had found *Thrinax ekmaniana*, and that our quest was finally over. It seemed like hours, but actually took 30 minutes to fly over some of the roughest paths yet to reach the bottom of the mogotes, where we could easily see the palms. There was a farm at the base of the mogotes where we received permission to go see the palms. We tore through the underbrush and began our ascent.

It was not an easy climb. The palms were close to the summit of a 500 (160 km) or 600 (200 km) foot solid limestone hill, extremely steep with very sharp and jagged edges. There were also some very sharp-pointed giant agaves and some very thorny acacia, which made the climb quite memorable. Buzzards circling above and a horde of mosquitoes did not help matters, but adrenaline kept us going, and we reached the top rather quickly.

Seen from the summit, the palms were scattered right along the cliffs on the north side of the hill, ~250 feet (80 km) from the top. Over on the next mogote, we could see more. They were absolutely beautiful, unique, short palms under 3 m, with a petticoat of old leaves reminiscent of the Cuban petticoat palm, *Copernicia macroglossa*. The petioles were very short, with a few fibers giving the leaf bases a hairy appearance. Their slender trunks appeared glued to the limestone at the base, with only a mass of small fibrous roots showing. It was difficult to imagine how these palms could grow on solid rock with no apparent nutrients available. There were approximately 20 mature plants on the hill we were on and a similar number on the next hill. We learned later that there were some on the third hill as well, so the total population consisted of 50–60 mature palms, with only 40–50 small seedlings. It was good to see that the palms had all been tagged recently, and were obviously being studied by someone.

The sun had begun to set when we suddenly realized that we still had to negotiate a descent from the top of the mogote. Luckily, we found a path used by farmers and researchers keeping watch on the plants. On the way down we noticed species of philodendron, bromeliads, plumeria, and other vegetation we had not seen anywhere else. This was obviously a very unusual habitat, isolated by many km of savannas. We learned from the farmers that they were entrusted with guarding the palms, and they showed us pictures of them taken back in the '30s and '40s. They were very proud of these palms, and checked on them constantly.

While talking to Dr. Celio Moya Lopez on a later trip, I learned that there would be an effort made to establish more *T. ekmaniana* palms on the mogotes. Up until now, there has been no success in germinating seed. Because there are very few seedlings on the mogote, this appears to be a genuine concern. *T. ekmaniana* is a greatly threatened species with a very small population in an extremely restricted habitat, and does not seem to reproduce well. It is not known to be cultivated anywhere. This is true of species everywhere in the world, but at least this species and habitat seem well-protected for now; and an effort will be made to establish more individuals.

Finding this palm was the highlight of all the trips I have taken to Cuba. Considering all the palms and cycads I have seen there, some even more threatened than *Thrinax ekmaniana*, finding it was still the most thrilling experience I have ever had. Only those fortunate enough to have been on a mission to locate a particular species, finally discovering it despite great odds, can understand the exhilaration involved.

The palms of Cuba include many unique species, of which *Thrinax ekmaniana* is but one. I hope someone better qualified than myself will take an interest in these palms and do some much-needed taxonomic work. In particular, the genera *Coccothrinax*, *Copernicia*, and *Thrinax* all are in need of study. Is there someone out there up to the challenge?

PALM LITERATURE *(Continued from p. 149)*

The book is handsomely illustrated with 187 color plates, three tables, and a series of maps showing the decreased area of the palm groves and the spread of urbanization. The book is easy to read (if you read Spanish), with a touch of poetry, and it represents a major new contribution to our knowledge about the importance of the white palm in history and in the contemporary culture of Elche. It is well-produced and contains the best information related to this topic. Every palm enthusiast and anyone interested in ethnobotany, especially of palms and the genus *Phoenix*, will want to add it to his library.

NORA MARTINEZ

TRIBUTE TO PHILIPPE CREMER

Good night, Philippe, we will sorely miss you and your inspiration. You had a passionate interest in palms that few understood.

I remember well my first meeting with Philippe Cremer. It was during my first trip to South Africa. The trip was extraordinary as I had gotten on an airplane and flown 21 hours to meet a person I did not know in order to travel four days into the tribal homelands in pursuit of *Jubaeopsis*. That was the extent of my raging palmophilia. The *Jubaeopsis* Reserve in the Mkambati is a special place. It is a laboratory of evolution and a monument to the splendor of biological diversity. That trip began my friendship with Philippe. I was fascinated by his infectious interest in the palms and his desire not just to learn about this palm but to thoroughly understand the other cocoids such as *Jubaea chilensis* and *Cocos nucifera*. His understanding was not limited to knowing the palms but also included the paleoecology, geology, and even the tribal languages of the areas where they resided. All this was the interest of a plumber who had escaped the Mau-Mau rebellion of the Belgian Congo with barely his life and the clothes on his back. He told me once he returned to Belgium after the revolution as they spoke French. He said he did not stay because he did not fit in there. He felt there is something unusual about South Africans; they are a special breed that do not fit in anywhere else in the world. He had an economy with words but his keen interest and passion resonated from his personality.

We nurtured friendship through correspondence and exchanging books. I grew intellectually from this exchange of ideas and observations. My interest and knowledge blossomed. His interest too had matured as he had taken trips to Madagascar, Zimbabwe, and Mozambique, and was planning a long trip to Zaire.

When I returned in 1991, he was still on this quest but his life had been turned upside down as he had become divorced and was living in a one-room flat in Durban's central slum. Though this had happened and he was living hand-to-mouth trying to make ends meet with a small furniture business, he was as cheerful as ever and still maintained his Quixotic pursuit of interests, as he was rethinking his plans for returning to Madagascar. His raffish grin and Gallic passion for life were certainly very disconcerting for many in the staid South African society.

I remember several years later when my life had (similarly) turned upside down I received a card from him about a South African Palm Congress inviting me with four words: "Can you join us?"

I wish you could join us now but you can't. I salute you Philippe. The world was better because of you and we regret your passing. Good night and may you exist in your dreams of palms.

EDWIN BROWN

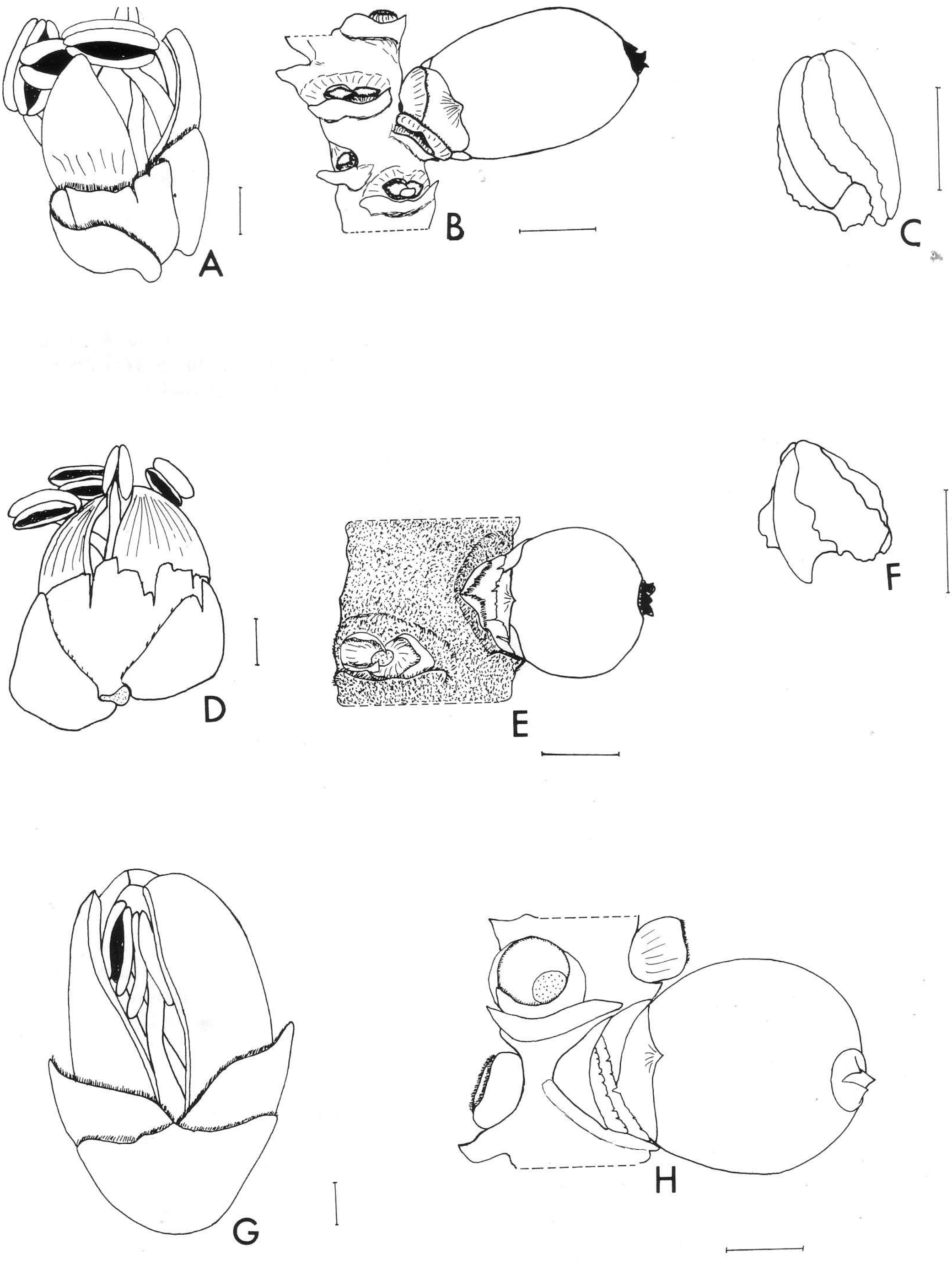
(Continued from p. 155)

We name and describe these new species in anticipation of publishing a fully illustrated book, now in press, on the palms of New Caledonia.

Burretiokentia dumasii Pintaud and Hodel, **sp. nov.** (Fig. 3, D, E, F)

Burretiokentia vieillardii (Brongn. and Gris) Pichi-Serm. affinis sed vaginis tomentosis albis, petiolis alatis, rachillis tomentosis differt. Typus: New Caledonia, Nodéla Valley, 600 m elev., 21°26′S, 165°21′E, 15 Sept. 1995 (fl.), *J.-C. Pintaud and Y. Bruireu 266* (Holotypus P; isotypi BH, K, NOU).

Solitary sub-canopy palm. Trunk 8–12 m tall, 10–13 cm dbh, prominently ringed. Leaves 10–12, borne in five ranks, spreading, expanding red; sheath 60–80 cm long, cylindric, distally costate along petiole axis, proximally rounded, abaxially pale green, covered with thick, white tomentum, adaxially bright pink with sparse to rather dense, white indument, splitting in distal 3/4 opposite petiole and terminating on petiole in two fibrous, chartaceous, prominent wings; petiole 15–35 cm long, winged at least on proximal half or up to rachis base, adaxially channelled, glabrous, abaxially angled, initially white or grey-tomentose, aging puncticulate; rachis 2–2.50 m long; pinnae ~25 on each side of rachis, borne in one plane, median ones 80–100 × 5–8 cm, distal ones 30–35 × 3 cm, proximal 2–3 pairs 25–30 × 0.8–1.5 cm, all straight, forward-pointing, acute to acuminate, 1-ribbed, glossy green and glabrous on both surfaces, paler abaxially, midrib prominent adaxially, bearing sparse, brown scales, midrib very prominent abaxially, bearing brown-centered, white-margined scales, 2–8 secondary nerves scarcely prominent, scales more abundant proximally. Inflorescences 1–4, infrafoliar, stiffly spreading, protandrous, 40–60 cm long, entirely and persistently greyish-tomentose, branched to 3 orders; peduncle 5–7 cm long, 3–5.5 cm wide and 2–3 cm thick distally; prophyll 25–40 × 10–15 cm, inserted 2–3 cm above peduncular base, bicarinate, bifid, chartaceous, incompletely encircling peduncle at insertion abaxially, splitting to 1/4–2/3 its length on opposite side; first peduncular bract 40–60 × 10–15 cm, oval-elongate, rostrate to acuminate, thin, completely encircling peduncle at insertion, inserted 1–2 cm above prophyll and exceeding it by 1/3–1/2, prophyll and first peduncular bract white-tomentose abaxially, second peduncular bract prominent, 8–13 × 3–5 cm, acute, bifid or truncate, densely greyish tomentose abaxially, glabrous adaxially, third peduncular bract to 5 × 3 cm, shape and indument same as second one; rachis 18–20 cm long, main branches 6–9, 5–8 cm long, 1.5–2 cm wide, second order branches 1–3 cm long, all branches angled; bracts subtending main branches triangular, 1–5 cm long, rachillae 18–35, divaricate, stout, 20–45 cm long, 1.3 cm diam.; rachis, branches, and rachillae densely greyish-tomentose. Flowers in spirally arranged triads except staminate only distally; triad clefts 8 mm wide, 4 mm high, 3 mm deep; bract subtending triad broadly rounded, densely fringed; outermost bracteole low, 4 × 2 mm, inner two bracteoles surrounding pistillate flower sepal-like, subequal, 3–4 × 3–3.5 mm; staminate flowers in bud 6 × 5 mm, at anthesis 11 × 11 mm, calyx 4 × 6 mm, sepals imbricate, prominently keeled, rounded apically, fringed; petals broadly ovate, 5 × 4 mm, 1/3 longer than sepals, connate basally; stamens 6, filaments 4.5 mm long, connate basally in a short ring, inflexed apically, anthers 2.75 mm long, dorsifixed, locules with a central, sterile part; pistillode short, 2 mm high, conic; pistillate flowers 6.5 × 4.5 mm, ovoid-cylindric; sepals 4 × 4 mm, rounded, sparsely fringed, imbricate; petals 5 × 5 mm, thin, broadly imbricate except valvate tips, fringed; staminodes three, within one petal, 1 mm long, triangular; pistil 6.5 × 3.5 mm, stigma trifid, lobes small, erect, ovule pendulous. Fruits 13 × 11 mm, obovoid-globose, pale green when immature, purplish at maturity, mesocarp grainy, tanniniferous with few included fibers, endocarp thin, crustaceous, sculptured and costate, operculate, with a band of fibers adherent to costa; seeds 8 × 8 mm, obpyramidal, depressed apically, sculptured, costate, endosperm homogeneous, embryo basal. Germination adjacent-ligular, eophyll deeply bifid; seedlings becoming strongly trigonous at base with age, leaf sheath sharply angled, late bifid leaves tristichous, petiole and rachis densely covered with numerous, prominent blackish scales, lamina obtriangular, to 40 cm long, lobes to 5 cm wide, connate in proximal 2/5 to half; trunkless juveniles with keeled leaf sheaths, petioles angled abaxially, deeply channelled adaxially and prominently winged, litter trapping; leaf sheath marcescent on trunked juveniles, abscissing and forming a crownshaft only in mature trees.



3. A, B, C. *Burretiokentia koghiensis.* A. Dried staminate flower (*Pintaud 403*). B. Fresh portion of rachillae with fruit (*Pintaud 311*). C. Seed (*Pintaud 311*). D, E. F. *Burretiokentia dumasii.* D. Dried staminate flower (*Pintaud 266*). E. Fresh portion of rachillae with fruit (*Pintaud 317*). F. Seed (*Pintaud 317*). G, H. *Burretiokentia grandiflora.* G. Dried staminate flower (*Pintaud 335*). H. Fresh portion of rachillae with fruit (*Pintaud 392*). Scale bars: 1 mm for flowers; 5 mm for fruits and seeds. Illustrations by J.-C. Pintaud.

Additional Specimens Examined. NEW CALEDONIA. Nodéla Valley, 600 m elev., in rain forest on ultramafic rocks, 21°26′S, 165°21′E, 25 Apr. 1995 (buds), *J.-C. Pintaud, S. Blancher and T. Jaffré 166* (BH, K, NOU, P), *id.* (seedlings) *167, 168, 169, 170* (P), *id.* (buds) *171* (P); *id.* 17 Sept. 1995 (fl.), *J.-C. Pintaud and Y. Bruireu 267* (P); *id.* 25 Jan. 1996 (fr.), *J.-C. Pintaud and S. Blancher 317* (BH).

Distribution. Burretiokentia dumasii is known only from collections in Nodéla Valley on the Mé Maoya massif north of Bourail in west-central New Caledonia, at 600 m elevation (Fig. 6). According to observations and photographs by J.-P. Tivollier, however, it may also grow above Emma Mine on the ridge leading to Mé Maoya summit at 1100 m elevation, and if so, it probably occurs elsewhere on the massif. A collection at Forêt de Saille, south of Thio, in southeast New Caledonia (*Hodel et al., 1501*) may represent the same species. In that case, *B. dumasii* may be relatively widespread.

Ecology. Burretiokentia dumasii occurs in rain forest on ultramafic rocks. It is found mostly on rocky, well-drained sites on oxysols derived from peridotites.

Phenology. Burretiokentia dumasii flowers in September and fruits in January.

Conservation Status (IUCN, 1994). Low risk, conservation-dependent (LRcd). The type and only documented locality in Nodéla Valley has been recently declared a Special Reserve of Flora and Fauna. The Forestry Service of Bourail manages and controls access to the reserve. Thus, although very rare, *B. dumasii* is adequately protected. This palm is abundant where it grows and regeneration is good.

Taxonomic History. J.-M. Veillon of ORSTOM and Serge Blancher of the Forest Service found *Burretiokentia dumasii* in 1992 when the Forestry Service began to manage the forests of Nodéla. A private company had partially logged Nodéla Valley prior to 1992.

Etymology. The name honors Marc Dumas, an ardent palm enthusiast who has greatly contributed to the study of New Caledonian palms in recent years and who helped in raising a new and strong interest in palms in New Caledonia with the founding of Association Chambeyronia, of which he is currently president.

Burretiokentia dumasii shares several characteristics with *B. koghiensis,* including the new leaf expanding red and the tristichous seedling with a triangular base and prominent blackish scales. *Burretiokentia dumasii* differs from *B. koghiensis* in the less numerous, spreading leaves with far fewer pinnae, the stiffly spreading, densely tomentose inflorescences with stout rachillae, the obovoid-globose fruits, and the peculiar, pyramidal seeds (Table 2).

Burretiokentia grandiflora Pintaud and Hodel **sp. nov.** (Fig. 3 G, H)

Species insignis pinnis latissimus, floribus et fructibus grandissimus, a ceteris speciebus bene distincta. Typus: New Caledonia, Montagne des Sources, 900 m elev., 22°08′S, 166°36′E, 9 Apr. 1996 (fl.), *J.-C. Pintaud and J.-P. Tivollier 335* (holotypus P; isotypi BH, K).

Solitary, sub-canopy palm. Trunk 8–12 m tall, 9–14 cm dbh, prominently ringed. Leaves 8–12, borne in five ranks, spreading, expanding light green; sheath 40–80 cm long, fusiform, weakly costate distally to rounded, white tomentose abaxially, glabrous adaxially, splitting deeply opposite petiole nearly to base and terminating on petiole in two 20 cm long wings; petiole 18–25 cm long, channelled adaxially, weakly angled to rounded abaxially, glabrescent; rachis 2–2.80 m long; pinnae 20–25 on each side of rachis, borne ± in one plane, median pinnae 80–90 × 8–11 cm, distal ones 25 × 2.5 cm, proximal ones 38 × 3 cm (lorae absent), all acute, arranged at 5–11 cm intervals, green and glabrous on both surfaces, midrib prominent, bearing brown scales adaxially and brown-centered, white-margined scales abaxially, secondary veins slightly prominent abaxially, bearing sparse scales. Inflorescences 1–4, infrafoliar, spreading, 40–70 cm long, branched to 3 orders; peduncle 7–9 cm long, 3–6 cm wide and 1.5–2 cm thick distally, white-tomentose proximally up to insersion of first peduncular bract, indument becoming sparse above, distally green, glabrous; prophyll 27–48 cm long, inserted 2.5 cm above peduncular base, bicarinate, truncate, incompletely encircling peduncle on abaxial side, splitting in distal 2/3 on adaxial side of petiole, white-floccose abaxially, glabrous adaxially; first peduncular bract rather thick, 50–97 × 12 cm, fusiform, prominently rostrate, indument same as prophyll, inserted 1.5–2 cm above prophyll, completely encircling peduncle at insertion, second peduncular bract 4–25 × 3–11 cm at base, triangular to subulate, acute, sometimes inserted laterally and then en-

Table 2. Synopsis of differences among the three new Burretiokentia.

	B. dumasii	*B. grandiflora*	*B. koghiensis*
Seedling base	Triangular	Weakly angled	Triangular
New leaf	Red	Green	Red
Leaves	Spreading	Spreading	Erect to ascending
Number of pinnae per side	25	20–25	35–45
Size of median pinnae	80–100 × 5–8 cm	80–90 × 8–11 cm	80–110 × 5–8.5 cm
Number of rachillae	18–35	12–18	20–30
Dimensions of rachillae	20–45 × 1–1.3 cm	25–60 × 1–1.4 cm	20–45 × 0.5–1 cm
Indument of rachillae	Tomentose	Glabrous	Glabrous
Staminate flowers at anthesis	11 × 11 mm	13 × 15 mm	11 × 11 mm
Fruit shape	Obovoid–globose	Oval–obovoid	Oval–elongate
Fruit size	1.3 × 1.1 cm	2.2 × 1.7 cm	1.6 × 1 cm
Seed	Obpyramidal, 8 × 8 mm	Unknown	Elongate,11 × 7 mm

circling more than half of the peduncle at insertion, covered with abundant white tomentum abaxially, third peduncular bract 2–6 cm long, 3 cm wide at base, triangular, acuminate; rachis 9–20 cm long with 4–6 main branches 3–11 cm long, thick, angled, bracts subtending branches 1–5 cm long, triangular, acuminate, upper ones reduced to low ridges; rachillae 12–18, 25–58 cm long, 1–1.4 cm diam., straight, rounded; rachis, branches and rachillae glabrous except in triad clefts, initially cream-colored with a touch of pink becoming pale green. Flowers in triads proximally, only paired or solitary staminate flowers distally; triads in 2 spirally arranged rows, disposed in horizontal, oval clefts 10 mm long, 8 mm high, 2.5–3 mm deep, subtended by a prominent rounded bract 2–2.5 mm high, broadly rounded to truncate, sharp-edged; outer bracteole low, 5 × 1.5 mm, inner two bracteoles sepal-like, 5–7 × 3–5 mm, broadly rounded, bracteoles and pedicels of flowers with whitish, 0.5 mm long hairs; staminate flowers in bud 10 × 6.5 mm, bullet-shaped, at anthesis 12–14 mm × 15 mm; calyx 3–3.5 × 7–8 mm, bowl-like, sepals strongly bowl-like, imbricate nearly to apex, truncate to broadly rounded, dark-margined, abaxially sharply keeled; petals 8 × 6 mm, ovate, thickened, lightly ridged adaxially, striate abaxially when dry, valvate and spreading apically, connate in basal 1/6; stamens 6, 9–10 mm high, ascending to spreading, exceeding petals, filaments 8 mm long, 1.5 mm wide at middle, 3 mm wide at base, inflexed at apex, anthers 4 mm long, dorsifixed just below middle, locules with a sterile, central part, filaments connate basally in a 1 mm high ring and adnate to pistillode and petals, forming a 3 mm tall base; pistillode broadly conic, 3 mm high. Pistillate flowers just prior to anthesis 10 × 7 mm, bullet-shaped; calyx 6 × 8 mm, deeply cup-shaped, sepals scooplike, imbricate nearly to apex, broadly rounded or truncate, dark-margined, fringed; petals 8–9 × 6–7 mm, boat-shaped, ovate to oval, imbricate nearly to apex, dark-margined; staminodes 3, within 1 petal, 2 × 1 mm, triangular-rounded, connate basally; pistil 10 × 5.5 mm, ovoid, stigma lobes small, erect, acute. Fruit oval-obovoid, 2.2 × 1.7 cm, pale green when immature with prominent apical stigmatic remains 5 mm diam., perianth 7 mm high, endocarp 1.5–1.7 × 1.1–1.3 cm, rather thin, obpyramidal, deeply depressed apically and prominently costate on one side, slightly grooved on the other one; mature fruit and seed unknown. Germination adjacent-ligular, eophyll deeply bifid, late bifid leaves with petiole up to 40 cm long, channelled and winged proximally, covered with brown lepidote indument, sheath weakly angled, blade to 70 cm long, lobes connate in proximal 3/4, acute distally. Juveniles with keeled sheaths, channelled, angled and winged petioles, litter trapping.

Additional Specimens Examined. NEW CALEDONIA. Montagne des Sources, in montane rain forest on gabbros, 900 m elev., 22°08′S, 166°36′E, 19 Feb. 1996 (buds), *J.-C. Pintaud and R. Lavoix 320* (BH, NOU, P), *id.* (seedling), *321* (P), *id.* (juv.), *322* (BH, NOU, P), *id.* (seedling), 323 (P); *id.* 15 Sept. 1996 (fr.), *J.-C. Pintaud and J.-P. Tivollier 392* (BH, K, NOU, P), *id.* (juv.), *393* (K, P), 395 (BH, P); Upper Rivière Bleue Valley, in rain forest on peridotites, 200 m elev. 22°06′S, 166°38′E, 18 Jan. 1997 (fl.), *J.-C. Pintaud and J.-P. Tivollier* 438 (K,P).

Distribution. *Burretiokentia grandiflora* is only known from the upper Rivière Bleue valley in southern New Caledonia (Fig. 7), from the banks of the river at 200 m elevation about to the ridge of Montagne des Sources at 900 m elevation.

Ecology. *Burretiokentia grandiflora* grows in very wet forest (rainfall >3 000 or 4 000 mm per year) on deep, often humic soils overlaying peridotites or gabbros on well-drained slopes or wet depressions.

Conservation Status. Low risk, conservation-dependent (LRcd). Two populations of this species are known at 200 m and 900 m elevation on the same slope, each consisting of ~10 adults with juveniles and seedlings. Since exploration in nearby areas of similar forest resulted in no additional plants, it seems that *Burretiokentia grandiflora* occurs in extremely scattered, small groups, a pattern similar to the distribution of *Lavoixia macrocarpa* on Mont Panié. Contrary to *Lavoixia* though, *B. grandiflora* has normal regeneration. The species is adequately protected since its entire range is included in the Provincial Park of Rivière Bleue and the Réserve Naturelle Intégrale of Montagne des Sources.

Taxonomic History. Raymond Lavoix found this very rare species in a remote place away from trails high on a slope overlooking the valley of the Rivière Bleue. Gilles Pierson later found it near the Rivière Bleue in 1997.

Burretiokentia grandiflora is especially remarkable for its large flowers, bracteoles, and triad clefts, and leaves with few, wide pinnae. Fruits are also unusually large but are still imperfectly known. Leaf sheaths are less prominently keeled than in the two other species, and the new leaf expands light green, not red.

Burretiokentia koghiensis Pintaud and Hodel **sp. nov.** (Fig. 3 A, B, C)

Burretiokentia dumasii Pintaud and Hodel affinis sed foliis ascendentibus, pinnis numerosis, rachillis glabris, seminibus elongatis differt. Typus: New Caledonia, Mont Koghi, 500 m elev., 22°10′S, 166°30′E, 26 Sept. 1996, (stam. fl.) *J.-C. Pintaud 403* (holotypus P; isotypi BH, K, NOU).

Solitary, sub-canopy to canopy palm. Trunk 10–18 m tall, 12–17 cm dbh, prominently ringed. Leaves 12–17, borne in five ranks, erect to ascending and finally spreading, straight or twisted laterally, expanding red; sheath 60–80 cm long, cylindric to bulbous, distally costate along petiole axis, proximally rounded, abaxially pale green, covered with thick, white tomentum, adaxially bright pink with sparse to rather dense, white indument, splitting in distal 3/4 opposite petiole and terminating on petiole in two fibrous, chartaceous, prominent wings; petiole 15–35 cm long, winged at least in proximal half or up to rachis base, adaxially channelled, glabrous, abaxially angled, initially white or grey-tomentose, aging puncticulate; rachis 2.20–2.90 m long; pinnae 35–45 on each side of rachis, borne in one plane, median ones 80–110 × 5–8.5 cm, distal ones 30–35 × 3 cm, proximal 2–3 pairs 25–30 × 0.8–1.5 cm, all straight, forward-pointing, acute to acuminate, 1-ribbed, glossy green and glabrous on both surfaces, paler abaxially, midrib prominent adaxially, bearing sparse brown scales, midrib very prominent abaxially, bearing brown-centered, white-margined scales, 2–8 secondary nerves scarcely prominent, scales more abundant proximally. Inflorescences 1–4, infrafoliar, drooping, protandrous, 40–60 cm long, cream-colored to pink becoming pale green when exposed, branched to 3 orders; peduncle 4–8 cm long, 3–5.5 cm wide and 2–3 cm thick distally, covered proximally up to attachment of 3rd peduncular bract with dense white tomentum, glabrous distally; prophyll 25–40 × 10–15 cm, inserted 2–3.5 cm above peduncular base, bicarinate, bifid, chartaceous, incompletely encircling peduncle at insertion abaxially, splitting to 1/4–2/5 its length on opposite side, abaxially pale green with white-floccose tomentum, adaxially bright pink, glabrous; first peduncular bract 40–70 × 10–15 cm, oval-elongate, acuminate, chartaceous to woody, to 2 mm thick, completely encircling peduncle at insertion, inserted 1–2 cm above prophyll and exceeding it by 1/3–1/2, color and indument same as prophyll, second peduncular bract very prominent, to 30 × 15 cm, acute or bitrifid or truncate, sparsely tomentose abaxially, ciliate marginally, glabrous adaxially, third peduncular bract to 9 × 4.5 cm, shape and indument same as second one; rachis 12–19 cm long, main branches 6–8, 3–5 cm long, 1.5–2 cm wide, second order branches 0.5–1.5 cm long, all branches angled, glabrous; bracts subtending lower main branches prominent, 5–25 cm long, 3–6 cm wide at base, triangular-subulate or 2–3-fid, tomentose abaxially, subsequent bracts 0.5–6 × 1.5–3.5 cm, triangular-acuminate or enlarged basally and abruptly subulate, glabrescent; rachillae 20–30, 20–45 cm long, 0.5–1 cm diam., straight, rounded, glabrous except in triad clefts. Flowers in triads in proximal 2/3 to 4/5 of rachillae, only paired or solitary staminate flowers distally, triads closely arranged in 3 spiralling rows, disposed in horizontal elliptic clefts 6–7 mm long, 4–5 mm high, 3 mm deep, distal wall of cleft pubescent; bract subtending triads prominent, broadly rounded, sharp-edged, glabrous; outermost bracteole 3.5–4.5 × 1 mm, collarlike, next 2 bracteoles surrounding pistillate flower 4–5 × 3–3.5 mm, subequal, sepal-like, cupped; margins of bracteoles, sepals, and petals fringed with minute, whitish hairs 0.25 mm long; pedicels of staminate flowers 0.5–0.9 mm high, flattened, densely fringed with whitish hairs distally; staminate flowers in bud 6 × 4 mm, bullet-shaped, at anthesis contiguous, 11 × 11 mm; calyx 2.5–3 × 5 mm, cuplike, sepals imbricate nearly to apex, concave adaxially, prominently keeled abaxially, margins rounded; petals 6.5–7 × 3.5–4 mm, ovate, much exceeding sepals, valvate, spreading apically, acute, connate in basal 1/6, lightly grooved adaxially, ± pulvinate, striated abaxially when dry; stamens 6, 8 mm high, conspicuously exceeding petals, erect to spreading, filaments 7 mm long, flattened-columnar, inflexed apically, connate basally in a 0.5 mm high ring and adnate to petals and pistillode to form a 2.75 mm high base, anthers 2.75–3 mm long, dorsifixed slightly below middle, locules briefly united by a central connective, each with a sterile, tanniniferous median part marked with included raphides; pistillode short, 2.5 mm high, broadly conic; pistillate flowers 7 × 5 mm, ovoid; calyx 4.5 × 4–5 mm, cuplike, sepals cupped, imbricate nearly to apex, broadly rounded or truncate, fringed; petals 6 × 3.5–4 mm, equalling pistil, cupped, imbricate except valvate tips, thin; staminodes 3, within 1 petal, 1 mm long, triangular; pistil 6 × 3 mm, ovoid, stigma trifid, lobes small, ± blunt, rough, erect to slightly recurved, ovule pendulous. Fruits 16 × 10.5 mm, oval, immature whitish-green becoming pink and finally dark purple at maturity, perianth 5 mm high, stigmatic remains subapical, epicarp smooth, mesocarp 1.25–1.5 mm thick, grainy with numerous tannin cells and few, short longitudinal fibers, endocarp thin, crustaceous, sculptured and costate, with a band of fibers adherent to costa, operculate; seeds 11 × 7 mm, deeply sculptured and fluted longitudinally with a prominent costa running the length of the seed; endosperm homogeneous, embryo basal. Germination adjacent-ligular, eophyll deeply bifid; seedlings and juveniles like those of *B. dumasii*.

Additional Specimens Examined. NEW CALEDONIA. Mont Koghi, 600 m elev., 6 Nov. 1951 (old infr.), *M. G. Baumann-Bodenheim 15746* (BH, P, Z); Mont Koghi, in rain forest on serpentine, 500 m elev., 22°10′S, 166°30′E, 29 Nov. 1994 (seedlings), *J.-C. Pintaud, J.-M. Veillon and J. Favier 78, 80* (P); 20 Dec. 1994 (juv.), *J-C. Pintaud, J.-M. Veillon and J. Favier 103, 105, 106* (P); *id.* 29 Dec. 1994 (juv.), *J.-C. Pintaud and H. Jourdan 119, 120* (P); *id.* 17 Jan. 1995 (juv.), *J.-C. Pintaud 133* (P); *id.* 22 May 1995 (buds), *J.-C. Pintaud 198* (K, P), *id.* (juv.), *J.-C. Pintaud 199* (P); *id.* 8 Sept. 1995 (stam. fl.), *J.-C. Pintaud 260* (BH, K, NOU), *id.* (pist. fl.), *J.-C. Pintaud 261* (BH, NOU, P), *id.* (stam. fl.), *J.-C. Pintaud 262* (BH), *id.* (pist. fl.), *J.-C. Pintaud 263* (K, P), *id.* (pist. fl.), *J.-C. Pintaud 264* (P); *id.* 12 Jan. 1996 (fr.), *J.-C. Pintaud and M. Dumas 311* (K), *312* (NOU), *313* (BH, K, NOU, P), *314* (P).

Distribution. Burretiokentia koghiensis is only known from the southeast and southwest slopes of Mont Bouo in the Mont Koghi massif above Nouméa (Fig. 1) at 500–600 m elevation.

Ecology. Burretiokentia koghiensis is restricted to a narrow band of serpentine rocks located between the schistose base and peridotitic cover of Mont Bouo (Fig. 1). It occurs in the rain forest understory or canopy in very rocky habitats on brown hypermagnesian, neutral soils of serpentine origin (Fig. 4).

Phenology (Fig. 2). Flowering of *Burretiokentia koghiensis* is very seasonal. Anthesis occurs August–October and fruits mature in December–January. Plants are sterile February–April, the first inflorescences appearing in May but the flowers remaining in bud until September. The thick first peduncular bract often does not open before anthesis, suggesting self-pollination can occur. Bees visit exposed flowers.

Conservation Status. Vulnerable. *Burretiokentia koghiensis* is known from a single location in an area ~4 × 0.5–1 km. Despite its restricted range, it is abundant where it occurs and regeneration is good. However, the status of the location is very complex since several parties, including private and governmental entities, own and/or manage portions of the land. In recent years, forest fires on Mont Koghi and in the Thy River valley and land clearing where *B. koghiensis* reaches its highest density on private properties have demonstrated that the site is not adequately protected. The forest was selectively logged half a century ago but this did not affect the palm populations.

Taxonomic History. Burretiokentia koghiensis was first collected in 1951, but mistaken for *B. vieillardii* with which it occurs. The only collection known to Moore (*Baumann 15746*) was listed under *B. vieillardii* in Moore and Uhl (1984). In the early 1990s, members of Association Chambeyronia noticed major differences between the two species (Dumas 1994) and named the new palm *Burretiokentia* sp. #83, in reference to a label in front of one specimen along the self-guided nature walk at the tourist site of Auberge du Mont Koghi. Seeds have been widely distributed as *Burretiokentia* sp. #83.

Concurrently, J.-M. Veillon and T. Jaffré of ORSTOM, Nouméa, working on the structure and floristics of the forest, noticed *Burretiokentia* sp. #83 was restricted to soils derived from ultramafic serpentine rocks, while *B. vieillardii* was confined to soils derived from schistose rocks; the two species occurring together only in the area of contact between both substrates (Fig. 1). The two species differ strikingly in their phenology (Fig. 2), and there is no evidence of hybridization.

Burretiokentia koghiensis is readily distinguished from *B. vieillardii* (Table 1) particularly by the open, white-tomentose leaf sheaths (Fig. 5), the numerous, erect leaves expanding red and with many, closely inserted pinnae, the contracted, drooping inflorescences with a short rachis and first order branches, and the small fruits which change from white to purple at maturity (Fig. 8).

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Astrocaryum minus, Rediscovered in French Guiana

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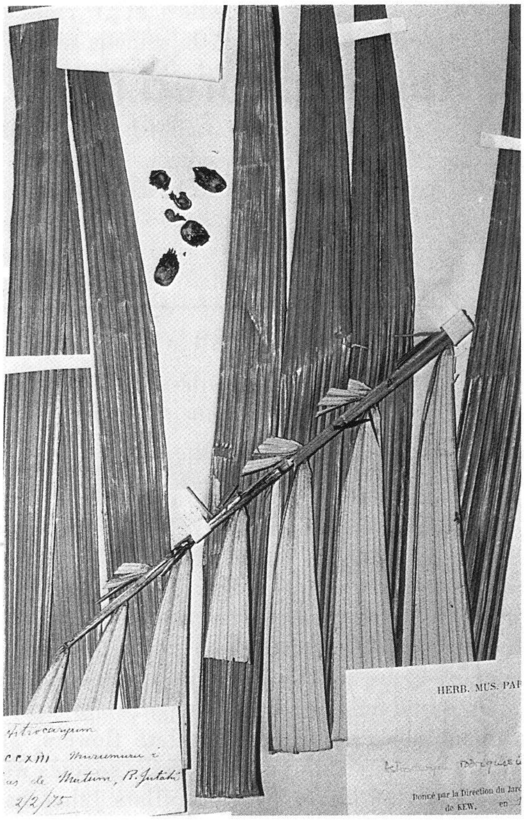
ABSTRACT

Astrocaryum minus, described by Trail (1877), was formerly known from only the type specimen. This taxon was treated as a variety of *A. rodriguesii* Trail by Barbosa Rodrigues (1879, 1903) and as its synonym by Wessels Boer (1965). Kahn and Millán (1992) and Henderson (1995) considered it a synonym of *A. gynacanthum* Martius. *Astrocaryum minus* was collected in French Guiana, near Cayenne, in 1995. Morphological and floral characters of this palm clearly differentiate it from other species within section *Munbaca* and thus support treating it as a distinct species.

Trail (1877:78–79) commented upon the description of *Astrocaryum minus*: "it can hardly be confounded with any species save *Astrocaryum gynacanthum*, or its variety *A. munbaca*.... From these it is readily distinguished by its larger size, much longer leaves with more numerous pinnae, and longer spadix. Comparison of examples of the two species shows at once that they are distinct, though it is rather difficult to express the points of difference in a description."

Trail had recognized a new species, but did not clearly differentiate it from other species of the genus. This species, which had not been collected since Trail's journey in Amazonia in 1874, soon fell into synonymy, though Drude (1881: 374) considered it a distinct species and described its variety *terrae-firmae* in *Martius Flora Brasiliensis*. Larger than *A. gynacanthum* Martius and single-stemmed, *A. minus* first became a variety of *A. rodriguesii* Trail (Barbosa Rodrigues 1879, 1903), which is a tall palm up to 20 m in height, and then its synonym (Wessels Boer 1965). The arguments used by these botanists are, however, far from persuasive. Barbosa Rodrigues (1903:76) wrote : "Je considère, dans le doute, l'*Astrocaryum minus* Trail et sa variété *terrae-firmae* Dr. comme une variété de l'espèce dont je m'occupe [*A rodriguesii*]", (I consider, in doubt, *Astrocaryum minus* Trail and its variety *terrae-firmae* a variety of the species I am dealing with [*A rodriguesii*]), but he did not express the botanical reasons which made him doubt species status for *A. minus.* Wessels Boer (1965: 139), based only on vegetative parts of the palm without considering the pistillate flowers, argued that the smaller size of Trail's species was the result of injury by caterpillars "that had gnawed about 1 cm wide holes in the trunk." He concluded: "The differences between *A. minus* and *A. rodriguesii* can be explained satisfactorily by this injury." It is true that such an injury may result in smaller, depauperate leaves and inflorescence, but it cannot change the structure of the flower. If this were possible, most concepts in higher plant systematics and plant evolution would have to be drastically revised.

The type of *A. minus,* deposited in Kew and Paris (*Trail 1071, CCXIII*), includes some pistillate flowers (Fig. 1). These have no pedicel; the calyx is deeply cup-shaped to tubular; and the corolla is oblong-urceolate, not tridentate, and clearly longer than or subequal to the calyx. The pistillate flowers of *A. rodriguesii* are borne on pedicels; the calyx and corolla are clearly tridentate, tubular to cone-shaped; and the corolla is shorter than the calyx. *Astrocaryum minus* is, in fact, closer to *A. gynacanthum,* the pistillate flowers of which are not pedicellate and the corolla of which is slightly longer than or subequal to the calyx. Kahn and Millán (1992) considered *A. minus* a synonym of *A. gynacanthum* (not of *A. rodriguesii*), but they did not reject the



1. Isotype of *Astrocaryum minus* in Paris (P). The holotype is deposited in Kew (K). Photo F. Kahn.

idea that it might be a distinct species. Henderson (1995) maintained *A. minus* as a synonym of *A. gynacanthum.*

Astrocaryum minus Rediscovered

In 1995, looking for some palm species in the forest of Mont Grand Matoury (elevation 234 m) near Cayenne, we found *Astrocaryum gynacanthum, A. paramaca* Martius, *A. murumuru* Martius, and two individuals of a species not known in the Guianas. The vegetative parts of this palm matched very well Trail's description of *A. minus* (Fig. 2); its pistillate flowers are similar to those of the type specimen, and the corolla is clearly longer than the calyx (Fig. 3). This species can easily be separated from *A. gynacanthum* by its single, much larger in diameter, trunk and its longer leaves. Its inflorescence is much longer. The two species differ in the size of their staminate flowers (Table 1) and in the petals, which are slightly reflexed at the apex in *A. minus* while those of *A. gynacanthum* are strongly reflexed. They also differ in the size and form of their pistillate flowers (Table 2, Fig. 4). These two species are therefore distinguishable in both vegetative parts and floral features. Consequently, *Astrocaryum minus* Trail must be considered as a distinct species.

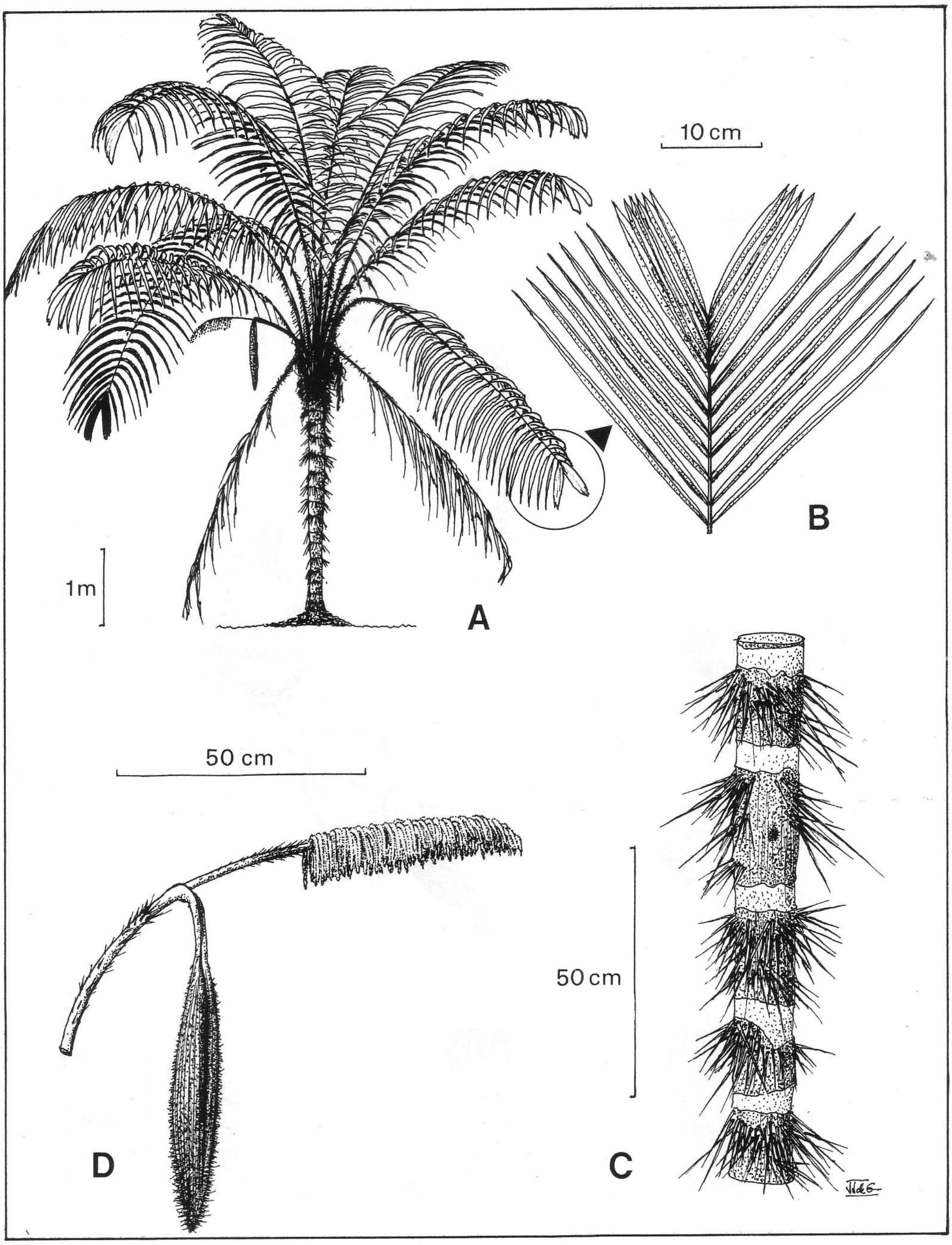
Position of *Astrocaryum minus* in the Genus

Drude (1881) classified *A. minus* and its variety *terrae-firmae* Drude in the section *Ayri.* Barbosa Rodrigues (1903:76) wrote: "M. le professeur Drude la classa dans sa section *Ayri,* dont le faciés et les fruits sont tout à fait différents de ceux de l'*A. gynacanthum.* Il est vrai que l'on ne connaît pas les fruits de l'individu trouvé par M. Trail. Ces fruits seuls pourront faire disparaître le doute." (Professor Drude classified it in his section *Ayri,* the facies and fruits of which are quite different from those of *A. gynacanthum.* It is true that the fruits of the individual found by Mr. Trail are not known. Only the fruits will eliminate the doubt.) The three species, *A. gynacanthum, A. paramaca,* and *A. rodriguesii,* are remarkable because of the fruit epicarp, which splits open into several lobes at maturity to display a yellow to orange mesocarp. Burret (1934) classified them in section *Munbaca.*

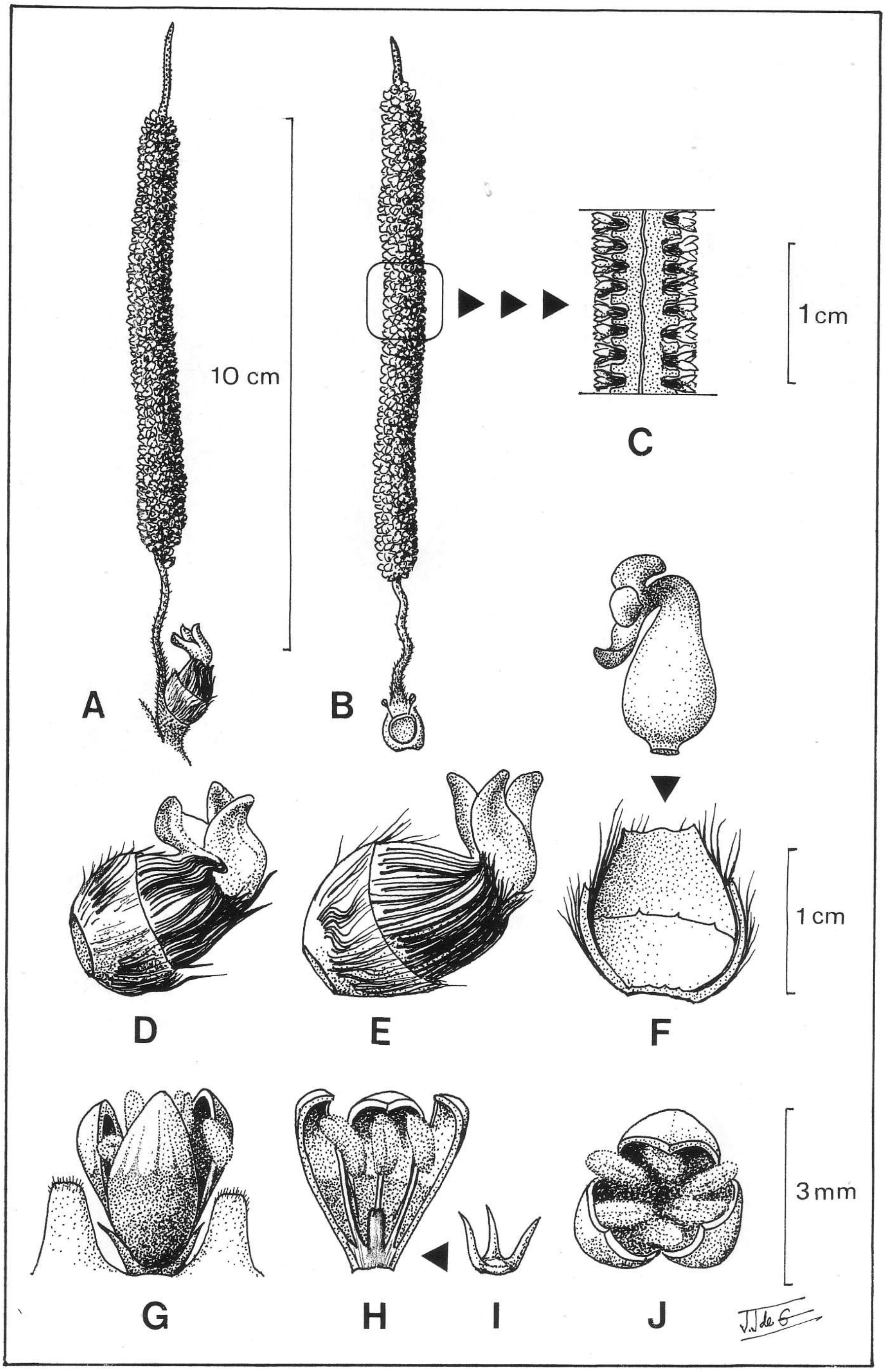
Though the fruit of *A. minus* is still unknown, the characters of the vegetative parts and of the inflorescence clearly suggest a close affinity with section *Munbaca* of subgenus *Monogynanthus,* which is characterized by only one pistillate flower at the base of the rachilla, spines grouped in rings on the trunk, pinnae regularly arranged in one plane, and sheaths of the dead leaves not persisting on the trunk under the crown. An analysis of DNA variation in the genus *Astrocaryum,* using the technique AFLP (amplification fragment length polymorphism), clearly shows affinities of *A. minus* with *A. gynacanthum, A. paramaca,* and *A. rodriguesii.* These four species form a group, which is very well separated from the members of the section *Ayri* at the molecular as well as at the morphological level (Kahn and Second, in press).

A New Palm Species for the Guianas

The genus *Astrocaryum* is represented in the Guianas by 11 of the 26 Amazonian species, of which eight (marked with an asterisk) occur in



2. A: *Astrocaryum minus*, single-stemmed palm; B: leaf apex; C: trunk with spines; D: inflorescence. (Drawing J-J. de Granville)



3. A: rachilla with a single pistillate flower at the base, the distal part with staminate flowers; B: two staminate flowers on each side of the pistillate flower forming a triad at the base of the rachilla; C: longitudinal section in rachilla showing the immersed staminate flowers; D, E: pistillate flower; F: corolla with the adnate staminodial ring inside; G: staminate flower; H: corolla, stamen and pistillodes at the base; I: calyx; J: staminate flower seen from above. (Drawing J-J. de Granville)

Table 1. Comparison of staminate flowers of Astrocaryum minus *and* Astrocaryum gynacanthum.

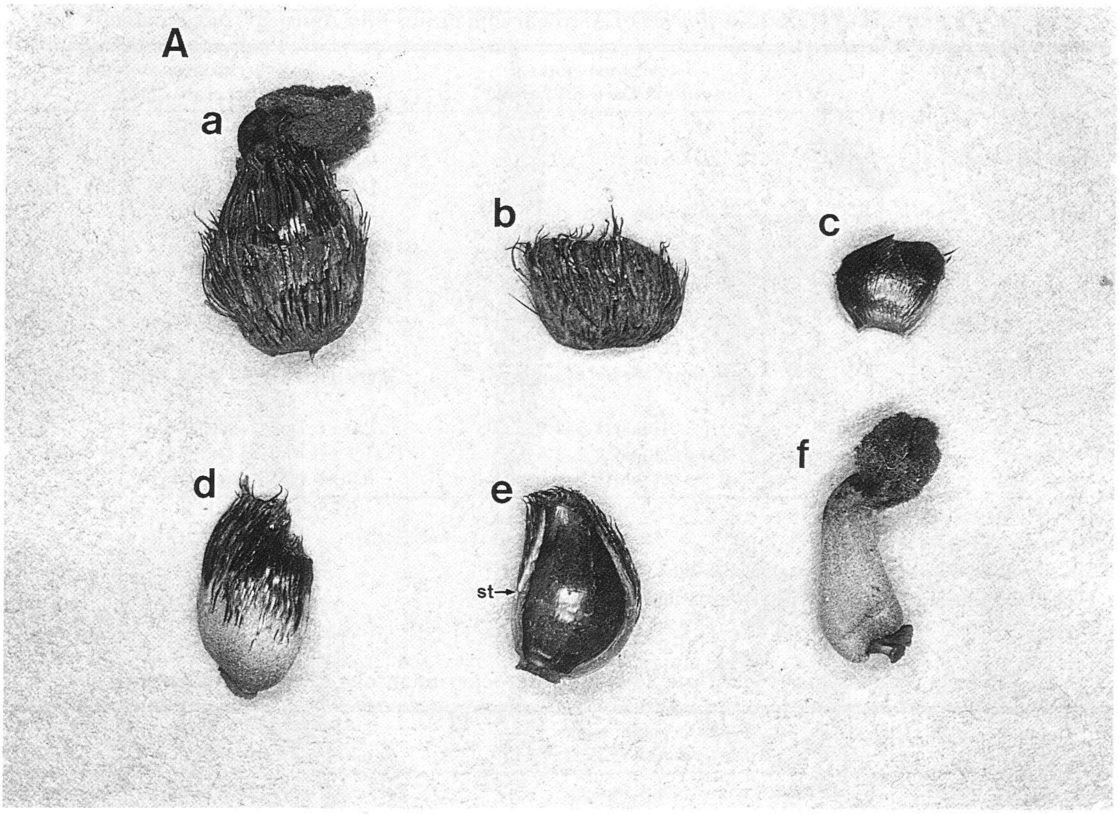
Flower Part	*Astrocaryum minus* (*Granville & Kahn 12921*, CAY)	*Astrocaryum gynacanthum* (*Balick et al. 1479*, CEN)
Rachilla[1]		
Basal part setose	1.9–3.6 cm	0.9–2.1 cm (1.5 cm)[2]
Distal part[3]	7.4–9.8 cm	3.1–5.0 cm (2.5–3.5 cm)[2]
Apex	1.3–2.2 cm	0.5–1.3 cm
Staminate flower[4]		
Sepals	0.8 ± 0.1 mm (0.6–1.0 mm)	0.5 ± 0.1 mm (0.4–0.6 mm)
Petals	3.3 ± 0.2 mm (2.8–3.6 mm) slightly reflexed at anthesis	2.8 ± 0.2 mm (2.5–3.1 mm) strongly reflexed at the apex at anthesis
Stamens		
Filament	1.7 ± 0.1 mm (1.5–1.9 mm)	2.0 ± 0.1 mm (1.8–2.3 mm)
Anther	1.3 ± 0.1 mm (1.1–1.5 mm)	1.1 ± 0.1 mm (1.0–1.2 mm)
Pistillodes	0.7 ± 0.1 mm (0.5–0.9 mm)	0.8 ± 0.1 mm (0.6–1.0 mm)

[1]Length: extreme values, $n = 20$.
[2]From Wessels Boer (1965).
[3]Part of the rachilla bearing the staminate flowers.
[4]Length: mean ± standard deviation (extreme values), $n = 20$.

Table 2. Comparison of pistillate flowers of Astrocaryum minus *and* A. gynacanthum.

Flower Part	*Astrocaryum minus* (*Granville & Kahn 12921*, CAY)[1]	*Astrocaryum gynacanthum* (*Scariot 5*, CEN)[1]
Calyx length	8.0 ± 0.6 mm (6.4–9.1 mm)	3.0 ± 0.2 mm (2.7–3.3 mm) (1–3 mm)[2]; (4 mm)[3]
Calyx shape	deep cup-shaped, spines twisty and slightly flattened, not hiding the floral parts, 4.8–9.5 × 0.2–0.4 mm[4]	wide-mouthed cup-shaped, spines very twisty and flattened, hiding the floral parts, 7.8–12.5 × 1.1–2.3 mm[4]
Corolla length	11.5 ± 0.6 mm (10.3–12.5 mm)	3.3 ± 0.2 mm (3.0–3.6 mm) (1–4 mm)[2]; (3 mm)[3]
Corolla shape	oblong-urceolate, spines twisty, 5.9–8.6 × 0.2–0.4 mm[4]	wide-mouthed cup-shaped, spines twisty and flattened, 4.8–8.6 × 0.6–1.4 mm[4]
Staminodial ring height	4.7 ± 0.7 mm (3.8–6.6 mm)	0.9 ± 0.2 mm (0.5–1.1 mm) (1 mm)[2,3]
Gynoecium length[5]	15.0 ± 1.3 mm (12.3–17.5 mm)	7.9 ± 1.3 mm (6.3–10.3 mm) (9–10 mm)[2]
Gynoecium diameter[6]	7.1 ± 0.3 mm (6.7–7.7 mm)	4.4 ± 0.3 mm (3.9–5.5 mm) (4–5 mm)[2]
Gynoecium shape	± cone-shaped, round in cross section, external wall of ovarium smooth ± pilose with minute indumentum	pear-shaped, ± oval in cross section, external wall of ovarium with longitudinal ridges, covered in brown to whitish hairs
Stigma length	8.2 ± 1.3 mm (6.3–10.5 mm)	4.3 ± 0.6 mm (3.4–5.6 mm) (5–6 mm)[2]

[1]Mean ± standard deviation (extreme values), $n = 20$.
[2]From Kahn and Millán (1992).
[3]From Henderson (1995).
[4]Extreme values; the largest spine of calyx and corolla was measured for each flower.
[5]Stigma length not included.
[6]The widest part of the gynoecium is measured.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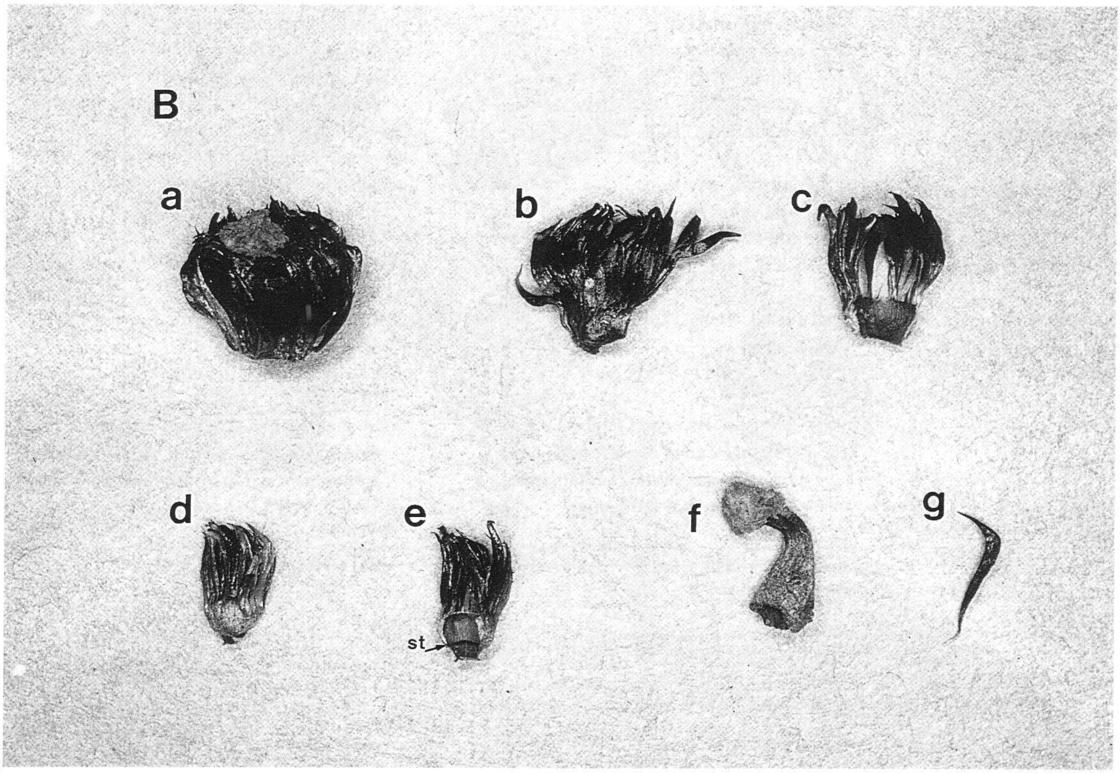
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French Guiana. Identification keys to these species are found in Kahn and Millán (1992) and Kahn and Ferreira (1995) :

Subgenus *Pleiogynanthus*: *A. acaule* Martius, *A. aculeatum* Meyer, *A. jauari* Martius*, *A. vulgare* Martius*

Subgenus *Monogynanthus*
Section *Munbaca*: *A. gynacanthum**, *A. minus**, *A. paramaca**, *A. rodriguesii**
Section *Ayri*: *A. farinosum* Barbosa Rodrigues, *A. murumuru**, *A. sciophilum* (Miquel) Pulle*.

The presence of *A. minus* on Mont Grand Matoury (52°21′W, 4°52′N) is noteworthy because the type specimen was collected in the Jutaí River valley located in western Amazonia, much nearer to Peru than to French Guiana. The place reported by Trail as "Barreiras do Mutum" may refer to the confluence with the Mutum River (approx. 68°06′W, 4°24′S). *A. minus* had never before been collected in French Guiana in spite of intensive botanical expeditions having been made for the last 30 years (Hoff and Cremers 1996). And, we never encountered a collection of this species in herbaria (BH, G, IAN, INPA, K, MPEG, NY, P, US) except for the type specimen.

Owing to its extreme rarity, *Astrocaryum minus* must be considered an endangered species. The construction of a new road to the top of the mountain, where a military hertzian relay will be soon built (Commandement Supérieur des Forces Armées de Guyane 1995), traverses the site where the palms grow. Fortunately, the road has been detoured around this population of *A. minus,* thereby protecting the only known Guianan population of this species. Moreover, the vegetation of Mont Grand Matoury, one of the last patches of primary forest near Cayenne, was declared a protected habitat ("Arrêté de Protection de Biotope" in April 1994 (de Granville and Sanite 1995).

Conclusion

Johnson (1996:6) concluded, "It is remarkable that lumping occurred in palms of all categories of threat, but with the highest percentage in the group of Unknown, Insufficiently known but suspected to be threatened, and Rare palms. Many of these palms are known from their type collection only, or are otherwise rare and taxonomically not well defined." *Astrocaryum minus* was collected on February 2, 1875 and 120 years passed before it was rediscovered. This example should teach taxonomists that they must be very careful before lumping taxa that are insufficiently known. In doubtful cases, the rule to follow is to maintain the former poorly known taxa until new data from new collections are obtained.

Identification Key to Species in the Section *Munbaca* of the Subgenus *Monogynanthus*

1a. Pistillate flower with a short pedicel; fruit pedicellate [2]
 2a. Trunk subterranean. Inflorescence erect . . . .[*Astrocarym paramaca*]
 2b. Trunk well developed. Inflorescence pendent . . . .[*Astrocaryum rodriguesii*]
1b. Pistillate flower without a pedicel; fruit not pedicellate . . . . [3]
 3a. Multi-stemmed palm, the trunks 3.5–7 cm in diameter. Leaves with less than 50 pinnae per side. Pistillate flowers 8–11 mm long; calyx and corolla armed with flattened spines that hide the floral parts; staminodial ring 1 mm high . . . . [*Astrocaryum gynacanthum*]
 3b. Single-stemmed palm, the trunks 10–15 cm in diameter. Leaves with more than 50 pinnae per side. Pistillate flowers 13–20 mm long; calyx and corolla armed with spines that do not hide the floral parts; staminodial ring 4–6 mm high . . . .[*Astrocaryum minus*]

Acknowledgments

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←

4. A: pistillate flower of *Astrocaryum minus*; B: pistillate flower of *Astrocaryum gynacanthum* (a: flower entire, b: calyx outside, c: calyx inside, d: corolla outside, e: corolla inside with the staminodial ring (st), f: gynoecium, g: spine). Photo F. Kahn.

of the mountain. We are indebted to Dr. Scott Mori who reviewed the manuscript.

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1998 I.P.S. BIENNIAL AND POST-BIENNIAL TOUR, THAILAND

Although the regular Biennial Registration Deadline was July 15, it is still not too late to register for the event. Late registration surcharge after July 15, 1998 is only US $50 on both the Biennial and Post-Biennial Tour. There are no other surcharges for those who register soon. Fill out the registration form that was included as a separable insert in the January 1998 issue of *Principes*.

The Biennial will be in Central Thailand; starting in the Bangkok area, moving to Pattaya, and then returning to Bangkok. Biennial events officially begin on Friday, September 11, and end Thursday, September 17, with attendees departing on Friday. Directors and Officers should arrive in Bangkok the night before, in order to attend the morning Board Meeting on Thursday, September 10. Biennial costs are, not including airfares, US $750 per person double occupancy or US $920 per person single occupancy.

The Optional Post-Biennial Tour begins on Friday, September 18, and ends on Wednesday, September 23, in Bangkok. Tour events will be in Southern Thailand in the area of Sungai Ko-Lok and Phuket, then return to Bangkok. Costs (again exclusive of airfares) for the Post-Biennial Tour are US $850 per person double occupancy or US $980 per person single occupancy.

• Regarding Biennial registration information, payment, schedules, refunds, etc., please contact Bill Woodard at Allen Meeting Management, e-mail: <bwoodard@allenpress.com>. Telephone: (within the US) 1-800-627-0629 or (outside the US) 011-1-785-843-1235

• Regarding specific questions on itinerary or individual needs, please contact Phil Bergman, President I.P.S., at: telephone 1-619-291-4605, fax 1-619-574-1595, or e-mail to <palmNcycad@aol.com>.

• Regarding discounted international airfares or extra accommodations: Christina Grant, Universal Travel, phone (within the US) toll free: 1-888-890-4588; direct phone line: 619-278-8980; fax: 619-278-5658.

Back Cover

Tectiphiala ferox H. E. Moore

The wettest part of Mauritius is home to the unusual palm *Tectiphiala ferox*. During a recent hike through the region, not surprisingly in heavy rain, the species was observed and photographed in flower. The individual in this photograph is larger than most, at nearly five meters tall. Its bright yellow inflorescences stand out against the silver-grey undersides of the leaves and the cloudy sky.

Tectiphiala ferox is one of five palm species endemic to Mauritius. Like the others, it is highly endangered and restricted to a very small part of the island. At present, it survives in remnants of native moist shrubland, in the central mountains south of Curepipe. *Tectiphiala* may have been quite common until about 30 years ago, when large portions of its range were cleared. Much of the area had been converted to pine plantations well before 1978, when the genus was described by H. E. Moore Jr.

Moore estimated a total population size of 28 individuals, noting several small groups scattered between the tracts of timber plantations. Some of these have disappeared since then, including the group of cespitose individuals at the type locality. All plants known to exist today have a solitary habit.

Though there has been a gradual loss of known populations, several others have been discovered in recent years. It is now estimated that more than 50 adult *Tectiphiala* plants remain. They flower regularly, with occasional seed production, but seedlings are never found naturally in the wild. Regeneration is prevented by vigorous exotic plants, such as Chinese guava (*Psidium littorale*). These outcompete slow-growing palm seedlings.

The National Parks and Conservation Service has been able to raise *Tectiphiala* from wild-collected seeds. The seedlings are planted among wild stands in managed plots, where invasive exotics are cleared away. With care, the *Tectiphiala* seedlings are becoming established gradually (see photo below).

CARL E. LEWIS

Tectiphiala ferox seedling, four years of age, cultivated for reintroduction into the wild.