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PRINCIPES

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Contents for July

Cover Picture

Scheelea butyracea (Mutis ex L.f.) Karsten (as *Scheelea regia* Karsten). Source: Hermann Karsten, *Florae Columbiae* 2: tab. 176(1866). Photo: Victor Krantz.

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Principes, 31(3), 1987, pp. 107–109

Carl Wilhelm Scheele, of the Palm Genus Scheelea

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In the Middle Ages the European alchemists believed that the beating rays of the sun engendered veins of gold in the earth, and sought to duplicate the process by forging base metals into gold (Tiffany and Adams 1985). By the time C. W. Scheele appeared on the scene, however, the alchemists had since given up the search for a "philosopher's stone" to convert dross into gold, and a rudimentary science of chemistry had emerged, often joined as a handmaiden to medicine and pharmacy. Scheele (Fig. 1), a pharmacist and chemist, lived in an era when it was still possible to find drug emporia stocked with powdered sapphires, emeralds, garnets and pearls to be ingested for various maladies (Zekert 1931–1933).

It was an age when people were confusedly grappling with the actual meaning of fire, air, stone and water as the elemental components of the universe. Scheele sought to clarify the concepts of air, fire, light, and heat from a chemical standpoint, through experiments to determine whether air is a simple or compound gas, and which entity is the combustible part of the air (Zekert 1936). And, for his successful work, he is credited with the discovery of oxygen.

Scheele's family was of German stock, living in Stralsund at a time when it was the capital city of Swedish Pomerania. Stralsund is located on the Baltic Sea coast, and is today in the German Democratic Republic (East Germany). Carl Wilhelm Scheele was born in Stralsund on December 19, 1742 to Margaretha Eleonora Warnekross and her husband Johann Christian Scheele, a brewer and grain merchant. He had a peaceful and rather uneventful childhood as the seventh-born child amidst his five brothers and five sisters. In 1757 at the age of fifteen he left Stralsund to learn pharmacy as an apprentice at the Apotheke "Zum Einhorn" in Gothenburg, where he stayed until 1765 doing basic chemical experiments.

Then, in 1765 he went to Malmo to work as a resident apothecary in the Apotheke "Zum Reichsadler," during which time he was influenced by the scholar J. A. Retzius, director of the Botanical Gardens in Lund. Always in search of more advanced surroundings, he migrated in 1768 from Malmo to Stockholm, where he worked at a shop known as the Apotheke "Zum Raben" until 1770. In 1769 he began his career as an independent chemical researcher, which resulted in the discovery of oxygen sometime between 1771 and 1773, and the discovery of chlorine in 1774. Even the non-chemist will appreciate the scope of his other discoveries, a few of which are hydrofluoric acid, citric acid, hydrogen sulfide, hydrogen cyanide—and he very materially contributed to the discovery of manganese, nitrogen, tungsten, barium and molybdenum (Smeaton 1986).

Scientific historians have established that Scheele's discovery of oxygen occurred at least one or two years prior to the more publicized, independently achieved preparation of oxygen by Joseph Priestly on August 1, 1774. To the public at large, the discovery by Priestly (1733–1804), an English chemist, has become the better known of the two events, because Priestly managed to publish his findings first. This

1. Carl Wilhelm Scheele. Source: Otto Zekert, 1931. *Carl Wilhelm Scheele: Sein Leben und Seine Werke.* Photo: Victor Krantz.

happened due to the negligence of Scheele's publisher, who caused a two-year delay in releasing his *Chemical Treatise on Air and Fire* (1777), which Scheele had submitted for printing in 1775. For years afterwards, Scheele glowed with indignation over the ungenerous priorities of fate, and, as luck would have it, another of his major discoveries, that of chlorine in 1774, was also pre-empted—in 1810 by Sir Humphrey Davy (1778–1829), the English chemist, who surpassed him by recognizing chlorine as a chemical element (Anonymous 1974).

Scheele left Stockholm in 1770 for Uppsala (the university city of Carl Linnaeus), where he became an apothecarial assistant at the Apotheke "Zum Wappen von Uppland," staying there until 1775. In that year he became a member of the Royal Swedish Academy of Sciences, and moved to the town of Kopping, where he purchased (in 1776) and managed his own pharmacy. He spent the remainder of his sadly foreshortened life, which spanned only 43 years, there in Kopping, Sweden, a victim of progressively worsening rheumatism and arthritis (Zekert 1963).

Scheele had seemed destined to be a lifelong bachelor, but fate intervened and on May 19, 1786, only three days before his death, he married Sara Pohl (1751–1793), the widow of H. P. Pohl from whom Scheele had purchased the Kopping pharmacy. Scheele succumbed to his illnesses and died on May 21, 1786, whereupon his wife inherited the pharmacy as he had planned. Two years later the twice-bereaved Mrs. Scheele married Mathias Georg Bolkau (1753–1804). In his last will and testament, Scheele had designated his assistant Bolkau to look after his affairs, though he scarcely could have imagined how completely Bolkau would rise to that occasion.

The New World monoecious feather palm genus *Scheelea*, comprising about 28 species (Glassman 1977), was named in 1857 by Hermann Karsten (1817–1908), a German botanist who was born in Scheele's home town of Stralsund on November 4, 1817 and studied botany in the Stralsund pharmacy. Karsten was therefore an apprentice pharmacist as the great Scheele himself had once been, and Karsten published on the pharmaceutical-medicinal plants of Germany in the 1880's, after his earlier phase of writing on Latin American plants, such as the monumental *Florae Columbiae* of 1858–1869 (Tryon 1963).

A number of abundant *Scheelea* species having economic uses are discussed by Braun (1968, 1984), and the palms also have value as a primary wildlife food, especially for monkeys (Janson 1986). The cover photo for this issue depicts *Scheelea butyracea*, the spectacular "palma de vino" or "palma de puerco" of Colombia and Venezuela, originally designated *S. regia* by Karsten.

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Principes, 31(3), 1987, pp. 110–115

A New Species of Ptychosperma (Palmae) from New Britain

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New Britain is the largest island of the Bismarck Archipelago, which lies just to the east of the large island of New Guinea. The Bismarck Archipelago is part of the nation of Papua New Guinea, which includes the eastern half of New Guinea, and several other adjacent island chains. New Britain is a rugged, mountainous island of over 14,000 square miles, with peaks up to 7,500 feet in elevation. Although the two islands are separated by only 75 miles, the palm flora of New Britain is quite distinct from that of New Guinea, having more similarities with that of the Solomon Islands.

Botanical exploration, and particularly exploration for palms, in the Bismarck Archipelago has lagged behind that of the mainland part of Papua New Guinea, and only a handful of endemic species have been described from the region (Essig 1986). Collections that have been made there, however, including a number by forestry botanists based at LAE, several anthropologists, and by myself, give promise of many other undescribed species, particularly in the subtribes *Ptychospermatinae*, *Arecinae*, and *Iquanurinae*. Most of these specimens are not complete enough to be formally described and further collections are needed. One species, however, is fairly well known, and has even been cultivated, in Papua New Guinea and apparently also overseas. It is described here, and named for E. E. Henty, one of the foremost resident botanists in New Guinea for the past 30 years, and one of the discoverers of this species.

Ptychosperma hentyi occurs in lowland areas of eastern New Britain, and was first collected by Henty and David Frodin in 1966. It was apparently introduced into cultivation at that time, because two specimens established at the National Botanic Gardens in LAE (Fig. 1) match the type collection very well. Apparently seed was also sent overseas, either from the original collection, or from the progeny at LAE, because I have recently received leaf fragments and photographs of a specimen growing in a botanical garden in South Africa which appears to belong to this species. The specimens at LAE were already flowering and fruiting during my stay there in 1971–72.

The new species is very distinctive, with graceful, pendulous or "weeping" fronds and broadly cuneate leaflets with convex praemorse tips. The pinnae diminish markedly in size toward the tip and the apical pair are each only about 2–5 cm long (Fig. 2). These leaves are unlike any others known in *Ptychosperma*, in which pinnae are concave or notched at the tips, and not so reduced at the end of the frond. Also, the marked, weeping habit, in which the leaves curve gracefully into a downward-orientation, is otherwise unknown in

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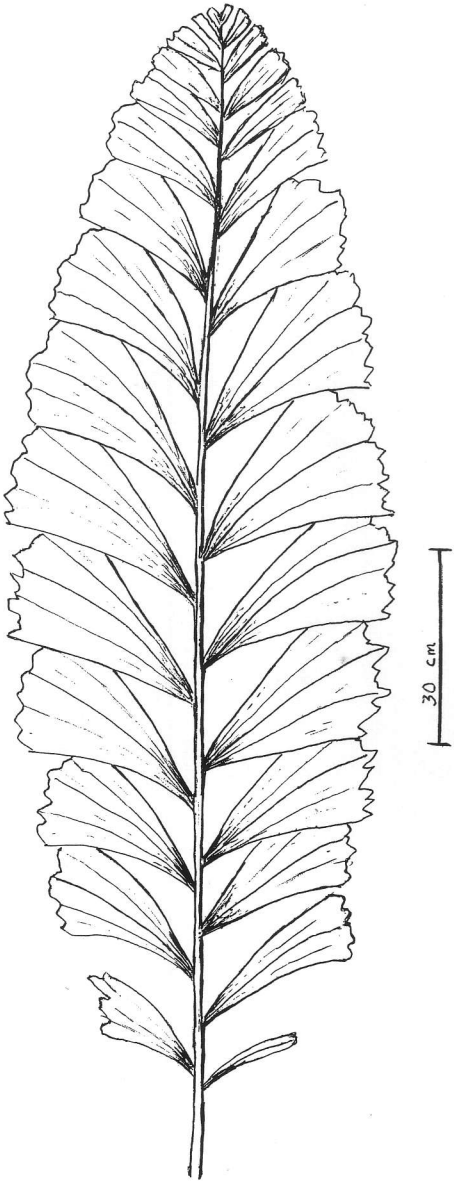
1. Photograph of one of the specimens of *Ptychosperma hentyi* growing at the National Botanic Gardens in Lae, Papua New Guinea in 1972 (reprinted from *Principes* 16(4):p. 125, 1972).



2. *Ptychosperma hentyi*: drawing of the leaf, based on the type specimen.

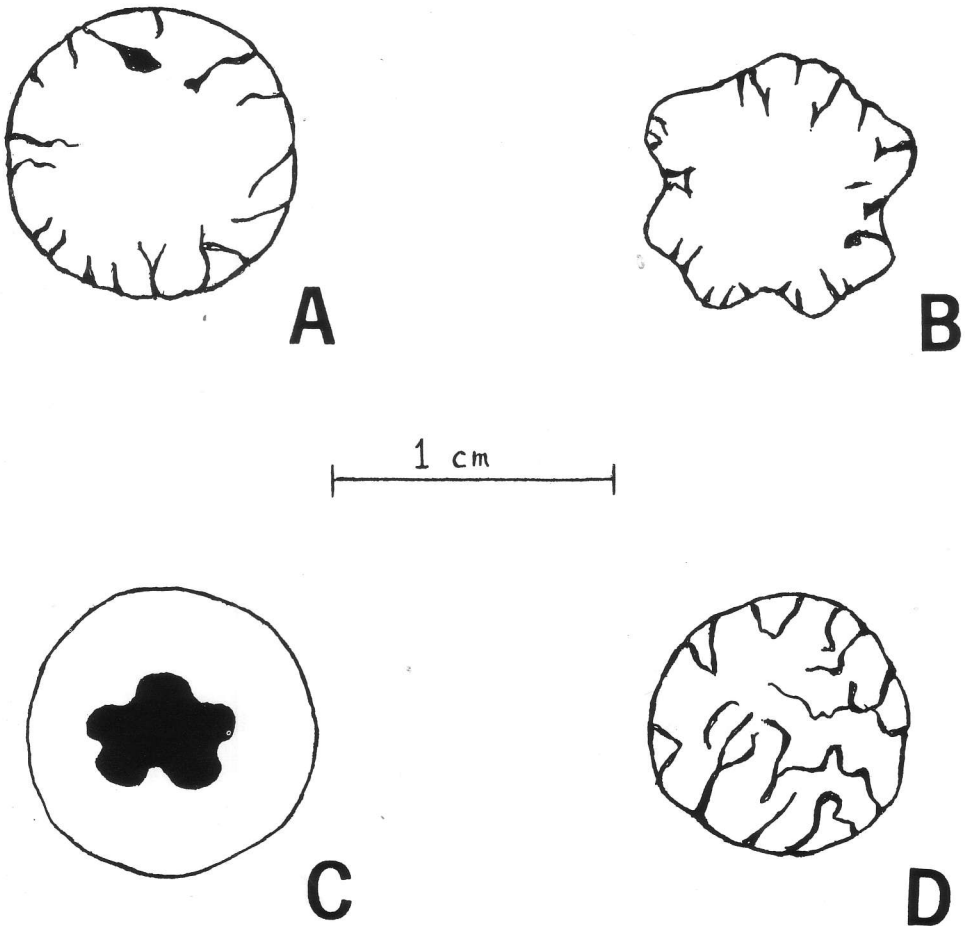
Ptychosperma. The foliage does resemble that of some species of *Drymophloeus* in which the pinnae are broadly cuneate with convex apices. Also, the peduncles are somewhat more elongate than is typical for *Ptychosperma*, and therefore more like those of *Drymophloeus*, and the seeds are nearly terete in cross-section (Fig. 3). Finally, the pistillode of the male flower is short and inconspicuous, unlike the elongate, nectar-bearing structure found in most species of the genus (Fig. 4, also see Essig 1973). In this respect it is like *Drymophloeus*, *Brassiophoenix*, and *Ptychosperma* subgenus *Ponapea*.

Because of these characteristics, I first annotated several specimens belonging to this species as "*Drymophloeus* sp.," even though there was a hint of 5 lobes on the seed, a characteristic of *Ptychosperma*, *Ptychococcus*, and *Brassiophoenix*. From a cursory examination, the pericarp anatomy of this species appears to be typical of *Ptychosperma*, and not like that of *Drymophloeus*. Flowers and fruits are, apart from the characters mentioned, essentially like those in typical species of *Ptychosperma*.

Because of the apparent mix of characters, I wondered if this species might be a primitive intermediate between *Drymophloeus* and *Ptychosperma*. However, later examination of immature fruits revealed a clear-cut 5-lobed structure in the developing seed (Fig. 3), and this convinced me that the new species was in fact a specialized, not a primitive, member of the genus *Ptychosperma*. The tereteness of the seed in this species is secondary and due to the swelling of the endosperm during development.

Hay (1984) was also misled and used a specimen of *Ptychosperma hentyi* to illustrate the genus *Drymophloeus* in his volume on the palms of New Guinea (his Plate 105). Ironically, he used another specimen, one with a more clearly lobed seed, but probably belonging to the same species (see note on variant specimens below) to illustrate the genus *Ptychosperma* (his Plate 117).

Ptychosperma hentyi is a unique and attractive species worthy of widespread cultivation. It may already be growing in



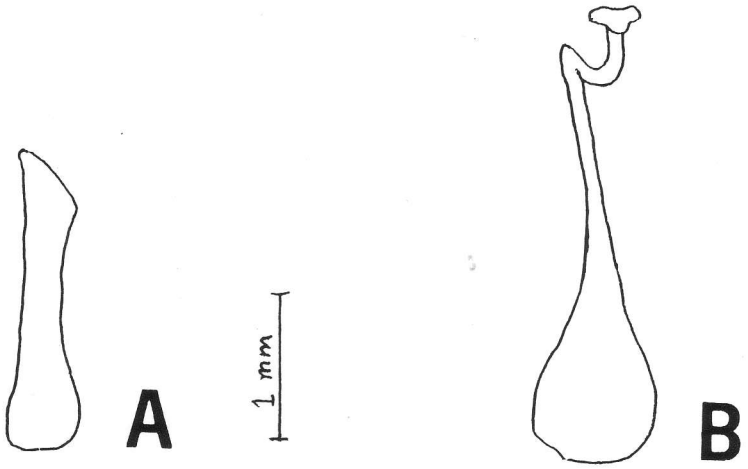
3. *Ptychosperma hentyi*: drawings of seeds in cross-section, A. *Henty & Frodin NGF 27237* (type); B. *Hay 72*; C. *Essig LAE 55197*, immature seed; D. mature seed from *Essig LAE 55197*.

a number of places, if the South African example is any indication, and now with its identity established it should be further distributed.

Ptychosperma hentyi Essig **sp. nov.**

Palma mediocris, solitaria, frondibus pendulis, pinnis late cuneatis, apicibus praemorsis, convexis, floribus masculis pistillodio inconspicuo; fructus subglobosus; semen leviter 5-lobatum, endospermio ruminato. Typus : Papua New Guinea, East New Britain Province, Kandrian Subprovince, along west side of Pulie River, alt. 100 ft., forest on rising ground, red soil over limestone, 16 March 1966, *Henty & Frodin NGF 27237* (Holotypus LAE; isotypus BH).

A solitary, slender palm to 8 (–10) m in height; stem 6–8 cm diam. Leaves about 10 (–13) in the crown, pendulous, with tips hanging vertically, crownshaft prominent; leaf sheath ca. 45 (–75) cm long, petiole 15–21 cm long, blade 160 (–240) cm long, leaf axis with moderate coating of dark scales; pinnae ca. 12–14 (–21) on each side of the rachis, evenly spaced,



4. Drawings of the pistillode: A. *Ptychosperma hentyi, Essig LAE 55197*; B. *Ptychosperma schefferi, Essig LAE 55077*, for comparison of pistillode typical of the genus.

largest in mid-rachis, diminishing markedly toward the apex; central pinnae broadly cuneate, irregularly praemorse and convex at the tip, longest in the mid-region, ca. 37 (–54) cm long, to 30 cm broad at the apex; apical pinnae 2–5 (–8) cm long, 1–3 cm wide at the tip; pinnae sometimes with scattered ramenta along ribs on the lower surface. Inflorescence to 75 cm long, branching to two orders, peduncle 12 (–17) cm long, with first peduncular bract somewhat exceeding the prophyll in bud; second peduncular bract prominent, triangular-linear, to 9 cm long; rachillae weakly flexuous, 11–20 cm long in fruit, ca. 1.5 mm thick in the lower part when dry, bearing 15–22 triads and diads; inflorescence parts sparsely black-scaly. Staminate flowers ovoid, 6–7 (–10) mm long; petals strongly lined when dry from the prominent, unbranched fibrous bundles within; stamens 25–30, dorsifixed with dark connective; pistillode inconspicuous, ca. 2 mm long, not swollen at the base, pointed and lacking a stigmatic enlargement at the tip; pistillate flower buds ca. 3 mm in diameter during staminate anthesis. Fruit red, nearly globose, 13 mm in diameter (to elongate-ellipsoidal, 23 × 12–13 mm); fruiting perianth to 6 mm high, with 1–2 linear staminodes; seed nearly terete (to strongly 5–lobed) with strongly (to moderately) ruminate endosperm. Vernacular names: none recorded.

Distribution: Eastern New Britain, in the Kandrian, Rabaul and Pomio subdistricts at low elevations. Type specimen growing on "red soil over limestone."

Specimens Examined: PAPUA NEW GUINEA. West New Britain Province: Kandrian Subprovince, along west side of Pulie River, alt. 100 ft., forest on rising ground, red soil over limestone, 16 March 1966, *Henty & Frodin NGF 27237* (LAE holotype, BH isotype); East New Britain Province: Pomio Subprovince, regrowth near Sali Village, at sea level, 16 October 1968, *Millar NGF 40558* (LAE, BH); Rabaul Subprovince, lowland rain forest at Powell Harbour, alt. 30 m, 28 June 1972, *Foreman LAE 52171* (LAE, BH).

Cultivated Specimen: PAPUA NEW GUINEA. Morobe Province: Lae, National Botanic Gardens, alt. 100 ft., location #196 on Essig-Leach map, 13 April 1972, *Essig LAE 55197* (LAE, BH).

Variant Specimen: PAPUA NEW GUINEA. East New Britain Province: Open

Bay Timber Company logging area, alt. 50 m, 13 July 1978, *Hay 72* (USF).

This last specimen, collected by Alistair Hay at Open Bay in East New Britain agrees with the above specimens in general respects, but varies significantly in others. Parenthetical measurements in the species description are derived largely from this specimen. Fruits are substantially larger (to 23 mm long), and elongate-ellipsoidal rather than subglobose. Seeds are clearly 5-lobed, while the typical specimens have nearly terete seeds, sometimes with no hint of lobing. Other dimensions are also somewhat more robust, including those of the staminate flowers (10 mm long vs. 6–7 mm), and the leaves (21 pinnae/side vs. 12–14). Whether this specimen represents another variety or subspecies, or merely an individual variant, remains to be seen as further collections are made in the area.

Acknowledgments

The support of National Science Foundation grant #GB–20348X made possible the initial observation of this species in cultivation at Lae. I thank also Alistair Hay for sending one of his specimens to me, and I apologize to him if my annotations on the specimens at LAE mislead him. I thank the staff of the Division of Botany in Lae for sending specimens, and the staff of the L. H. Bailey Hortorium, Cornell University, for their hospitality while studying their herbarium.

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Conservation of Colombian Palms

The endangerment of Colombian palms is the subject of a survey currently being done by Rodrigo G. Bernal, of Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá. With the joint support of World Wildlife Fund and The International Palm Society, three expeditions have been planned to critical areas in that country, where palms have been found in the past, many of them described as new species, but which have never been collected again. These expeditions will be the cornerstone for our knowledge of the conservation status of Colombian palms, and for the understanding of the species themselves. This work is essential for a long-term treatment of the Palmae for Flora de Colombia being carried out by Rodrigo G. Bernal and Gloria Galeano-Garcés, as well as for several generic revisions currently in course.

Principes, 31(3), 1987, pp. 116–122

Notes on the Palms of Amazônia Legal

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ABSTRACT

New records, range extensions, and notes of interest are given for palms occurring in the Amazônia Legal region of Brazil.

Amazônia Legal is the name given to Brazil's share of the Amazon basin. It includes the Federal Territories of Roraima and Amapá, the States of Acre, Pará, Rondônia, and parts of Goiás, Maranhão and Mato Grosso (Fig. 1). It is a vast area, extending at its widest 3,000 km from west to east and 2,500 km from north to south. Much of the area is tropical lowland rainforest, but there are extensive savannas in the northern and southern parts.

During the nineteenth century there were various botanists studying the palms of the Amazon region, starting with Martius (1823–1853). This was followed by significant contributions by Wallace (1853), Spruce (1871), Trail (1876, 1877a, b), Drude (1882) and many works by Barbosa Rodrigues, which culminated in Sertum Palmarum Brasiliensium (1903). There has been less activity this century, with the exception of Hawkes (1952a, b) and Bondar (1964). Recently, Balick et al. (1982) have provided a check list of palms in the region.

1. Amazônia Legal of Brazil.

The present paper presents new records, range extensions, and notes of interest on the palms collected over the last few years especially by Brazilian and foreign collectors as part of Projeto Flora Amazônica (Prance et al. 1984). The order of sub-families, tribes, and genera is taken from Dransfield and Uhl (1986).

Coryphoideae—Corypheae

Of the 31 genera of this tribe, 3 occur in Amazônia Legal; *Chelyocarpus*, *Itaya* and *Copernicia*.

Chelyocarpus is a genus of three species, two of which occur in western Brazil. *Chelyocarpus chuco* (Mart.) Moore is known from Bolivia and Brazil, in the area of the Rio Madeira. The second species, *C. ulei* Dammer, had never been collected in the wild in Brazil, although reported to occur there by Moore (1972). There are, however, two collections from nearby Bolivia and it is well known from Amazonian Peru.

The monotypic *Itaya* was previously only known from one small area of Peru near Iquitos (Moore 1972). Here the population of *I. amicorum* Moore was reported to number less than 100 individuals, and was thought to be in danger of extinction

2. *Copernicia prunifera* in Mato Grosso. 3. *Iriartella setigera* near Manaus.

(Moore 1977). However, this species has now been collected from western Brazil on the Rio Javari. This represents a range extension of approximately 200 km, and it is to be expected, and hoped, that this rare and interesting palm occurs in the intervening area.

Copernicia prunifera (Miller) Moore, the carnauba wax palm, was previously only known from northeastern Brazil (Maranhão, Ceara, Piauí, Paraiba, Rio Grande do Norte, Pernambuco, Sergipe and Alagoas). Dahlgren and Glassman (1961, plate II) show the distribution of this species (but note that Dahlgren and Glassman use the incorrect name, *C. cerifera* (Arruda da Camara) Mart.). However, this species has now been collected in the northern part of Mato Grosso (Fig. 2). This is a range extension of almost 800 km from its nearest previously known locality, and is geographically intermediate between the range of *C. prunifera* in northeastern Brazil and *C. alba* in southwestern Brazil. This emphasizes the probable relatedness of the two species, even though Dahlgren and Glassman placed them in different subgenera.

Calamoideae—Lepidocaryeae

Three neotropical genera, all found in Brazil, make up this tribe; *Mauritia*, *Mauritiella*, and *Lepidocaryum*. This tribe needs systematic work, but in *Mauritia* there appear to be just two species; *M. flexuosa* L. (Fig. 4) and *M. carana* Wallace (Fig. 5). The latter, easily distinguished from *M. flexuosa* by its fibrous leaf sheaths, was reported by Wallace (1853) to grow in areas adjoining the Rio Negro and Upper Orinoco, preferring dry catinga forests or sandy margins of streams. It seems to grow in two distinct habitats,

4. *Mauritia flexuosa* near Manaus, showing non-fibrous leaf sheaths. 5. *Mauritia carana* near Manaus, showing fibrous leaf sheaths.

in swampy areas in tall forest and also in campinarana forest. Both species are common near Manaus.

Ceroxyloideae—Hyophorbeae

The predominantly Central American *Chamaedorea* is represented in Brazil by probably just two species from Acre and Rondônia, but previously neither had been much collected. *Chamaedorea integrifolia* (Trail) Dammer and *C. lanceolata* (R. & P.) Kunth (synonymous with *C. pinnatifrons* (Jacq.) Oersted) are now relatively well collected. A specimen representing *Chamaedorea* from Serra do Cachimbo, on the border of Mato Grosso and Pará, represents an extraordinary range extension of almost 2,000 km eastwards for this genus in Brazil. The specimen is very similar to *C. lanceolata* (R. & P.) Kunth.

Arecoideae—Iriarteeae

Species from five of the six genera of this tribe occur in Amazônia Legal. Their correct names are *Socratea exorrhiza* (Mart.) Wendl. ("paxiúba"); *Iriartea deltoidea* R. & P. ("paxiuba barriguda"); *Iriartella setigera* (Mart.) Wendl. ("paxiubinha"); *Wettinia maynensis* Spruce ("paxiuba de macaco"); and *Catoblastus pubescens* (Karst.) Wendl. *Iriartella setigera* (Fig. 3) is a common species in western areas of Amazônia Legal, but a second species from Peru, *Iriartella stenocarpa* Burret just makes it into Brazil in extreme western Acre. *Wettinia* and *Catoblastus* are other typical Andean genera known from western Brazil.

Arecoideae—Areceae

Six genera of this, the largest tribe of palms, occur in Amazônia Legal; *Mani-*

6. *Manicaria saccifera* near Manaus. 7. *Leopoldinia pulchra* near Manaus.

caria, *Leopoldinia*, *Euterpe*, *Oenocarpus*, *Jessenia*, and *Hyospathe*. *Prestoea* possibly occurs in Brazil, and Barbosa Rodrigues (1903) mentions it in passing.

Manicaria, the common and well-known "bussu," is distributed up the Amazon valley from Belém to above Manaus. Throughout its range *M. saccifera* (Fig. 6) was always known to occur near rivers at low elevations, and never above 200 m. In Venezuela, close to the border with Brazil, *M. saccifera* has now been collected at 1,200 m elevation on Cerro Marahuaca. This is an extraordinary extension in the range of elevation of this species, and in view of this discovery there is every reason to suppose that it may be found on some of the Brazilian tepuis. It is known from the base of Serra Aracá.

Leopoldinia pulchra (Fig. 7) is known from Manaus north up the Rio Negro into Venezuela, and also from the Trombetas and Tapajos (Barbosa Rodrigues 1903; Spruce 1871), usually on black water rivers and north of the Amazon (Wallace 1853). This species has now been collected 400 km south of Manaus, where the Transamazonica Highway crosses the Rio Marmelos, east of Humaitá.

There are at least six species of *Euterpe* from Amazônia Legal, but some species are poorly known. *Euterpe precatoria* Mart. and *E. oleracea* Mart. are familiar species. *Euterpe catinga* Wallace has been collected several times, and it now seems that the following are synonyms of this species; *E. caatinga* Barbosa Rodrigues, *E. controversa* Barbosa Rodrigues, and *E. catinga* var. *aurantiaca* Drude. Wessels Boer (1972) also thought that *E. aurantiaca* Moore from 1,500 m on Cerro Sipapo in Venezuela should be included here. If so, this would mean a range in elevation of 100 to 1,500 m for *E. catinga*. In view

8. *Euterpe erubescens* on Serra da Neblina, with *Geonoma appuniana* in background. 9. *Phytelephas macrocarpa* near Tabatinga.

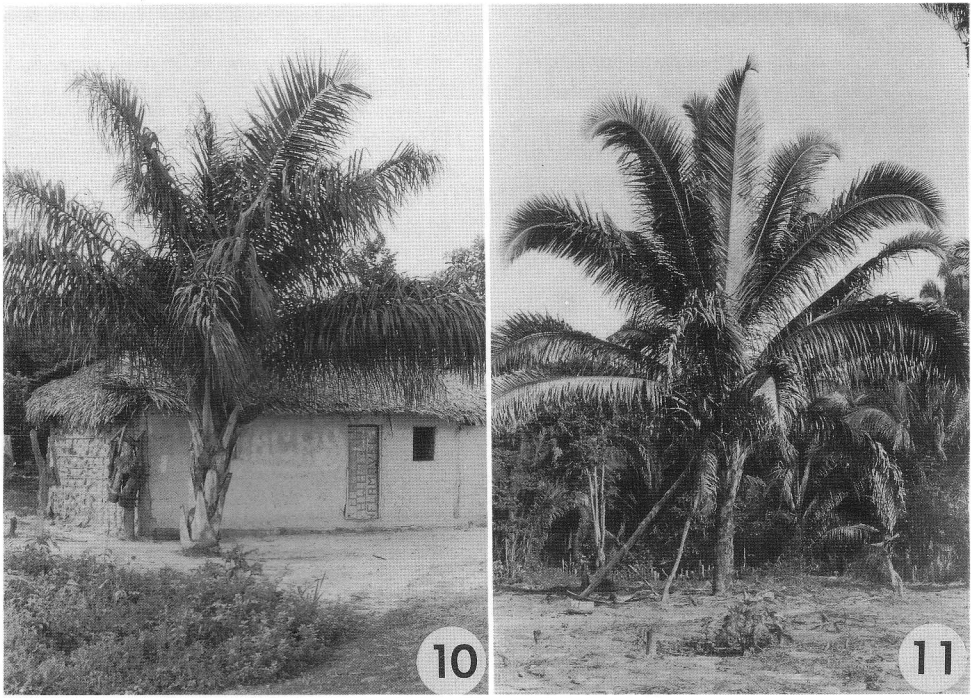
of what is now known about *Manicaria*, perhaps this range is not so unusual as Wessels Boer suggested. *Euterpe erubescens* Moore, previously only known from the Venezuelan tepuis, has now been collected on Serra Aracá. It also occurs on Serra da Neblina, on the border with Venezuela, where it grows at 2,000 m with *Geonoma appuniana* Spruce (Fig. 8).

The known distribution of various species of *Jessenia* and *Oenocarpus* has recently been expanded (Balick 1986). *Oenocarpus distichus* Mart. is well-known from Pará and Maranhão, and has now been recorded from northern Goias. *Oenocarpus discolor* Barb. Rodr. remains known only from the type locality in Mato Grosso. The third distichous-leaved species, *O. tarampabo* Mart. is known from Bolivia, and may also be present in Brazil (Balick 1986). *Oenocarpus minor* subsp. *minor* (Burret) Balick, previously known from a single locality in Manaus, has now been collected near Ruropolis in Pará. A hybrid between *O. minor* and *O. bacaba* has been observed near Manaus, and will be the subject of a forthcoming study (Balick et al., in prep.).

Arecoideae—Cocoeae

Recent collecting has greatly extended the known range of *Barcella odora* (Trail) Drude. Henderson (1986) reported how this species is now known over a 400 km area north of the Rio Negro, being especially abundant in campinaranas.

Markleya dahlgreniana Bondar (Fig. 10) is now known to be a hybrid between *Orbignya phalerata* Mart. and *Maximiliana maripa* (Correa de Serra) Drude. Previously only known from the type locality in Pará, it has now been collected in



10. *Markleya dahlgreniana*. 11. ×*Attabignya minarum*.

other localities in Pará, Maranhão, and also in Suriname (Balick et al., in prep.). A second hybrid genus, ×*Attabignya* (Fig. 11) has recently been described (Balick et al., 1987).

According to Barbosa Rodrigues (1903) *Aiphanes* spp. occur on the Rio Javari, but they have apparently not been recollected.

Arecoideae—Geonomeae

Two genera of this tribe are known in Amazônia Legal: *Geonoma* and *Pholidostachys*. *Geonoma* is ubiquitous in Amazônia Legal. *Pholidostachys synanthera* (Mart.) Moore was first collected by Trail (1876) in Brazil as *Calyptronoma robusta*, "in sylvis primaevis ad fl. Javary." It has only been recollected once since on the Rio Javari. This species is another example of an Andean palm just reaching western Brazil.

A new species of *Asterogyne*, similar to *A. spicata* (Moore) Boer has recently been collected in French Guiana (de Granville & Henderson, in prep.), just over the border from Amapá in French Guiana. It would not be surprising if this species turned up in Brazil.

Phytelephantoideae

Phytelephas macrocarpa R. & P. is known from Acre, and also from near Tabatinga in Amazonas (Fig. 9). It is cultivated in the grounds of the Museu Goeldi, from seed collected in Acre. The other common eastern Andean species, *Phytelephas microcarpa* R. & P., is not yet recorded for Brazil, but is very common in Ecuadorean and Peruvian Amazonas.

Acknowledgments

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The Effects of Increasing Lime Concentrations in the Development of Pigmy Date Palm Seedlings in Containers After 17 Weeks

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Literature concerning ornamental palm nutrition is limited. Research on palm nutrition has largely been conducted with those species grown commercially for their products, namely coconuts, dates, and oil palms. (Furr and Armstrong 1957, Hartley 1967, Menon and Pandulai 1958).

Since the foliage industry began an important upsurge about 20 years ago, interest in indoor plants has increased (Smith et al. 1982). Consequently, as problems occurred in the production of foliage plants, nurserymen brought their questions to university researchers. One result was the establishment of the Agricultural Research Center at Apopka, Florida, devoted solely to research on many tropical foliage plants. Preliminary research has been conducted with foliage palms such as *Chamaedorea elegans* Mart., *Chrysalidocarpus lutescens* H. A. Wendl., and *Howea fosteriana* (C. Moore and F. V. Muell.) Becc. Studies to determine fertilizer rates, foliar analyses and constant fertilization rates were conducted to help growers produce a more saleable plant faster (Conover and Sanders 1978, Poole and Conover 1977, Poole and Conover 1981).

The purpose of this study was two-fold: to provide additional information on foliage palms, as very little research has been conducted with *Phoenix roebelenii* O'Brien, the pigmy date palm, and to determine the effects of increasing lime concentrations in the development of pigmy date palm seedlings in containers.

Bare-rooted seedlings in the 2–3 leaf stage were potted in 11 cm black plastic containers each containing 0.72 l of amended Metro Mix 500 (marketed by W. R. Grace and Co., Cambridge, Mass.). The pH of the unamended mix was 6.5, which reflected the amount of dolomitic limestone added to Metro Mix 500 by the manufacturer (1.87–2.24 kg/0.765 m^3). The dolomitic lime treatments consisted of: 6 pots in treatment 1, no additional lime added; 6 pots in treatment 2, 35.4 g of additional lime added to 11.4 l of Metro Mix 500 (50 percent increase in lime); and 6 pots in treatment 3, 70.8 g of additional lime added to 11.4 l of Metro Mix 500 (100 percent increase).

The seedlings were placed in a completely randomized design on a greenhouse bench at Louisiana State University, Baton Rouge, LA for 17 weeks. All plants were grown under 47 percent black polypropylene shade cloth, with temperatures ranging from 18° to 41° C, and watered approximately every two weeks with 400

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Table 1. Foliage, root and total dry weights of container grown pigmy date palm as affected by 50% and 100% increases in dolomitic limestone 17 weeks after application.

Treatments	Mean Foliage Dry Weight (g)	Mean Root Dry Weight (g)	Mean Total Dry Weight (g)
1. No additional lime added to Metro Mix 500[y]	0.988a[x]	0.463a	1.45a
2. 50% (35.4 g/11.4 l) lime added to Metro Mix 500	0.688b	0.33b	1.02b
3. 100% (70.8 g/11.4 l) lime added to Metro Mix 500	0.757b	0.34b	1.10b

[y] Marketed by W. R. Grace and Co., Cambridge, Mass.
[x] Mean separation within column by Duncan's New Multiple Range Test, 5% level.

ml of water. They received one treatment of fertilizer with 400 ml of Peters 25-9-17 soluble fertilizer containing 2.3 g of fertilizer per 3.8 l.

Data examined included length of the longest leaf, leaf number, foliage, root, and total dry weights, leaf tissue analyses, and soil mix analyses at the conclusion of the experiment (Doughty 1982).

Leaf length appeared to be an unreliable growth measurement because in some observations smaller leaves were produced due to increasing light and duration as long days approached. There were no significant treatment effects on leaf length or number.

Foliage, root, and total dry weights were significantly affected by treatments. As the rate of lime increased by either 50 percent or 100 percent, the foliage, root, and total dry weights significantly decreased (Table 1).

Although number of leaves produced over 17 weeks was not significantly affected by treatment, there appeared to be a trend in the mean number of leaves. In treatment 1, no lime added, the mean leaf number was 6.33. In treatment 2, 50 percent lime added, the mean leaf number was 5.6; and treatment 3, 100 percent lime added, the mean was 5.17. This seemed to suggest that plants grown in 50 and 100 percent added lime produced fewer leaves.

Foliar tissue analysis of manganese (Mn) and zinc (Zn) showed no significant effects of treatment. However, tissue iron (Fe) and copper (Cu) significantly increased with added lime (Table 2). The increase in Cu could be explained by a strong complexing of Cu by the soil organic matter. Lindsey (1977) indicated that this complexing is believed to be an important factor explaining why Cu deficiencies occur in soils with a high pH even though both cations show

Table 2. Foliar tissue analysis of Fe and Cu as affected by 50% and 100% increases in dolomitic limestone of container grown pigmy date palm 17 weeks after applications.

Treatments	Mean Foliar Tissue Fe (ppm)	Mean Foliar Tissue Cu (ppm)
1. No additional lime added to Metro Mix 500[y]	86.43b[x]	6.30b
2. 50% (35.4 g/11.4 l) lime added to Metro Mix 500	124.05a	8.40a
3. 100% (70.8 g/11.4 l) lime added to Metro Mix 500	126.73a	8.38a

[y] Marketed by W. R. Grace and Co., Cambridge, Mass.
[x] Mean separation within column by Duncan's New Multiple Range Test, 5% level.

Table 3. Metro Mix 500[y] Zn and Cu analysis as affected by 50% and 100% increases in dolomitic limestone of container grown pigmy date palm 17 weeks after application.

Treatments	Mean Soil Mix Zn (ppm)	Mean Soil Mix Cu (ppm)
1. No additional lime added to Metro Mix 500[y]	29.85a[x]	22.72a
2. 50% (35.4 g/11.4 l) lime added to Metro Mix 500	20.46b	18.12b
3. 100% (70.8 g/11.4 l) lime added to Metro Mix 500	20.93b	18.03b

[y] Marketed by W. R. Grace and Co., Cambridge, Mass.
[x] Mean separation within column by Duncan's New Multiple Range Test, 5% level.

similar decreases in solubility with increased pH. Knezek and Ellis (1980) reviewed evidence that Cu and Zn could be absorbed from a very dilute solution of Ca saturated peat. It was thought that the bonding might be through the hydroxyl groups in the peat.

A study by the senior author (unpublished) using Metro Mix 500, with the same rates of lime, but growing a sorghum-sudangrass hybrid in 11 cm containers for seven weeks seemed to cause similar Cu concentrations in foliar tissue.

The significant increase of Fe in treatments 2 and 3 is difficult to explain. However, according to Krauskopf (1977) in soil containing abundant organic matter much of the Fe may be reduced to $Fe^{\pm\pm}$. Iron may also be present in soil solutions, adsorbed on colloid surfaces as $Fe^{\pm\pm}$, or complexes thereof.

As the soil pH increases, adsorption increases and the formation of specific Fe(II) minerals such as $Fe(OH)_2$, $FeSiO_3$, and $FeCO_2$ is possible. According to Lindsey (1977) the Fe(II) minerals are very soluble and readily dissolve in soils. Small changes in O_2 and CO_2 partial pressures can also cause a slight shift in the solubility of Fe(II) compounds.

The mean pH values for treatments 1, 2, and 3 were 6.38, 6.78, and 6.82 respectively. The solubility of Fe apparently was sufficient due to the natural chelates present in organic soils (humic acid).

Metro Mix 500 pH analysis increased in a linear fashion, as expected with 50 and 100 percent increases in lime. Of the micronutrient elements tested, only mean Mn and Fe were not significantly affected by treatments. However, mean soil Zn and Cu were significantly influenced by treatment (Table 3). As the dolomitic limestone rate increased, the concentration of soil Zn and Cu significantly decreased.

The pigmy date palm, although subjected to 50 and 100 percent increases in dolomitic limestone, exhibited no apparent chlorosis or other symptoms at any time during the experiment. *Phoenix roebelenii* palms were not affected by increased lime, demonstrating the buffering capacity of Metro Mix 500 due to the inhibition of large pH increases. This experiment also showed that as the rate of lime increased the pH significantly increased along with tissue Fe and Cu, but soil Zn and Cu and foliage, root, and total dry weights decreased.

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Observations on Pigafetta filaris

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Pigafetta filaris, the single-stemmed pinnate palm, native to Sulawesi, Indonesia, is the most elegant among palms, according to David Fairchild (1943). Those who have seen and admired this dioecious species in its wild state, growing at elevations between 300–1,500 m above sea level, on slopes of well-drained volcanic hills studded with lush equatorial vegetation, would only agree with Fairchild's eulogy of *Pigafetta*. M. E. Darian (1973), Dransfield (1973), and Sneed (1981) have paid further tribute in *Principes* to this remarkable, erect, stately palm.*

The authors made several visits to *Pigafetta* forests of north (Fig. 1) and central Sulawesi Provinces and examined the way the delicate-looking tiny seedlings of *Pigafetta* struggle to become established on the hill slopes and grow into massive palms. Germination studies were made at the Coconut Research Institute at Manado, North Sulawesi, Indonesia. Also we recorded the emergence, development and shedding of leaves in adult palms and measured their size at the Botanical Garden at Bogor, where some palms were introduced by J. Dransfield and J. P. Mogea in 1973. In addition, some data are provided on the size of male and female inflorescences as well as the number of fruits per infructescence.

*Dransfield (1976) drew attention to the curious ecology of *Pigafetta*, commenting on the huge number of very small seeds produced, and on the apparent behavior of *Pigafetta* as a light-demanding pioneer.

Size of Fruit, Germination and Seedlings

The tiny, orbicular fruits (Fig. 3) about 6 mm in diameter covered with scales are borne by the thousands on long infructescences that stay almost horizontal in the crown up to fruit maturity (Fig. 2), beyond which they gently bend downwards. Two consecutive mature fruit-bunches each were cut from 5 palms, and 100 fruits from each infructescence were weighed and the values recorded in Table 1.

Fruit samples collected from palms growing near Lake Tondano, North Sulawesi were sown in polybags (that are normally used for raising coconut seedlings) at the residence of the first author close to the Coconut Research Institute, Manado. Shoots started appearing 30 days after sowing. An additional couple of days elapsed before the eophyll could be seen above the surface of dry leaf mulch. According to Dr. M. E. Darian, germination ran from two to three months in California. Observations were recorded on: germination of fruit and nature of seedlings; date when the lamina portion of each leaf fully emerged; length of lamina portion of leaf; number of leaflets per leaf; diameter of collar at soil level; number of epidermal hairs (as far as possible to count); the height of plant from ground to tip of tallest leaf; date of withering of each leaf; and size of infructescences and number of fruits per infructescence. The size of fruits does not vary significantly between inflorescences

1. A grove of wild *Pigafetta filaris* on a hill slope in North Sulawesi, Indonesia.

from either the same palm or between palms from the same locality.

From the above observations, we calculated the duration of full emergence of a leaf from its first appearance outside the leaf preceding it. The data in Table 2 show that the leaves took 10–19 days for full emergence of lamina from its first becoming visible, and that this time could vary considerably. For example, leaves 3–8 took the least time for emergence while leaves 17–20 required the maximum time. The difference in the time of emergence of leaves could be due to the presence or absence of rain. The period for the emergence of successive leaves also shows considerable variation. A new leaf is produced at an interval of 10–19 days. However, such variation decreases in adult palms. The active life of each leaf (as inferred from its green state) was also calculated from the dates of full emergence to complete withering. The first two leaves remained green for a longer period compared with the subsequent six leaves. Thereafter, for subsequent leaves there is clear indication that the leaf remained green for progressively longer periods. Within about one year, the plant had grown to about 140 cm. (Darian reported a much greater growth for his well-cared for young palm.) Also its girth has registered a tenfold increase from 5th month to 12th month. The first leaf had 6 leaflets. The lamina was bilobed, and each lobe had 3 unsplit leaflets. The 20th leaf bore 39 leaflets, all free.

Speedy germination, fast rates of growth, production of leaves and roots, long internodes and nodal roots characterize the early growth of *Pigafetta filaris* (Fig. 4). The rapid growth-rate of the seedlings is achieved by having very long internodes and developing roots from nodes that help

Table 1. Pigafetta filaris*: Weights of 100 mature fruits from each infructescence.*

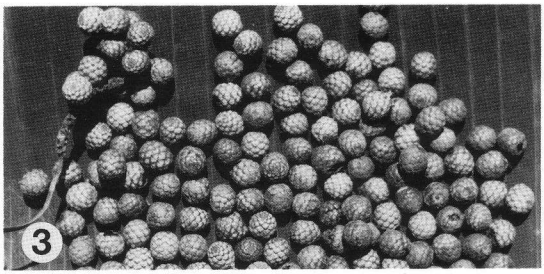
Palms	Wts. of 100 Fruits from Older Infructescence (gm)	Wts. of 100 Fruits from Younger Infructescence (gm)	Mean per Palm (gm)
1	66.59	66.17	66.38
2	65.71	65.64	65.68
3	65.49	66.72	66.11
4	66.25	66.19	66.22
5	66.29	65.65	65.97
Mean	66.07	66.27	66.17

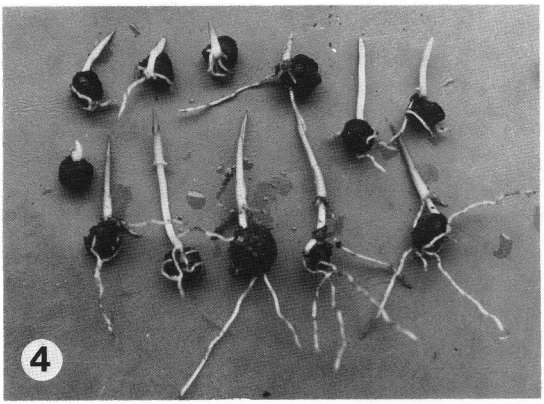
2. Female *Pigafetta* bearing about ten infructescences.

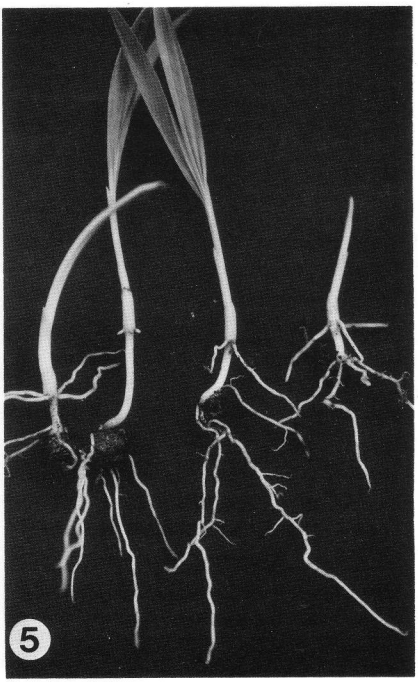
to anchor the young palm by serving as stilt roots. The lowest portion of the stem is the thinnest; with every node where more and stronger roots are produced, the girth of the stem increases steadily (Fig. 5). Such stem growth is similar to that of certain palms which produce stilt roots, like *Vershaffeltia splendida*. Another extreme case is *Eugeissona minor*, in which the whole plant is supported by stilt roots (see Holbrook, Putz, and Chai 1985). Thus, the development of the trunk of *Pigafetta* is different from that of palms which develop a thick bole at the base of stem, a good example being the coconut.

A seedling produces two scale leaves before the appearance of the first laminate leaf. The leaves of *Pigafetta filaris* have a profusion of long, slender epidermal spines of a golden color. Especially on the leaf-base and petiole, they are arranged characteristically in horizontal, long or broken rows (Fig. 6). The stem is smooth where the lighter-colored, grayish annular leaf-scars contrast with the greenish-brown, shiny internodes. The lowermost portion of the trunk above ground level may produce numerous aerial roots that penetrate the soil and serve as extra support for the tall stem, and as additional organs for the absorption of nutrients. Up to some distance above this aerial root zone, many palms show a profusion of short, rootlike structures that dry up and function as hard spiny outgrowths (Fig. 7).

The hairy outgrowths on the leaves of *Pigafetta* start appearing practically from the eophyll. The periphery of the petiole starts supporting a linear row of soft spines. The two margins of the petiole of subsequent leaves also develop such hairs. As more leaves are produced, the hairy outgrowths also start developing from the leaf rachis, both on the abaxial and adaxial surfaces. The petiole and the leaf-base develop greater numbers of hairs which grow long and eventually get stiffer. The increase of hairs as the seedling grows is shown in Table 2. It was not possible to make accurate counts of the numerous







3. Tiny, spherical, ripe fruits of *Pigafetta* covered by spirally-arranged scales. 4. Seedlings of *Pigafetta*; note the elongated thin internodes and nodal roots. 5. Stages of germination: bifid leaves appear after 2 rudimentary leaves; adventitious roots emanate from nodes.

outgrowths on the leaves beyond the 11th leaf.

Figure 8 shows a *Pigafetta* seedling bearing 7 laminate leaves which is about five months from sprouting of seed. The same seedling is illustrated at 10 months in Figure 9, having produced 15 leaves, many of the older ones having already withered away.

The Stem

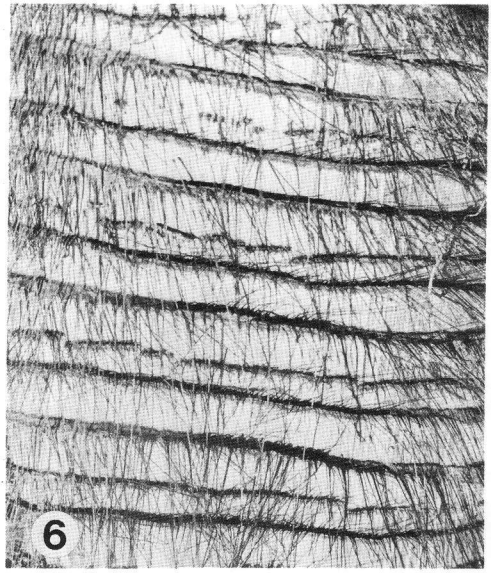
The stem of *Pigafetta filaris* is fast-growing, solitary, stout and "as straight as an arrow." Since many palms stand close to each other in their natural habitat, the shining, dark-green and smooth stem makes a magnificent sight. The periphery of the mature portion of the stem is very strong although the inner core is pithy and soft. Farmers make conduits (Fig. 10) out of the mature stem by removing the soft core. Another good use for the stem of *Pigafetta* is as pillars or legs for granaries and houses of the Toraja People of South Sulawesi, as illustrated by Sneed (1981).

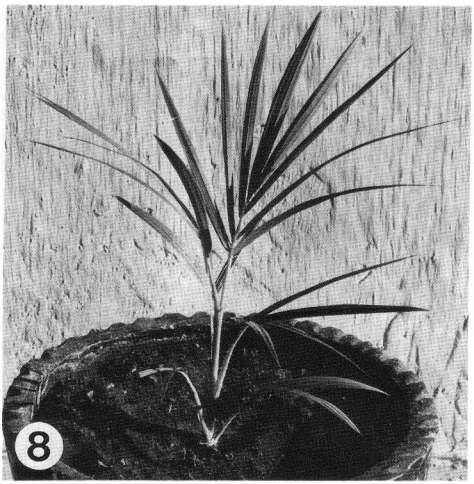
The girth of the stem of 3 female and 3 male palms at the Botanical Garden, Bogor was measured at one-meter intervals to see at what rate the stem decreases in girth. The data are given in Table 3.

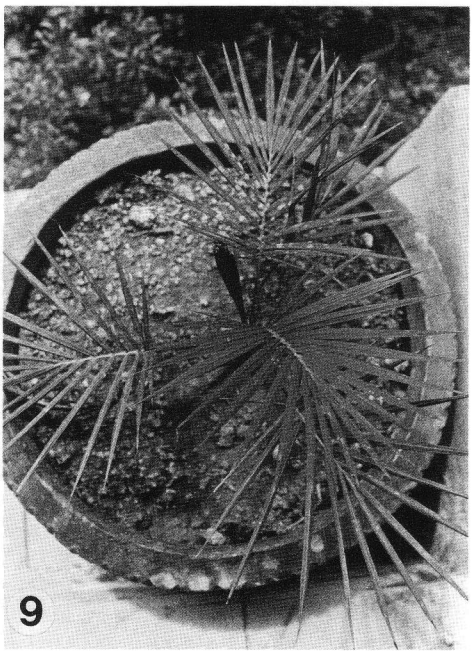
The stems of adult *Pigafetta* show a bolar swelling up to about one-meter in girth from ground level. It may be recalled that all these palms were transplanted in 1973, when the original thin stem-tips were buried in the seedling hole. Further, the palms at Bogor were planted on level ground unlike the hilly terrain of their natural habitat where they have to struggle

Table 2. Pigafetta filaris: *Germination and growth of a typical seedling (sown 5-5-1978).*

Number of Laminate Leaves	Date of Emergence	Interval btn. Leaves (days)	Duration of Emergence (days)	Lamina Length (cm)	No. of Leaflets	Collar Thickness (cm)	No. Epidermal Hairs	Date of Drying 1978–1979	Life of Leaf (days)	Ht. of Plant (cm)
1	22 Jun 78	—	—	6.5	6	—	13	21 Oct	121	—
2	20 Jul 78	28	19	7.2	6	—	22	10 Nov	117	—
3	28 Aug 78	39	12	8.3	7	—	34	2 Dec	96	—
4	12 Sep 78	15	10	9.5	8	—	38	10 Dec	89	—
5	26 Sep 78	14	11	12.3	9	0.4	57	18 Dec	83	17.0
6	10 Oct 78	13	11	14.3	12	0.5	68	5 Jan	87	22.5
7	25 Oct 78	13	11	16.8	14	0.8	102	24 Jan	91	30.0
8	10 Nov 78	16	12	20.8	16	1.1	120	17 Feb	99	33.5
9	27 Nov 78	17	13	18.7	18	1.2	135	19 Mar	112	36.5
10	18 Dec 78	21	14	17.0	22	1.4	145	18 Apr	121	37.5
11	9 Jan 79	22	13	19.2	24	1.5	200	1 May	112	—
12	27 Jan 79	18	13	20.0	24	1.6	numerous	20 May	113	—
13	16 Feb 79	20	12	16.0	25	—	numerous	9 Jun	115	—
14	1 Mar 79	13	10	18.0	27	2.8	numerous	30 Jun	121	45.0
15	15 Mar 79	14	11	25.0	29	—	numerous	20 Jul	127	—
16	29 Mar 79	14	10	27.0	31	—	numerous	—	—	76.5
17	17 Apr 79	19	15	38.0	34	3.5	numerous	—	—	—
18	8 May 79	21	16	43.0	37	3.8	numerous	—	—	—
19	4 Jun 79	26	19	45.0	39	4.0	numerous	—	—	138.0
20	1 Jul 79	27	18	44.0	39	4.1	numerous	—	—	—

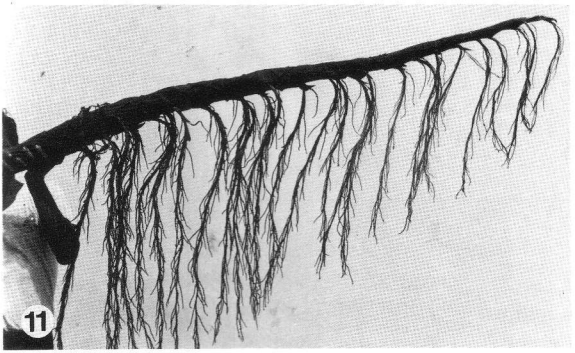






6. Profuse hairy outgrowths (spines) distributed in horizontal rows on the outer side of leaf-base. 7. Many palms develop spiny outgrowths and aerial roots towards the base of the stem. 8. Five-month old seedling raised in a clay pot at Manado. 9. Seedling in Figure 8 at 10 months from sprouting. Pinnate leaves start bending gently even at this stage.

against fallen leaves and undergrowth. These factors may be responsible for the swelling. Apart from this basal swelling, the stems of male palms are thinner than the females. Further, they seem to grow more slowly than the females as the figures in Table 4 reveal. The decrease in the girth of the trunk is gradual. Hence, there is no



10. Pipes turned from mature portion of stem, used as conduits between goldfish culturing ponds in North Sulawesi. 11. Male inflorescence bearing several drooping first-order branches, each giving rise to numerous rachillae. 12. Portion of female inflorescence. The rachillae are laden with numerous small fruits.

swellings seen on the stem of *Pigafetta* as in the belly palm (*Colpothrinax wrightii*) or irregular thickenings as on the coconut or palmyra.

Rate of Growth of Stem

Variation in the length of the internodes within the same species grown under uniform conditions indicates variation in the rate of growth of stem. To find if there is any difference in the rates of growth of males and females, the number of leaf-scars of the six palms mentioned in Table 3 were counted. The stem was marked at one-meter intervals. The number of leaf-scars in each one-meter length of stem was counted and the data presented in Table 4.

The stem of females grows faster than that of the males. To produce one-meter height of stem just above the 6th meter, the males have to produce 30 leaves while the females achieve this height by producing only 19 leaves. It is surprising that the females in spite of having to produce massive inflorescences bearing tens of thousands of fruits, can still maintain a higher rate of stem-growth. They were not shaded by other trees.

Leaf Production

The number of leaves in the crown can give a measure of the fruit-productive capacity of a palm; this is particularly clear in the coconut. It is important to know the green life or functional period of a leaf. It is surprising that in spite of years of work by hundreds of researchers investigating the coconut palm, we do not yet know the exact green life of a coconut leaf. As the rate of production of the leaf varies with varieties and forms, and within a variety/form between localities, it is essential to gain knowledge of this area. Partly to give a lead to the coconut scientists, we started to estimate the green life of leaves of many species of palms growing at the Bogor

Table 3. Pigafetta filaris*: Girth of stem at different heights.*

Ht. from Ground (in meters)	Girth (circumference) of Stem in cm							
	Males				Females			
	1	2	3	Mean	1	2	3	Mean
1.00	145	150	132	142.33	142	142	126	136.67
2.00	121	124	132	125.67	125	136	132	131.00
3.00	104	126	118	116.00	123	122	123	122.67
4.00	105	127	122	118.00	118	118	120	118.67
5.00	101	120	112	111.00	117	112	117	115.33
6.00	102	115	105	107.33	115	108	117	113.33
7.00	100	106	101	102.33	110	106	112	109.33
8.00	—	—	100	100.00	106	89	107	106.67
9.00	—	—	—	—	106	—	100	103.00
10.00	—	—	—	—	100	—	—	100.00

Botanical Garden. The study is not complicated. All emerged leaves of a palm crown are numbered from the oldest green leaf to the youngest fully opened one. The dates of initial visibility of new leaves, and their full emergence, as well as the dates when an old leaf starts drying and when it completely withers, are recorded. The green life period of a leaf is calculated from these dates.

Six individuals of *Pigafetta* (3 males and 3 females) were included in the study. Observations were started in May 1979 and concluded at the end of December 1980. During this period, dates of emergence for about 40 leaves in each palm were recorded. Also about 40 leaves withered or were shed from each palm during the period. Because the palm had already 25–30 green leaves in the crown at the time of starting the observations, complete data from emergence to shedding could be had only in ten to thirteen leaves per crown. Data relating to one male and one female palm are presented in Table 5.

In the case of the female palm, the mean

Table 4. Pigafetta filaris*: Number of leaf-scars at 1-meter intervals.*

Portion of Stem (in meters)	Numbers of Leafscars per Meter Interval							
	Males				Females			
	1	2	3	Mean	1	2	3	Mean
Ground to 1 m	15	20	14	16.33	10	14	15	13.00
1–2 m	16	20	15	17.00	11	13	15	13.00
2–3 m	18	19	16	17.67	10	14	17	13.67
3–4 m	19	22	16	19.00	10	15	14	13.00
4–5 m	22	20	17	19.67	13	16	16	15.00
5–6 m	24	24	20	22.67	14	20	16	16.67
6–7 m	30	33	27	30.00	14	22	21	19.00
(7.5 m)	(21)	—	—	—				
7–8 m	—	—	29	29.00	18	25	24	22.33
8–9 m	—	—	15	15.00	25	(11)	24	24.50
9–10 m	—	—	—	—	18	—	—	18.00
Total	165	158	169	—	143	150	172	—

Table 5. Pigafetta filaris*: Data on production of leaves.*

Leaf Number	Date of Emergence (1979)	Interval between Leaves	Date of Withering (1980)	Interval between Leaves	Life-span of Leaf (days)
Male palm					
30	5 Jun	—	18 Aug	—	440
31	18 Jun	13 days	6 Sep	19 days	446
32	3 Jul	15 days	20 Sep	14 days	445
33	18 Jul	15 days	10 Oct	20 days	450
34	5 Aug	18 days	25 Oct	15 days	447
35	20 Aug	15 days	15 Nov	21 days	453
36	5 Sep	16 days	8 Dec	23 days	460
37	20 Sep	15 days	29 Dec	21 days	466
Mean		15.29 days		19.00 days	450.88
Female palm					
22	12 Jun	—	1 Jun	—	355
23	29 Jun	17 days	18 Jun	17 days	355
24	17 Jul	18 days	3 Jul	15 days	352
25	2 Aug	16 days	17 Jul	14 days	350
26	18 Aug	16 days	30 Jul	13 days	347
27	4 Sep	17 days	12 Aug	13 days	343
28	20 Sep	16 days	26 Aug	14 days	341
29	8 Oct	18 days	17 Sep	22 days	345
30	22 Oct	14 days	29 Sep	12 days	343
31	4 Nov	13 days	17 Oct	18 days	348
32	18 Nov	14 days	5 Nov	19 days	323
33	9 Dec	21 days	23 Nov	18 days	350
34	30 Dec	20 days	11 Dec	18 days	337
Mean		16.67 days		16.08 days	345.31

green life duration for a leaf is 345.31 days while that of a male palm is 450.88 days. Similar values for another female palm are 325.54 days. Two more male palms show clearly that their leaves remain green for longer periods when compared with those of female trees. This situation suggests that data should be collected on a larger number of palms to see whether the difference in the green life of leaves between sexes are insignificant.

Size of Leaves

The gently curved leaves with numerous gracefully arching leaflets are responsible for the beauty of the crown of *Pigafetta*. The number of green leaves in a crown at any time may vary from 20 to 30 in Bogor. However, during the dry season, shedding of leaves exceeds production, and so, the number of leaves in the crown is reduced. Palms growing under more ideal conditions may bear as many as 35 fully emerged

Table 6. Pigafetta filaris*: Data on size of leaf.*

Sex	Length of Lamina (cm)	Length of Petiole (cm)	Length of Leaf (cm)	No. Leaflets
Male	338.84	299.10	637.94	123.15
Male	347.09	284.10	631.19	123.14
Male	314.99	217.85	532.84	115.73
Female	348.21	257.67	605.88	118.00
Female	323.63	210.85	534.48	118.90
Female	316.66	220.45	537.11	112.81
Mean	331.57	248.34	579.91	118.62

Table 7. Pigafetta filaris*: Size of male and female inflorescences.*

Sex		Length of Inflorescence (cm) of Palms				Max. Girth of Peduncle of Palms (cm)			
		1	2	3	Mean	1	2	3	Mean
Male:	older	145	170	160	158.33	20	25	20	21.67
	younger	160	171	150	160.33	21	19	22	20.67
	Mean	152.5	170.5	155.0	159.33	20.5	22.0	21.0	21.17
Female:	older	152	131	165	149.33	23	21	23	22.33
	younger	154	145	161	160.00	22	22	23	22.33
	Mean	153.0	138.0	163.0	154.67	22.5	21.5	23.0	22.3

leaves and two more leaves at the spear-stage. The number of leaflets per leaf, and lengths of petiole and lamina were measured for about 40 leaves, each from six palms. The data are presented in Table 6. The male palms bear more leaflets than the females even though the difference is not statistically significant. Also the overall length of leaves of male palms is greater than that of the females. In this species, the petiole occupies 57.18% of the length of the whole leaf.

Size of Inflorescences and Number of Fruits

The inflorescence of *Pigafetta* is a massive, axillary structure bearing many bracts. About 6–10 inflorescences are produced between the leaves during September–October. By the time the inflorescences mature, their supporting leaves are already shed. At this stage, the bunches appear below the leaves. The size of male and female inflorescences and the number of fruits per infructescence were recorded at Bogor on 12 inflorescences from six palms. The data are given in Table 7.

The male inflorescences are slightly longer than the female, but the latter are stouter (Fig. 11).

The rachis produces several first-order branches, all of which hang downwards. These branches are longest at the base of the inflorescence and subsequent branches become shorter and shorter. They bear second-order branches which are the rachillae. Each rachilla in the infructescence may bear 5–15 fruits (Fig. 12).

Numbers of Secondary and Tertiary Branches

The number of first- and second-order branches varies between 22 and 24 in the male inflorescence while in the female there are 17 to 23 first-order branches. The mean length per inflorescence was also calculated which for the males ranges from 88.18 cm to 94.58 cm and for the females, from 88.00 cm to 117.29 cm. The number of rachillae per first-order branch was also counted. They range in the male from 36.86 to 41.68 and in the female between 29.48 to 34.59.

Number of Fruits per Infructescence

From 3 female palms, 5 complete infructescences laden with ripe fruits were pulled down carefully and the number of fruits per infructescence counted (Table 8).

Table 8. Number of fruits per bunch.

Infructescence 1	4,824 fruits
Infructescence 2	3,740 fruits
Infructescence 3	12,452 fruits
Infructescence 4	14,237 fruits
Infructescence 5	19,918 fruits
Mean per infructescence	11,034.2 fruits

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The Effects of Several Pre- and Postemergent Herbicides on Ornamental Palms

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Palms are an important component of the nursery industry. In Florida, most palms for interior use are container grown. Landscape material may be either container or field grown. Both situations have associated weed control problems.

Competition for water and nutrients by weeds is known to reduce the growth rate of many ornamental plants. Hand weeding, although a common practice in Florida nurseries, is costly and labor intensive. Tillage is often used as part of an effective weed control program in field nurseries but does not eliminate all weeds, particularly those adjacent to the desired crop.

Little is known about the effects of pre- and postemergent herbicides on palm species (Schubert et al. 1986). Neel (1977) reported on the safety of Ronstar (oxadiazon) granular preemergent on *Chrysalidocarpus lutescens* (areca palm) and *Livistona chinensis* (Chinese fan palm). Reports to the authors by local nurserymen and preliminary research indicated that other commonly used preemergent herbicides may be causing problems with palms. Two experiments were designed to determine whether three preemergent herbicides and one postemergent herbicide commonly used in nurseries affected the growth of several palm species frequently grown by the nursery industry.

Materials and Methods

Experiment 1 (Preemergent Herbicides): Palm seedlings with 3–4 leaves were transplanted into 10 cm plastic containers with a pine bark, Florida peat, and sand (5:4:1, v:v:v) medium amended with 3.6 kg of dolomite, .68 kg of Micromax® (Sierra Chemical Co., Milpitas, CA) and 4.5 kg of Osmocote 18–6–12 (Sierra Chemical Co.) per m^3 of soil. Six weeks after transplanting, 7 replicate palms of *Carpentaria acuminata* (carpentaria palm), *Chamaedorea elegans* (parlor palm), *Chrysalidocarpus lutescens* (areca palm), and *Ptychosperma elegans* (solitaire palm) were treated with Ronstar® (oxadiazon, Rhone-Poulenc, Inc.), Rout (oxyfluorfen & oryzalin, Sierra Chemical Co.) and Ornamental Herbicide 2® (oxyfluorfen & pendimethalin, O. M. Scott & Sons Co., Marysville, OH) at 0, 1, and 4 times their recommended rates (Table 1). No granules were allowed to contact foliage during application as direct contact is known to produce lesions in many palms. Plants were grown under 73% shadecloth and received about 1.2 cm of water daily from overhead irrigation. Palms were rated (0 = no damage, 5 = dead) for herbicide phytotoxicity 1 month after application.

Experiment 2 (Post-Emergent Herbicide): Fifteen replicate palms of *Syagrus romanzoffiana* (queen palm), *Carpentaria acuminata* (carpentaria palm), *Chamaedorea cataractarum* (cat palm), *Chamaedorea elegans*, *Chrysalidocarpus lutescens*, *Cocos nucifera* (coconut palm), *Phoenix roebelenii* (pygmy date palm), *Ptychosperma macarthurii* (Macarthur palm), and *Roystonea regia* (Cuban royal palm) were selected and divided into three

Table 1. Phytotoxicity of 3 preemergent herbicides on 4 species of palm seedlings.

Treatment	Rate[z]	Species			
		Carpentaria acuminata	*Chamaedorea elegans*	*Chrysalidocarpus lutescens*	*Ptychosperma elegans*
Control	0.000	0[y]	0	0	0
Ronstar ×	3.13	0	0	0	0.1
Ronstar 2×	6.26	0.7	0.1	0.1	0.2
Ronstar 4×	12.52	1.4	0.4	0.9	0.8
Rout ×	2.20	0.8	1.0	0.9	1.2
Rout 2×	4.40	1.7	2.1	0.9	1.7
Rout 4×	8.80	3.1	1.5	1.4	2.7
OH2 ×	2.50	1.4	1.5	1.4	2.4
OH2 2×	5.00	1.3	2.5	1.9	2.4
OH2 4×	10.00	2.6	2.3	2.1	3.2

[z] In lbs/1,000 ft^2.
[y] Rating scale: 0 = no damage to 5 = dead.

treatments of five palms each. Soil, watering, and fertilization were the same as in Experiment 1. All palms were well established and grown under 73% shade except for the coconut palms which were grown under full sun. All palms were in 10 cm plastic containers except for the *Chamaedorea cataractarum* (16 cm containers) and the *Cocos nucifera* (25 cm containers).

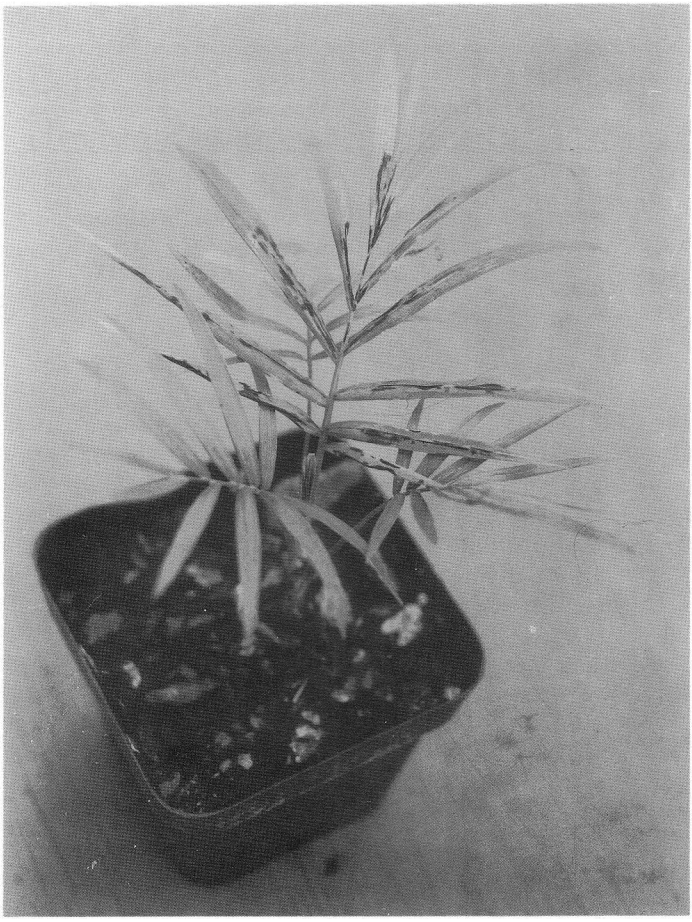
Roundup (glyphosate, Monsanto) was applied to all palm foliage to runoff. Treatment 1 consisted of the low recommended rate for weed control in a field situation (11 ml/L). Treatment 2 was at the high recommended rate (21 ml/L) and treatment 3 was a water control. After 8 weeks, the number of deformed leaves per palm was counted.

Results and Discussion

Experiment 1. Phytotoxicity of preemergent herbicides on most species of palms appeared primarily on newly emerging foliage as necrotic blotches (Fig. 1). The first leaf produced following application of these herbicides was often the only leaf affected and the time required for such a leaf to emerge after application had little effect on the symptom severity. *Carpentaria acuminata* generally showed few signs of phytotoxicity until the next leaf emerged 4 to 6 weeks after herbicide application.

Of the three products evaluated, Ronstar appeared to be safe on all four species of palms at rates up to twice that recommended by the manufacturer (Table 1). At 4×, Ronstar caused minor injury to some palm species. Damage to *Chrysalidocarpus lutescens* by Rout was less than that sustained by the other species, but even at its recommended rate, this product caused some injury to all four species. Ornamental Herbicide 2 was the most phytotoxic of the three products tested on all four palm species.

Although Rout and Ornamental Herbicide 2 may give slightly better control of some weeds in container grown palms, these products should not be used on palms grown as foliage plants where leaf appearance is important. Ronstar is safe on these palms when applied at the recommended rate. It is important to remember that, although these materials are registered for use on a broad variety of ornamental plants, they are not labelled for use on palms. This experiment illustrates the fact that application rate and method of application are critical to the safe use of preemergent herbicides on palms.



1. Typical preemergent herbicide phytotoxicity symptoms on *Chamaedorea elegans*.

Experiment 2. Direct foliar spraying of the postemergent herbicide Roundup was phytotoxic at both low and high recommended rates on all palms except for *Cocos nucifera* (Table 2). Distortion in the newly emerged leaves often resulted in reduced leaf size or necrosis of the leaflets. An average of two leaves per palm were affected by the low rate in *Phoenix roebelenii*, *Ptychosperma macarthurii*, *Chrysalidocarpus lutescens*, and *Chamaedorea cataractarum*, while only one leaf was distorted in *Carpentaria acuminata*, *Chamaedorea elegans*, and *Roystonea regia*. At the high rate leaf distortion was generally more severe with the greatest effect on the *Roystonea regia*. *Cocos nucifera* palms showed no leaf distortion at either rate. Two *Carpentaria acuminata* palms died when sprayed with the high rate although all other palm species survived and resumed normal growth within 2–3 months. Except for the *Cocos nucifera*, growth rate appeared to be slowed down for a period of time in the treated plants. All species of palms except for *Ptychosperma*, *Syagrus*, and *Cocos* palms showed a tendency to exhibit a lighter foliage color when sprayed with Roundup.

Palms appear to be quite resistant to

the herbicide Roundup when applied under the conditions of this experiment. Although distortion occurred in most palm species, the plants recovered and resumed normal growth. This herbicide is widely used in field nurseries to control weeds and, although one should avoid directing the spray to the leaves of palms to prevent leaf distortion, it appears to be safe with a single application, to a wide variety of palm species.

Table 2. Effects of Roundup spray application on number of deformed leaves per palm.

Application rate (ml/l)	Species								
	Chrysalidocarpus lutescens	*Chamaedorea cataractarum*	*Cocos nucifera*	*Phoenix robelenii*	*Pytchosperma macarthurii*	*Carpentaria acuminata*	*Chamaedorea elegans*	*Roystonea regia*	*Syagrus romanzoffianum*
0	0.0b[a]	0.0b	0.0a	0.0b	0.0b	0.0b	0.0c	0.0c	0.0c
11	2.0a	2.2a	0.0a	1.8a	1.6a	1.2ab	1.0b	1.0b	1.0b
21	2.4a	2.6a	0.0a	2.2a	1.6a	2.4a	2.0a	2.8a	2.0a

[a] Mean separation by Waller-Duncan K-ratio method, 5% level.

Acknowledgments

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PALM LITERATURE

SAW PALMETTO, a book by Dr. Edwin M. Hale, published by Boericke & Tafel, of Philadelphia, 1897.

Because this very interesting hard-cover book is not included in the listings of the International Palm Society's "Bookstore," it deserves ample space for review in *Principes*, with more than usual attention to extracts and quotes. This review follows:

In the book's introduction, Dr. Hale very truthfully notes that this great family of palms "numbers over one hundred species." He concludes the introduction as follows: "The genus, *Sabal* embraces six or eight species, five of which are found in Florida and other Gulf States. Some officious botanist removed the Saw Palmetto from this genus and made it a monotypic member of a new genus *Serenoa*, just as another removed the blue palmetto and named it *Chamaerops*. There was no occasion for such a change. It only renders the study of botany more difficult and serves no practical use."

In the chapter on history is discussion of observations of early explorers of Florida on the use of palm seeds as food by both animals and man. Included is the following extract: "There is no doubt that the aborigines of the Florida peninsula depended largely upon the berries of the Saw Palmetto for their food. In a very old book, with a quaint title page, published in 1796, are narrated by Jonathan Dickinson the adventures of a shipload of Quakers who were shipwrecked on the coast of Florida at its extreme southern point. The shipwreck occurred in August, 1696. They were captured by the Indians, who were believed to be cannibals. After terrible sufferings, a part of the men and women arrived at St. Augustine. Dickinson narrates that on their arrival they were taken to the wigwam of the "casseky," or chief, who "seated himself on his cabin, cross-legged, having a basket of palmetto berries brought him, which he eat very greedily." These Quakers, while with the Indians, nearly starved to death. The only food given them was fish and berries. Their first trial of the berries was not favorable. "We tasted them, but not one among us could suffer them to stay in our mouths, for we could compare the taste of them to nothing else but rotten cheese steeped in tobacco juice—we could not bear the taste in our mouths."

The chapter on pharmacology contains the most sensational pages in the book; on these pages the oil extracted from the seeds of the Saw Palmetto is represented as a virtual cure-all for the medical and aging problems of humanity. Salient extracts follow:

"Saw Palmetto may be hopefully prescribed in any depraved condition. It is a valuable remedy in tuberculosis, laryngitis, in bronchitis, in asthma, in whooping cough and in cartarrh."

"The special vitalizing action of Saw Palmetto affects the reproductive organs generally. The mammae, under its continued use, increase in size; the atrophied uterus and its inactive appendages are awakened; and by it the cold female is aroused from her sexual lassitude."

"In the male, the action of Saw Palmetto is prompt and efficient. The cold atrophied testes and penile organ, even if in part due to masturbation are given new life and a more generous supply of blood through the influence of Saw Palmetto. Waning sexual power is restored; impotence is dethroned, and man is made new."

"The fluid extract of this invaluable berry has a special action upon the testes. Its action is that of a great vitalizer, tending to increase their activity, to promote their secreting faculty, and add greatly to their size."

"In the chronic cases of gonorrhoea those which appear to be cured, but are

prone to recur on slight indiscretion, such as the drinking of spirits, sexual indulgence, masturbation, etc, this remedy is most effective. The pus discharge is usually arrested in three or four days; and if the remedy is continued two or three weeks, permanent relief appears to result."

In modern day perspective, were the claims of this book valid, we, as members of the International Palm Society, would be espousing palms for their cure-all properties for mankind—rather than just for their dilettante beauty in our eyes—and for their economic uses to the natives of the tropics, and to others.

And, were the claims of this book valid, the Indians of Florida, who ate the seeds of Saw Palmetto as their primary diet, would not have been reduced to near extinction by gonorrhea—one of the diseases for which Saw Palmetto is represented in this book as being a cure.

And, were the claims of this book valid, reprints of it still would be available—and it would now be listed in the International Palm Society's "Bookstore."

But this book, which was copyrighted 90 years ago, in 1897, was but a typical example of the irresponsible "quack" medicine of that era. It survived but one printing, and its copyright expired long ago. But because that book now is very old, and very rare, it is a classic among palm books. In that sense, it is a pleasure to hereby share it with you.

BILL GUNTHER

NOMENCLATURAL NOTE

A New Name to Replace a Homonym

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In a recent paper (Galeano 1986) I described a new species of *Chamaedorea* with the name *Chamaedorea macroloba* Galeano. Due to an oversight, which I am myself unable to understand, I overlooked that Burret (1933) had already published a *Chamaedorea* with this same epithet. So *Chamaedorea macroloba* Galeano is a later homonym which must be rejected and a new epithet must be provided. I hereby propose:

Chamaedorea murriensis Galeano, nom. nov.

Synonym: *Chamaedorea macroloba* Galeano, Brittonia 38(1): 60, fig. 1. 1986 nom. illeg., non *Chamaedorea macroloba* Burret, Notizbl. Bot. Gart. Berlin-Dahlen 11: 757. 1933.

Acknowledgments

I wish to acknowledge Dr. Robert W. Read and Don Hodel for bringing this faux pas to my attention.

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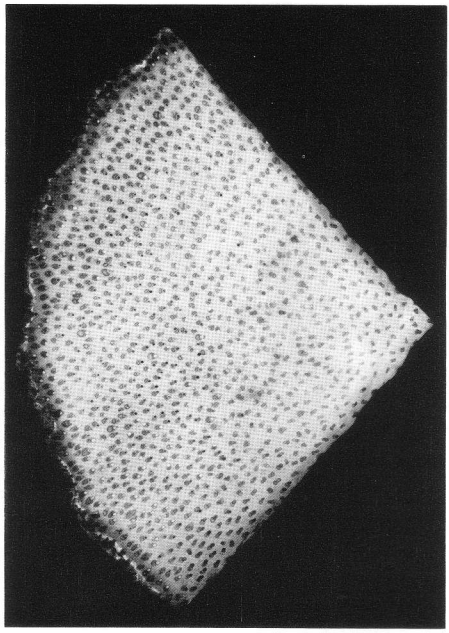
Principes, 31(3), 1987, p. 140

PALM BRIEF

Petrified Palm Wood

During the Miocene and Eocene epochs some 12 to 60 million years ago, palms represented, in contrast to the present, a much more important component of the vegetation of North America. As the earth's environment underwent slow but significant changes inimical to their continued growth, palms died out in most areas. Fortunately, in certain locations, parts of trees—roots, trunks, leaves, inflorescences, fruits, pollen grains—became embedded in sediments and were preserved by petrification. Infiltrating mineral matter replaced the plant tissue particle by particle and, in a very slow process, preserved not only the outward forms but also the minutest details of the internal structure. Fossil palms in general were the subject of an excellent illustrated paper by Tuta (1967).

Petrified palm wood may not be as familiar as the fossilized pines and cedars which abound in the Petrified Forest National Park in Arizona, but it has been found from New Jersey to California, and is common along the Gulf Coast. A major source of petrified, or agatized, palm wood is located about 60 miles southeast of Austin, Texas, in a cluster of counties centered on the town of La Grange. Although the best areas for rock-hounding reportedly have been either picked-over or are on inaccessible private land, gem and lapidary shops in eastern Texas sell petrified palm wood as uncut rocks, as thin slices across the vascular bundles, and as cabochons, stones which are cut and polished but not faceted. Large pieces may be squared and used as bookends or doorstops; small pieces polished and fashioned into attractive cuff links, belt buckles, pendants, and so forth. It is the distinctive vascular bundles which make the stone easy to identify, and give to the various products their unique appearance. Texas officially recognized the beauty of petrified palm wood when it was adopted as the state stone in 1969. Anyone seeking information about palm wood in Texas should consult an article on the subject by Towner (1975), and a useful field guide to gems by Simpson (1958).



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DENNIS JOHNSON

Principes, 31(3), 1987.

PALM BRIEF

Wodyetia bifurcata

Wodyetia bifurcata is an exciting new and very attractive addition for landscape use in more temperate regions.

Photographed (Fig. 1) is a specimen planted out in our Brisbane garden in October, 1984. This plant had a diameter at ground level of 1¼ inches, a height of 33 inches and carried 4 or 5 leaves. Approximately 20 months later it has reached 10 feet high with a diameter at ground level of 7½ inches.

Somewhat similar to *Normanbya normanbyi* at first glance, it has a much more vigorous appearance and seems to grow at least 5 or 6 times faster than the *Normanbya* in our Brisbane conditions, although cultivation to an eight inch pot size is still rather slow. Once in the garden, the requirements of *Wodyetia* and *Normanbya* for a strong and speedy growth seem to be the opposite. Whereas *Normanbya* requires lots of protection, e.g., planted in a shadehouse and allowed to grow through the roof, *Wodyetia* obviously relishes being exposed to as much sun as possible. Winter temperatures here range between 3° C–22° C, and in summer from 20° C–35° C with our average annual rainfall of 45 inches falling mainly in summer.

Due to the initial demand for seed of this new palm species, some problems have arisen, with the price of seed ranging from 40¢ each up to $5 ($Aust.). As the price soared unfortunately unscrupulous people have gone in to make a fast buck and collect seed with the use of a chainsaw—obviously not people who care about plants or intend to make a second collection.

In a typically bureaucratic reaction, the Government officials around North Queensland have confiscated or threatened to confiscate seedlings of *Wodyetia*. Until the day that Government bodies the world over realize that the road to conservation is not to say 'No, you can't have it' but 'Yes, you can have as many as we can supply,' the destruction by mankind will continue.

1. *Wodyetia bifurcata* growing in the Walkley garden in Brisbane, Australia.

We must give nature a helping hand. Money raised by selling rare seed from small colonies could be used to help manage the palm populations and to produce more seedlings to replant as healthy young specimens, thus reducing the pressure on the wild plants.

Thanks to the worldwide distribution of *Wodyetia* on its first real collection, seedlings raised in more tropical areas must by now be reaching maturity. This widespread cultivation may help to save the plants from extinction.

STAN WALKLEY

NEWS OF THE SOCIETY

A Mainlander's Impression of the Post-Biennial Trip to Hawaii

Hawaii—To those of us who are from the temperate zones (this includes me even though I have lived in Miami for 50 years) the very word Hawaii evokes visions of the tropics, friendly people, warm sunny days, perfumed nights and exuberant vegetation with extravagant blooms. How right those fantasies are—what we saw of Hawaii on the Post-Biennial trip June 29 to July 6 lived up to my expectations yet added new dimensions to the pictures long carried in my mind.

Forty of us flew to Hawaii, the Big Island, from California, though not on the same plane. Our hotel at Kona-lua Kai was a pleasant structure with open areas, planted patios and the dining-room located along the side of a bay, sheltered yet in the open air. The next day we got a whiff of the eruption of Moana Loa, but a change of breeze soon brought back the fresh air.

The first morning our group met and was briefed on our day's activities. We were to go in a caravan with Ray Baker and Jaime Lee as our leaders. A car had been assigned to each room but many teamed up with someone from another room thus getting a more comfortable car and incidentally making it easier to find parking space. Even in Hawaii such space was sometimes at a premium.

We followed our leaders into a hilly area where Norman Bezona has a fascinating piece of property on which he is growing palms, heliconias and gingers as well as ferns and many other tropicals. It was pleasantly cool and damp. No wonder the plants looked so happy, but like many other places in the world in this age of quick and easy transportation, plants from elsewhere have been introduced and find the climate of their new home greatly to their liking. Then they often crowd out the native plants. Such was the case with a pretty pink flowering vine that produces a banana-shaped pod, hence called the banana vine, though it is really a passiflora. It becomes enormous, covering (and eventually killing) large native trees in undeveloped areas.

Norman had many young palms planted out, most of them familiar to South Floridians. His collection will be impressive as his plants become larger. However, the overwhelming effect was of the magnificent tree ferns that towered over us. Among them, to my astonishment, was *Angiopteris evecta* with trunk to six feet (80 cm); this fern is grown in Florida but does not reach such huge proportions—we walked under them! They are almost a weed in Hawaii.

From this place Norman led us down to Kealakekua where he is Agricultural Agent. Behind the office was *Veitchia joannis* but unfortunately most of the fruit had already been collected. He also had a thornless individual of *Bactris gasipaes* which he was trying to propagate since it is one of the palms used for hearts of palm. After lunch we visited Jaimie Lee's nursery nearby to see many different tropicals. Then on for some distance along the road which paralleled the coast and occasionally gave delightful glimpses of the ocean. We passed an orchid nursery that was a mass of vanda blooms, possibly for use in "leis." An old nursery with many mature palms was the next stop. It had recently been taken over by Jaimie Lee but unfortunately there were few ripe seeds to be found.

The next morning we drove to Hilo, passing through areas that are still comparatively new lava, with just a few plants beginning to take hold. The black lava was an astonishing sight. We were on our way for an unscheduled visit to the nursery and cut flower business of newly-elected Board member Jules Gervais. He had a big, high warehouse where his people were busily taking care of hundreds of containers filled with cut anthuriums as well as many hel-

1. *Pigafetta filaris* in palm collection of Jules Gervais.

iconias and gingers. It was a breath-taking sight; no one was prepared for such a sea of red bloom. We then each were handed a large square of plastic to help protect us from the imminent rain, and thus protected, took off to see Jules' plantings of palms. He has not too long ago set out his collection but it was already very impressive with the palms obviously happy. Among his treasures were many *Areca catechu* from which he had to keep the seed cut as otherwise the tree was damaged when people came to steal the nuts. He had a large collection of other species of *Areca*, such as *A. triandra*, a large *Pigafetta filaris* (Fig. 1), many licualas and a host of other palms, some very rare. A real cloud-burst somewhat dampened our spirits, but we pressed on until it became so bad that we scuttled for shelter in the warehouse—even the plastic sheets were not entirely adequate to keep us dry. At the warehouse a delicious cool drink had been prepared by Jules' wife, Soontaree, using coconut and nipa juices. Upon inquiry we were told it is imported from the Philippines! It was refreshing and not too sweet, most enjoyable.

The rain being over, a short walk across the street took us to the huge shade house of Jerry Hunter's Rancho Soledad Nursery. Here palm seedlings were grown in enormous numbers until they are large enough to be shipped to his operation near San Diego.

Those of our group who had not gone to Jules' place met us at the Moanaloa Hotel in downtown Hilo for the caravan trip to Donn Carlsmith's estate. It is located some distance up in the midst of lush high native growth. Interspersed in the vegetation were tall stands of *Archontophoenix alexandrae* that had found a congenial home in this exotic spot. In fact, they have

2. *Phoenicorium borsigianum*, Carlsmith garden.

become naturalized and are often called the Hilo palm. They were very conspicuous and certainly added to the tropical aspect of the landscape. Along the way a stop was made to visit the garden of Toshio Imoto, the caretaker of Donn's estate. Toshi's *Calyptrocalyx spicatus* was in full fruit. He had thoughtfully provided a ladder so those who wished could collect seed. He also had a magnificent tree of *Amherstia nobilis*.

The road to Carlsmith's was narrow, winding through dense vegetation. We passed the Hawaii Tropical Botanical Garden but decided to take it in on the way back, if time permitted, but unfortunately it did not. A bit further on the caravan stopped along a particularly sharp curve to get a view up the ravine at the grove of *Phoenicophorium borsiginum* (Fig. 2) which Donn had established amidst the dense vegetation. It was a magnificent, unbelievable sight.

At Carlsmith's we were met by Donn's wife Jean and Toshi, both of whom greeted us warmly. Unfortunately, Donn was unable to be present. Toshi led the group on a tour of the property where whole areas are devoted to various kinds of plants, among them large numbers of natives, but palms were much in evidence. How can one describe them all, or even a small part of them, there were so many. It was a bewildering tour, so much to see. A beautiful group of *Clinostigma samoense* (Fig. 3) caught the eye with its triple touch of chartreuse in crown, crownshaft and trunk. Not far were not one or two, but four double coconuts, the largest with five leaves. Many other palms were equally outstanding (Fig. 4) though mostly as single specimens. The garden is a very large area with various elevations and paths; new views appeared as one progressed. Refreshments were served at the patio near the house. From this lovely spot there was a vista across a valley with several stands of the Hilo palm on either side framing the ocean in the distance. It is altogether a marvelous spot and we all thanked our hostess, as well as our host *in absentia*, for letting us enjoy it.

3. *Clinostigma samoense* in Carlsmith collection.

4. Large specimens of *Carpentaria acuminata* in the Carlsmith garden.

Dinner on our own in Kona gave us time to explore some of the restaurants and shops near our hotel. The streets are lined with a fascinating variety of frangipani (known there as plumeria) in many colors and leaf forms. No wonder the evening air was so fragrant. A few of us wandered into the grounds of the venerable King Kamehameha Hotel with its old plants of coconuts, pritchardias and spindle palms.

The following day, our last on Hawaii, was free until time to take off to Oahu in late afternoon. Some of us made use of the morning to get as near to the volcano as possible, others drove back to the Kealakekua area. Continuing along the road, in an area where not a soul was to be seen, we saw a huge planting of white frangipani. Were they being grown for their flowers for "leis," or as landscape plants? Not too many palms were evidence. At the end of the road, down by the shore, was a bay with a monument to the first white man to be buried on the Hawaiian Islands, a sailor with Captain Cook. Nearby was the Kona Coffee Factory offering a free taste of that famed brew.

In mid-afternoon we took our rental cars back to the airport and embarked on the short hop to Oahu where we stayed at a hotel in Waikiki not far from the famous beach. Few of us were interested in that for it was crowded, as were the streets during most of the day. However, we were not there to see city life. We'd come to see palms in great variety. Thursday morning in a caravan in our rented cars we followed Ray Baker to the famous Lyon Arboretum. What a fascinating and beautiful place that is. Upon our arrival ladies of the Friends of the Arboretum provided coffee or a cool drink and delicious cookies. Then we set off, under Ray's guidance, on a tour of the Arboretum. The variety of palms, in fact of all kinds of plants, was overwhelming. I was enchanted by *Phloga nodifera*, from Madagascar, a plant about five feet tall with fronds that looked almost

frilly; it reminded me of a young *Wodyetia bifurcata*, of which there was also a beautiful young plant. Again, *Clinostigma samoense* was eye-catching as was an *Orania palindan* from the Philippines, with its wide base and big growth rings. There was almost too much to see along the various paths, but soon it was time to return to the office where the Ladies' Auxiliary had prepared a delicious lunch. Thus fortified we struck out again along a different path leading to a rather wild area which some of us decided to forego. Everywhere were palms of all kinds, too numerous to mention, as well as many gingers.

Back at the office Ray handed us a list of plants that could be ordered from the Arboretum. These plants were to be mailed, none were to be carried home as they were grown under strict quarantine conditions so there would be no problem with their entering the mainland. It was a rare opportunity to obtain unusual palms at an exceptionally low price. Before leaving we again had cool drinks and discussed the many plants we had seen. It had been a wonderful day and we again thank those responsible including Dr. Sagawa, Bob Hirano, the Ladies of the Arboretum Friends, and most of all Ray.

The next day we were due at Waimea Falls Park, an area that has not too many mature palms, but a big collection of new plantings. It is also an ancient Hawaiian historic site with great sacred importance. It is located in a fertile valley with plenty of water. An open-air bus takes visitors along the floor of the valley up to where the falls tumble into a small but lovely pool. Some of our members came prepared so they enjoyed a cooling swim. Then we were served a delicious lunch under a tent after being greeted by Director Dr. Keith R. Woolliams. Among the palms observed were a number of *Livistona carinensis*, licualas, ptychospermas and near a little pond a group of *Sabal bermudana*. There were many others too, all seemingly happy in the fertile soil of the valley with its abundant water.

After lunch we were given the choice of visiting the Polynesian Cultural Center or Wahiawa Botanic Gardens, one of the several gardens under the City and County of Honolulu. This is a rustic place with a deep ravine. Old, established plants were everywhere, with a particularly fine stand of pritchardias, some licualas and lots of gingers and heliconias that greatly interested some of our group. At the end we scrambled up a faintly visible trail to the area near the street. Here was a very old *Orbignya*, an astonishing sight, it was so tall. I am glad I was with the group who chose to go to this rather neglected, wild spot. Jim Specht, responsible for making the original plans for the trip to Hawaii, was helpful in identifying as were again Ray Baker and Jaime Lee.

Saturday found us on our way to the Ho'Omaluhia Arboretum, another unit of the Honolulu Parks Department. This area is large, 400 acres, most of it quite open, some still leased out to banana and sugar cane growers, thus bringing income. Nothing here is older than six years, but it has a growing, interesting collection of tropicals, including many palms, especially from the Philippines. Dr. Paul Weissich, Director, welcomed us but had to attend a meeting elsewhere so his able assistants took us on tour. There we found stands of two clumping species of *Ptychosperma*, one large with large black seeds, the other smaller with smaller black seeds. Even the Australian members present were unable to identify them. A nice *Pinanga speciosa* had a handsome trunk. There were quite a few other palms in fruit, among them *Areca concinna*. We were given a free hand to collect seed.

From Ho'Omaluhia we drove in the opposite direction to the home of one of our former Board Members, Dr. Charmin Akina, on Aiea Heights where a Japanese style lunch had been ordered. Thus we had

a sampling of many different foods on our short trip, all of them interesting and most of them delectable. Dr. Akina has a delightful garden sloping down gently from the back of his house, with a huge rain tree shading the terrace near the house and part of the the garden. These tall spreading trees with pale pink blooms create large areas wonderfully suited for growing palms and other tropicals. Dr. Akina has a very select collection of plants, many of them palms. Among his beauties was a large clump of *Areca vestaria*, a very big and vigorous clump of *Chamaedorea cataractarum* and *Licuala paludosa*, to name a few.

The next morning, our last day on the Islands, we went to Foster Botanic Gardens, the old garden located within the city of Honolulu. What a treasure-house of magnificent old specimens—even two mature, blooming *Lodoicea maldivica*! At least one huge flower, as big as a baseball but much harder, was ready to be pollinated, but unfortunately, both mature plants were female. I was enchanted to see the row of *Licuala grandis* that I remembered having seen in a picture in an old issue of *Principes*. Now they were very tall, way over my head. Opposite the *Licuala grandis* along the path were several large, mature plants of *Pelagodoxa henryana* under which we hopefully hunted seed but naturally found none. A huge many-branched doum palm dominated one area. Here too a very old *Orbignya cohune* supposedly brought to Hawaii as a small plant from Spain in 1880–90 by a ship's captain and given to the King of Hawaii, towered over everything else. We were told there was a second one also, planted somewhere in town. I believe I saw it later, lifting its head over the nearby growth. Foster also has a tall, fruiting *Syagrus amara* (formerly *Rhyticocos*) under which Ray Baker had just gathered a sackful of fruit. A *Satakentia liukiuensis* looked healthy but showed no sign of fruiting. Anyone going to Honolulu would do well to get a copy of *Principes* Vol. 12(1) with the article entitled: "Foster Botanical Garden" by Warren Dolby.

That afternoon our foursome drove to the dry side of the Island. What a contrast to the lushness of Lyon Arboretum and the other gardens.

That evening we returned to the mainland. It had been a memorable trip with almost too much to see, but all agreed that it had been a fantastic and enjoyable experience. We felt greatly indebted to Ray Baker for giving us such a large portion of his valuable time. Without him and his patience in answering our many questions we would have missed much. To the others—Jim Specht who had originally planned the trip, to Jaime Lee who accompanied us often and also answered many questions, to Dr. Akina for inviting us to enjoy his garden, and to those who may have contributed without our being aware of it, many heartfelt thanks for assuring that our trip was so successful. I wish that whoever may go on a future palm trip to Hawaii is as fortunate as we.

TEDDIE BUHLER

Note: Photos in this article by Dietrich.

Genera Palmarum

There is still time to take advantage of the presale! Send your orders to **Genera Palmarum,** Box 368, Lawrence, KS, USA 66044. Prepublication sale ($44.95 plus $5.00 postage and handling). Regular price after September 1st, 1987 ($69.95 plus $5.00 postage and handling).

A few genuine leather bound copies are available ($150.00 plus $5.00 postage and handling).

Overseas Airmail: please add $35 for Far East air, $25 for airmail elsewhere.

Visa and MasterCard orders are accepted.

The book is expected to go to press early in July and should be available shortly after

the presale ends on September 1st. The copies you have ordered during the pre-publication sale will be mailed to you as soon as they are ready.

Reminder

Suggestions for new Board members should be sent to one of the Nominating Committee. Committee members are: Chairman, Mr. James Mintken, P.O. Box 27, Forestville, CA, USA 95436; Mr. Edward Hall, 1111 Glen Garry Circle, Maitland, FL, USA 32751; and Mr. David J. Tanswell, 82 Leworthy St., Bardon 4065, Australia.

Principes Articles Dealing with Palm Seed Germination, Culture, and Care

The first issue of *Principes* was published in 1956. Since then, many articles about palm seed, germination, and cultivation have been published. The following is a list of back issues of *Principes* which contain seed articles.

Article Title	Author	Issue
Viability of Palm Seeds.	De Leon	Vol. 2, No. 3
The Preparation and Germination of Seed.	Loomis	Vol. 2, No. 3
Propagation of Palms.	Kiem	Vol. 2, No. 4
Brief notes on a Germination List of Species.		Vol. 10, No. 1
Venezuelan Palms and Germinating Tropical Palms.	Braun	Vol. 12, No. 2
Germination of Palm Seed.	Koebernik	Vol. 15, No. 4
Notes on Germination of Palm Seed.		Vol. 16, No. 4
Notes on Germination of Palm Seed.		Vol. 17, No. 2
Seed Germination and Seedlings of Sabal Palmetto.	Brown	Vol. 20, No. 3
Raising Ornamental Palms.	Wagner	Vol. 26, No. 2
Palm Seed Dormancy, Viability and Germination.	Odetola	Vol. 31, No. 1

If you are interested in ordering any of the back issues listed above, each volume is $5 including postage. Send your selections (listing Vol. and No.) and payment by check or money order in U.S. funds to: THE INTERNATIONAL PALM SOCIETY, P.O. Box 368, Lawrence, KS 66044 USA.

LYNN MCKAMEY

SEED BANK NEWS

Seed Bank Goes to the Amazon

After a short stopover in Lima, Peru your Seed Bank officer winged it once more into an area from which we had never received seed and where we had no contacts—Iquitos on the mighty Amazon river.

As I had made no reservations I took up with an outfit called "Amazon-Expeditions" and told them exactly what I needed, namely a car and a driver for a

day, a boat and housing somewhere on the Amazon, preferably where few tourists had gone. Inside an hour I was bobbing along the only road out of Iquitos on a palm-rich tour. I had shown my guide a letter I had received from Dr. Ostolaza of Lima with palm names in Latin—but what was a real find—also with the names people use in this area. A Palm Society member, Kember Mejia, had written these names in a report for the Instituto de Investigaciones de la Amazonia Peruana and now it came in really handy. As soon as I called *Mauritia flexuosa* "aguaje," faces lit up and I was in business.

Getting the seed was another story. We found "aguaje" soon enough, growing right along the sandy dirt track but the seed was high up. A friendly neighbor lent us a ladder and things went smoothly, but what a disappointment—the seed was not quite ripe! As usually happens in such situations we soon had a large audience and somebody living close by invited us to his property for a taste of "pijuayo." I try everything once and the mealy tasting fruit turned out to be *Bactris gasipaes* (distributed #87-PS-134) cooked and peeled. The tree was also close by and it was easy to drag the ladder around with the help of a large crowd.

Meanwhile I had a chance to take some pictures of *Mauritiella peruviana*, alas also with unripe seed. A little down the road we came upon the stilt palm *Socratea exorrhiza* (distributed under #87-PS-140) and even got a volunteer to go a bit into the jungle behind his house to get some ripe fruit for us. Why did I need a volunteer for this job? While I was still stomping around for a good picture, they caught a king snake with red markings and a thorn on its tail which the natives use for their spears. After this my stomping became a lot more cautious. But by far the most intriguing palm I had seen was right on the Plaza de las Armas back in Iquitos. It was *Euterpe precatoria*, but with leaves that are yellow/green striped. Unfortunately there were no fruit. I had mentioned that I would just about give anything for this beauty and Ricardo was about to die trying to show me what he could do for "la gringa loca." Right on a side-arm of the Amazon, where the road stops and we could go no further, was a little stand of jungle intermingled with this palm of striped beauty, but not in seed. On this sad note I ended the day.

Early morning found us in an open boat bound for a forest camp 160 km up the Amazon where the Ucayali joins the Maranon to form the Amazon. It took us seven hours to get there since the Amazon was so swollen by the yearly floods that the captain of our boat could not make use of its full power. Indeed the one try he gave nearly capsized us when we hit a submerged tree. But the trip was intensely interesting with the tiny settlements and submerged palm groves along the shores of the eight km wide Amazon river. Sunburned to the blister stage we finally turned into the Yarapa river where our happy home for the next few days (and nights) turned out to be. It was very primitive. When I inspected the Piranha bites the boys had on their arms and legs, I turned down their invitation to a swim. Being an old lady has its privileges—they put a couple of buckets of water into an oil drum high on a structure and I had a shower. The mosquito netting around my mattress made things bearable once I was in bed but chemistry really saved the night.

Next day we went by canoe to a little rise in the river where I was promised some good palm hunting. And true to his word Carlos knew his stuff. *Geonoma deversa* was easy, but there were no seed; *Phytelephas macrocarpa* (distributed #87-PS-136) was an easy mark—the boys were as anxious as I was for a different reason; they liked the palm juice in the fruit. We soon had a good handful each of ripe seed. *Oenocarpus mapora* (distribution #87-PS-135) gave us lots of problems. It was a miserable job in the steaming jungle to pick

up all the seeds when with all that fruit some small snakes fell out of the crown. So you had to sort out the seed from the thick undergrowth without collecting a snake in the bargain. (I wondered if the Seed Bank would arrange for a decent burial.) The most frustrating part was seeing several magnificent trees of *Astrocaryum* in full unripe fruit, knowing that we had to leave them behind. Those trees were spiney! After three hours of dragging my heavy boots through the mud we called it a day and moved on to the river's edge once more.

Carlos knew of a stand of *Euterpe precatoria* (distribution #87-PS-138) but upon checking they were just the "normal" green type. By now I was spoiled, but we took a large bag of seed home anyway.

Jessenia bataua (distribution #87-PS-137) was a bit of a fluke. There was a tree near a small settlement but the people had just eaten the fruit. Luckily they had thrown the seed out of their houses and we all crouched around collecting these little gems—being taken for total nuts by the natives, I am sure. *Scheelea cephalotes* (distribution #87-PS-138) was just too heavy and large a seed to be collected and transported in greater numbers.

The next few days were spent with more or less the same routine search and collect mission. I learned that I had come at the wrong time of the year. In February the Amazon is 40 feet high over the normal stage and only seed on the trees that are ripe could be collected. All that fell down, fell into the water. So what I mostly saw was un-ripe seed. Around the Cocha mono (Monkey-lake) grew thick stands of a species of *Bactris* of about an arm's thickness with wonderful spines and gooseberry-like fruits, intermingled with another *Bactris* sp. that had deeper green leaves in a four-and-four pattern leaflet arrangement and flat spines. The fruit had a distinctive stalk where it was attached to the fruit spike. I tried to make arrangements with the expedition leader, but I am still waiting for the promised shipment. Of course there were some nervous moments when we spied an anaconda up a tree directly above us while I was taking a picture of an orchid from the boat, and some funny moments while our captain was trying to lure the pink dolphins of Cocha Carmen alongside the boat and nearly joined them in the water. Ricardo had worked for Jacques Cousteau when he shot his films of the pink dolphins up that way.

In all it was a worthwhile venture especially when I finally found a contact who might in the future supply us with seed.

Unfortunately what followed was a totally disastrous undertaking, to cross the high Andes in search of *Ceroxylon*. A snowstorm and unseasonable rainfall had washed out the roads to Huanuco. Ill with soroche (high altitude sickness), your brave little Seed Bank officer called it a day at 4,875 m (13,000 ft) altitude on the Abra Anticana mountain pass near La Oroya, Peru.

This is why the continuation of "Seed Bank goes Inca" has to wait for another year.

INGE HOFFMANN

How Rare is Rare?

Every Seed Bank member is by now well acquainted with the Seed Want list and has made some choices, but at the very end of this list the question appears "rare seed wanted?" What does that mean? It seems there has been some confusion over this question.

Of course there exist many more palms than could possibly be offered on the Seed Want list. For some of these beauties we have no donors and some of them grow in such remote areas that they will scarcely ever be available. So the Seed Bank has done the next best thing—we have created a card file with a card for every palm whose name has ever come up. When such a

rarity becomes available, we go to our "rare seed demand list" and pick at random, or better by growing area, the people we think might be pleased to receive these seed. Sometimes we have specific demands for a rarity; then we try to please. And sometimes the seed is not all that rare, but we have just never had anybody collect it for us. Then "rare seed" is only rare in the Seed Bank availability file.

Your two volunteers just never know what will fly across the desk until it happens.

Some that were rare seeds only last year are now available because we now have a member living in the area and supplying us. This is when it gets exciting—suddenly a whole world opens up.

When we have donations from several expeditions, as it happened in spring 1987, then things become really busy. Just think of the lucky people who received all those beautiful pritchardias from Hawaii, available through the expedition of Robert Read of the National Museum of Natural History, Smithsonian Institution. Your friendly Seed Bank had helped a bit with the funding and received a wealth of seed for distribution.

The same holds true for the expedition of the University of California to Costa Rica and Panama under the leadership of Don Hodel that brought back two as yet unnamed species of *Chamaedorea* plus one very rare species (*Chamaedorea flavovirens, D. Hodel #648* (87-PS-273) from Panama. The unnamed species were distributed as *Chamaedorea* sp. *D. Hodel #630* (87-PS-272) and *Chamaedorea* sp. *D. Hodel #635* (87-PS-271). These seed will always be in the "super rare" range.

And more of these rare things are on the way as our aggressive public relation policy pays off and we are in the view of the very people who go places and look for the seed we so desperately want.

So take a chance on some "rare seed"—you never know what is in the wings.

INGE HOFFMANN

Some Sort of a Record

In the first quarter of 1987 the Seed Bank mailed a record number of seed to its members.

Total number of seed packets shipped: 4,725.

This means a shipping of 1,575 packages per month! Imagine not only all the labor involved but all the material and postage. Some of them were the heaviest seed we handle through the Seed Bank.

Your two Seed Bank officers would like to thank all their Donors:

KEEP THEM COMING—WE WILL DISTRIBUTE THEM. And a warm "thank you" to all the members who have supported us with their checks. We keep trying to find new sources to fill your needs.

INGE HOFFMAN

DAVID SYLVIA

Can You be a Source of Palm Seed?

The seed bank obtains donated seed from many sources—members' expeditions into remote regions of the world, growers, and hobbyists. If you have mature flowering palms or access to palm seed, the seed bank would be interested in having this information on record. It is possible that we might have need of this seed and will contact you detailing the amount needed and best shipping methods.

If you can be a seed source, please list the botanical name of the palm and the month that mature seed is usually available. Send to THE INTERNATIONAL PALM SOCIETY SEED BANK, DAVID SYLVIA, 36279 Christine Street, Newark, CA 94560 USA.

Wild *Jubaea chilensis* (Chilean Honey Palm) growing on coastal hills in central Chile (west of Santiago) at 33 South Latitude, an area with a Mediterranean type climate essentially identical to that of southern California. A U.S.D.A. Zone 9b palm, which, however, does not thrive under Florida conditions. See *Principes* 30(1): 26.