PRINCIPES

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THE INTERNATIONAL PALM SOCIETY

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PRINCIPES

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PRINCIPES

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Principes, 41(4), 1997, p. 175

Editorial

The front cover of this issue shows an exciting new species of *Trachycarpus*—the result of an expedition to Thailand by Martin Gibbons and Tobias Spanner who set out to solve a puzzle and found a prize. This trip was as adventurous or more than some of their others and makes an engrossing tale.

In another story of discovery, John Dransfield describes finding *Wallichia disticha* in Thailand on limestone rather than on sandstone as in its more northern habitats. Perhaps this is a palm we can watch for, certainly in gardens, during the coming Biennial in 1998.

The back cover of the issue illustrates some lovely objects turned by author Gene Doren from the fruits and seeds of palms. Most of us are aware that seeds of phytelephantoid palms are known as vegetable ivory. Gene has used seeds of *Phytelephas* as well as of several other genera, and his article describes in detail how to make different objects from them using a lathe. Those so inclined should be able to try their skill at using palm seeds as an art/craft medium.

The changing of names of palms is often considered a nuisance and is the source of much, sometimes acrimonious, discussion. That botanists do not change names lightly is sometimes not appreciated. Bill Baker explains, with good familiar examples from palms, why name changes are a necessary nuisance. The reasons are many but the net result can upset the user of a classification. However, without the rules that demand the changes, we would have chaos and we would lose the means for unambiguous communication of information.

We are pleased to present in *Principes* a treatment of *Linospadix* in Australia by John Dowe and Tony Irvine. The so-called walking stick palms are native to Australian and New Guinea rain forests and are most attractive small palms that have not been well known. Because they are variable in leaf structure, their taxonomy has been difficult. The authors have found five species, including a new one in Australia.

Finn Borchsenius and Flemming Skov have recorded the ecological tolerances of 129 Ecuadorian palms. The article provides information on elevation, rainfall, temperature, and tolerance of a dry period and should be useful to those cultivating the species.

You will note that the format for Chapter News has been changed as voted by the Board in London. For further information see the news item by Jim Cain. Please send us your comments and suggestions on the changes.

NATALIE UHL
JOHN DRANSFIELD

Principes, 41(4), 1997, pp. 175–176

Note from the President

Since my last message to you, the Board of Directors met in Richmond, Surrey, United Kingdom on May 17, 1997 and many important items were discussed. I am very pleased to announce that we have four new Chapters of the International Palm Society. These include the Far North Queensland Palm and Cycad Association (President David Warmington), Association Chambeyronia in New Caledonia (President Marc Dumas), La Asociacion Espanola de Amigos de las Palmeras (Spanish Palm Society, President Tomas Font), and the South China Palm Association (Director Sammy Au). All four of these are composed of people who independently started up groups in their region of the world with a common interest in palms and which subsequently decided to become affiliated with the I.P.S. I want to warmly welcome them all to the I.P.S. and hope that our relationship can be long-lived and prosperous. Some of you may wish to join these Chapters and receive more information about palms through their Chapter's publications.

The Board also decided to sponsor jointly the English translation of an exciting new French book on the palms of the Amazon, entitled the *Palms of Eldorado*, by Francis Kahn. Several Directors reviewed

the manuscript and found it to be very readable and a valuable edition on the palms from this region and a great addition to anyone's palm library. Ordering information was sent to you in the July issue of *Principes*, but be aware there was a rather limited printing of this work.

Our plans for the 1998 I.P.S. Biennial Meeting in Thailand are presently being finalized. The dates are as follows: Biennial September 11 through September 18, with departure home on September 19. The Post-Biennial Tour September 18 through September 23 with departure home on September 24. The proposed itinerary for the Biennial is that we meet in Bangkok and depart south for Nong Nooch Tropical Garden near Pattaya in Central Thailand. We will be entertained by our host, Kampon Tansacha, and his staff at Nong Nooch for approximately three days. Then we depart via air to the far-southern city of Narathiwat. There we will be visiting palms in the wild in various locations. We will journey north to Hat Yai, visiting palm localities en route and finishing with our traditional farewell banquet. Biennial-only attendees will then return to Bangkok for site-seeing and shopping, and the following day depart home. Attendees of the Post-Tour stay on and will travel from Hat Yai north to Trang, then on to Surat Thani, and finally to the famous city of Phuket, visiting wild palm and cycad habitats in each area. From Phuket we return to Bangkok for a tour of the Grand Palace and shopping in Bangkok. You will receive the formal announcement and registration material in your January issue of *Principes*, but plan now so as to not miss this fantastic opportunity. You may also wish to schedule an early arrival or later departure to enjoy the many wonders of Thailand.

Finally, I would like to announce that one or possibly two issues of *Principes* in the not-too-distant future will be dedicated to the sole topic of palm culture. Our plans are to pool the resources of multiple palm authorities and create a work that will be usable and enjoyed by all members of the Society.

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Principes, 41(4), 1997, pp. 177–178

Name changes—a necessary nuisance

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Readers of *The Palm Journal* may have noticed that the *Dypsis* issue (September 1996) contained a tirade in which the author expressed his "utmost displeasure with the arrogance of the botanists who, with little discussion or explanation, have once again changed the names of a group of palms just after the collectors, growers and beginners have finally learned to pronounce them." Opinion of this kind is worryingly widespread amongst horticulturists throughout the world. In order to avoid rapid disillusionment and a course of psychological therapy, any self-respecting botanist must acquire a skin thick enough to deflect such indignant assaults, which are vocalized often and appear regularly in print.

Unfortunately, anti-name change arguments more often reflect a lack of understanding of the activities of botanists than flaws in the reasoning behind the changes being made. The botanists must take the blame for this. Name changes should not be made without offering an explanation to the users of names, although, to be fair, in the case of the infamous example mentioned above, where several well-known and loved genera were lumped into the now massive genus *Dypsis*, an excellent explanation *was* published in *The Palms of Madagascar*.

In the remainder of this article, I will try to reduce the distress that name changes cause by discussing the three basic categories of changes and explaining some of the underlying principles and rules to which botanists must adhere when making changes.

Misidentification

Sometimes, when a plant is introduced to cultivation, a person makes a stab at naming it and gets it wrong. A good example is the palm distributed from Thailand as "Licuala elegans." This spectacular palm has proven to be easy to grow and is now quite widespread in cultivation around the world. Growers may be shocked to know that this is not *Licuala elegans*. The true *L. elegans* described by Blume in 1838 is a dwarf palm with several leaf segments known from the rain forests of Sumatra, which is, in fact, the same as *L. pumila* from Java described also by Blume in 1830. The Thai palm, however, is a variety of *L. peltata* with undivided leaves, recently named formally by Saw Leng Guan. The grower may be annoyed with the botanist for changing the name, but it is clear that the error lies with the incorrect name applied in the first instance.

Nomenclatural Name Changes

This is where the *International Code of Botanical Nomenclature* and the *International Code for the Nomenclature of Cultivated Plants* come in. When any plants are named or changes made, the rules laid out in these codes must be strictly obeyed. One of the main reasons for the codes is to ensure stability of plant names. Our system for naming plants dates back to 1753 when the botanical world accepted Linnaeus' binomial system, whereby organisms are given both a genus and a species name. Between 1753 and 1866, there were no rules and many of the name changes that occur today are a consequence of the anarchy that occurred at that time.

The *Code* solves many problems by enforcing the rule of priority, which requires that the first name given to a plant is accepted over later names. For example, the individual specimen upon which the name *Cyrtostachys lakka* was based, the so-called type specimen, which is required by the *Code* for any name to be valid, is not significantly different from the type specimen of *Cyrtostachys renda* and so the two species have been merged together. *Cyrtostachys renda* is the earlier name and is therefore the one that we now use. A much messier example relates to the once widely known palm *Stevensonia grandifolia*. This species had been described earlier as *Phoenicophorium sechellarum*, a name that takes priority

over *Stevensonia grandifolia.* To complicate matters further, earlier still it had been described as *Astrocaryum borsigianum.* However, this palm is quite clearly not a member of the genus *Astrocaryum* as we know it, so this name could not be adopted. Given that the rule of priority operates only within designated ranks (i.e., within the species rank, the genus rank, etc.), the solution involved taking the earliest useable genus name and coupling it with the earliest species name to give *Phoenicophorium borsigianum.* Undoubtedly, this must seem tortuous and overcomplicated, but without the rule of priority, we would have no means of selecting between valid names when plants have been described more than once, and the resulting confusion would be horrific.

The rule of priority has been a cause of some unpopular name changes in the past, but the *Code* does allow this rule to be circumvented in special cases where a name change due to priority would cause excessive difficulties. This is not as easy as it sounds as cases for the conservation of names are only considered at the five-yearly International Botanical Congress. A case in point is *Roystonea regia* of Cuba and *R. elata* of Florida. The second species name is the earlier of the two. Scott Zona has shown clearly that these are the same species. The consequence would normally be that all palms known as *R. regia* should be renamed *R. elata.* However, Scott has made a compelling case for conservation of *R. regia* over *R. elata.*

The *Code* is changing to make the conservation process easier, thereby reducing the need for nomenclatural name changes. However, if good botanical reasoning shows that a name must change to reflect scientific progress, conservation cannot be justified and the change is inevitable.

Taxonomic Name Changes

Taxonomy is the study of variation between organisms and the classification of that variation. It is those botanists that specialize in plant taxonomy who are responsible for name changes. Thanks to the efforts of plant taxonomists, our knowledge and understanding of plant variation never cease to advance. One purpose of a name is to reflect underlying relationships among plants. Advances in our knowledge of variation may indicate that many of our ideas of relationships are wrong. For example, the decisions to consolidate *Chrysalidocarpus, Phloga, Neodypsis, Neophloga,* and *Vonitra* into *Dypsis,* or *Louvelia* into *Ravenea* were based on extensive experience of these palms in the field and exhaustive study of specimens, which revealed that the divisions between these groups could no longer be justified in the light of the new information derived from these activities. The new delimitations reflect more accurately the current concepts of the evolutionary relationships of these palms. Changes like these are not made on a whim!

Recently, tremendous developments in technology and theory have helped to revolutionize our understanding of the evolutionary relationships of plants. Classifications today are based on information from many previously unavailable sources including DNA, chromosomes, pollen, anatomy, and phytochemistry. These collective data sources frequently support existing classifications, but often give a completely new perspective on plant relationships. For example, I have been researching the classification of the calamoid palms using both modern DNA techniques and traditional morphology. The results are suggesting that the circumscription of the rattan genus *Calamus* and the closely related genera *Daemonorops, Ceratolobus, Pogonotium, Calospatha,* and *Retispatha* must be radically reconsidered. Obviously, in cases like this where the plants are of such economic importance, name changes must be kept to a minimum so as to reduce the inevitable confusion as new names are adopted. However, accurate plant classifications are essential to many users such as the field botanist, the plant breeder, and even the medical profession as good taxonomy has predictive value. Scientific progress that benefits all users of names (not just horticulturists) cannot be held back for the sake of short term convenience.

Finally it should be said that all botanists love plants and are often keen gardeners themselves. All believe that stability is in our best interests and tend to be conservative in their approach to name changing. Most are sensitive to the needs of other users of the names, whatever their requirements, but some name changes are inevitable as our understanding of plant diversity progresses. I appeal publicly to you now for patience!

This article was based on a letter published in *The Garden* [1997, 122(1): 61] written by James Compton, William Baker, Tim Upson, and Stephen Jury.

Principes, 41(4), 1997, pp. 179–183

Ecological Amplitudes of Ecuadorian Palms

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Ecuador is situated on the west coast of South America, straddling the equator. The mainland part of the country covers 279000 km^2 (excluding territories in reclamation), and is divided by the Andes Mountains, which traverse the country from north to south, into three natural regions: the coastal plain to the west, towards the Pacific Ocean; the mountains in the central part of the country with several snow-capped peaks more than 5000 m high; and the Amazonian lowlands to the east. In the western part of the country a strong precipitation gradient exists, with rainfall ranging from approximately 6000 mm in the north to less than 500 mm in the south. In the Andes, a range of climatic zones are found, depending on elevation and humidity. In this part of the country climate varies greatly from valley to valley, depending on its orientation and local rain shadow effects. The overall result of the varied climatic and topographical conditions is the occurrence of a wide range of ecological life zones, as defined by temperature and humidity (Cañadas 1983). The palm flora of Ecuador is correspondingly rich. One-hundred-twenty-four native species in 29 genera have been recorded in the country, corresponding to 43% of the genera and 24% of the species recognized for the Americas by Henderson et al. (1995).

In a recent publication, Skov and Borchsenius (in press) used the rich palm flora of Ecuador to test a GIS (Geographical Information System) model for predicting plant species distributions based on herbarium vouchers and climatic maps of temperature and precipitation. In this paper we provide a list of the palm taxa presently recorded in Ecuador, together with information on their ecological amplitude generated during that study.

Materials and Methods

Distributions of Ecuadorian palm species were derived from a data base containing information about more than 1900 herbarium specimens determined to species, subspecies, or variety. Naming is in accordance with Henderson et al. (1995), with the following exceptions. In the case of *Geonoma macrostachys*, a narrower concept of taxa was applied as this better suits the pattern of morphological variation found in Ecuador: plants with very narrow bluish-green leaves and male flowers with slender, briefly jointed filaments (conspicuously jointed in *G. macrostachys*), were treated as a separate species, *G. tamandua*, following Wessels-Boer (1968) and Skov (1989); mountain plants with affinity to *G. macrostachys*, but different in their male flower and leaf morphology, were referred to *G. paradoxa*, following Skov (1989); and an unnamed variety of *G. macrostachys* with flowers similar to those of var. *macrostachys*, but with somewhat divided leaves and veins conspicuously raised on the adaxial leaf surface (veins are never raised in the other varieties of *G. macrostachys* in Ecuador), was treated as a separate taxon (var. 1). *Bactris schultesii* was segregated from *B. simplicifrons* and recognized as a separate species due to its simple, wedge-shaped leaf blade and branched inflorescence (in *B. simplicifrons* the blade has 1–10 sigmoid pinnae, and the inflorescence is unbranched). *Bactris setiflora* was segregated from *B. macroacantha* on the basis of its straight, spinulose, more or less regularly inserted pinnae and pale spines on the leaf sheaths (pinnae are sigmoid, glabrous, and strongly grouped in *B. macroacantha*, and the leaf sheath spines are black: A. Henderson, personal communication). Finally, a group of *terra firme* understory palms with affinity to *Bactris corossilla* but different in their much smaller size, distinctly sigmoid pinnae, and proportionally large fruits were treated as a distinct, unnamed species (*Bactris* sp. 1). Segregation of varieties of *Bactris concinna* and *Euterpe*

Table 1. Recorded ecological amplitudes of native Ecuadorian palms.

Species	Number of Records	Altitude Above Sea Level (m)		Mean Annual Precipitation (mm)		Mean Annual Temperature (°C)		Humidity Index		Tolerance of a Dry Season
	N	min	max	min	max	min	max	min	max	
Aiphanes chiribogensis	8	80	2031	2031	5865	16.2	27.6	0.23	0.31	−
Aiphanes eggersii	7	74	441	600	1494	23.2	26.0	0.76	2.14	+
Aiphanes erinacea	17	600	2200	1448	6000	15.7	24.3	0.19	0.54	+
Aiphanes gelatinosa	1	1100	1100	2344	2344	22.9	22.9	0.53	0.53	−
Aiphanes grandis	4	1028	2400	1300	1512	14.2	21.0	0.50	0.75	+
Aiphanes hirsuta subsp. *fosteriorum*	4	800	1600	3090	6000	20.1	24.4	0.19	0.33	−
Aiphanes macroloba	4	568	877	3332	6000	24.0	25.5	0.19	0.38	−
Aiphanes tricuspidata	6	40	600	843	5996	23.0	27.3	0.18	1.19	+
Aiphanes ulei	31	200	1850	3000	6000	17.4	25.9	0.18	.48	−
Aiphanes verrucosa	2	2422	2595	2053	2081	15.0	15.2	0.58	0.58	−
Aiphanes weberbaueri	4	1000	1850	3000	4787	17.7	23.2	0.20	0.42	−
Ammandra dasyneura	4	257	299	3088	3229	25.4	25.6	0.44	0.45	−
Aphandra natalia	6	200	806	2000	5000	23.2	25.9	0.24	0.63	−
Asterogyne martiana	8	100	863	3467	6000	24.0	27.5	0.18	0.37	−
Astrocaryum chambira	10	200	307	3000	4009	25.4	25.9	0.35	0.48	−
Astrocaryum jauari	7	200	299	3000	3229	25.4	25.9	0.44	0.46	−
Astrocaryum standleyanum	4	3	300	1820	3266	24.4	27.3	0.34	0.66	−
Astrocaryum urostachys	20	200	690	3000	4838	24.6	25.9	0.26	0.48	−
Attalea butyracea	14	200	400	3000	4522	25.1	25.9	0.29	0.48	−
Attalea colenda	10	3	368	930	3318	23.3	27.3	0.37	1.32	+
Attalea insignis	6	200	200	3000	3000	25.9	25.9	0.46	0.47	−
Attalea maripa	9	215	400	3000	3180	24.7	25.9	0.44	0.48	−
Bactris acanthocarpa var. *acanthocarpa*	3	200	290	3000	3201	25.5	25.9	0.44	0.46	−
Bactris coloniata	2	100	207	1486	3000	25.9	26.0	0.48	0.77	+
Bactris coloradonis	2	35	495	2190	3351	23.7	27.3	0.32	0.38	+
Bactris concinna	10	200	566	3000	5000	24.6	25.9	0.25	0.48	−
Bactris corossilla	20	200	880	3000	4838	22.0	25.9	0.21	0.48	−
Bactris hirta var. *mollis*	1	300	300	3000	3000	25.4	25.4	0.47	0.47	−
Bactris hondurensis	3	535	801	6000	6000	24.3	25.7	0.19	0.22	−
Bactris macana	6	100	985	930	3750	22.8	25.6	0.25	1.32	+
Bactris maraja var. *maraja*	20	27	810	2991	4536	22.4	27.3	0.25	0.48	−
Bactris riparia	6	200	290	3000	3201	25.5	25.9	0.44	0.46	−
Bactris schultesii	17	200	600	3000	4536	24.7	25.9	0.28	0.48	−
Bactris setiflora	7	600	1000	4000	4397	21.1	23.6	0.22	0.27	−
Bactris setulosa	14	35	1666	2344	6000	18.3	27.3	0.20	0.53	−
Bactris simplicifrons	10	200	1100	2344	3636	22.9	25.9	0.39	0.53	−
Bactris sp. 1	10	200	300	3000	3636	25.4	25.9	0.39	0.48	−
Ceroxylon alpinum subsp. *ecuadorense*	5	1563	1788	1300	2917	16.0	19.6	0.25	0.50	+
Ceroxylon amazonicum	5	1000	1149	2000	3000	22.1	23.4	0.42	0.58	−
Ceroxylon echinulatum	4	1800	1965	1300	4516	15.7	19.2	0.23	0.65	+
Ceroxylon parvifrons	10	1819	3597	1160	2072	9.0	17.4	0.50	1.01	+
Ceroxylon parvum	1	1333	1333	1106	1106	20.7	20.7	0.95	0.95	+
Ceroxylon ventricosum	2	2008	2205	1000	1679	14.4	17.8	0.41	0.75	+
Ceroxylon vogelianum	6	1989	2595	1809	4334	12.8	17.0	0.23	0.59	−
Chamaedorea deneversiana	8	750	1600	2315	6000	20.1	24.6	0.19	0.52	−
Chamaedorea linearis	78	3	2223	783	6000	15.6	27.2	0.19	2.08	+
Chamaedorea pauciflora	41	200	1000	2000	4838	21.6	25.9	0.24	0.60	−
Chamaedorea pinnatifrons	128	200	2329	999	6000	16.0	25.9	0.18	1.21	+
Chelyocarpus ulei	3	200	600	3000	3000	23.5	25.9	0.43	0.47	−
Desmoncus cirrhiferus	11	3	824	2548	6000	22.9	27.2	0.18	0.49	+
Desmoncus giganteus	11	200	441	3000	4838	24.7	25.9	0.26	0.48	−
Desmoncus mitis var. *mitis*	7	200	280	3000	3166	25.5	25.9	0.45	0.48	−
Desmoncus orthacanthos	3	227	290	3000	3201	25.5	25.9	0.44	0.48	−
Desmoncus polyacanthos var. *prunifer*	6	215	1000	3000	4625	21.0	25.9	0.20	0.48	−
Dictyocaryum lamarckianum	5	1149	1600	2694	6000	18.4	20.9	0.18	0.35	−
Elaeis oleifera	2	400	400	3000	3000	24.7	24.7	0.44	0.44	−
Euterpe caatinga var. *roraimae*	3	1000	1029	4455	4481	20.8	21.1	0.20	0.21	−
Euterpe oleracea	7	0	40	1479	3960	27.0	27.4	0.33	0.86	−
Euterpe precatoria	12	40	441	3000	5967	25.1	27.3	0.22	0.48	−

Table 1. Continued.

Species	Number of Records	Altitude Above Sea Level (m)		Mean Annual Precipitation (mm)		Mean Annual Temperature (°C)		Humidity Index		Tolerance of a Dry Season
Geonoma arundinacea	9	200	1850	3000	4763	17.7	25.9	0.26	0.47	−
Geonoma brongniartii	18	200	300	3000	3586	25.4	25.9	0.40	0.48	−
Geonoma camana	13	200	300	3000	4155	25.5	25.9	0.34	0.46	−
Geonoma congesta	8	44	535	4517	6000	25.7	27.6	0.20	0.29	−
Geonoma cuneata var. *cuneata*	59	16	1426	985	6000	20.5	27.3	0.18	0.89	+
Geonoma cuneata var. *gracilis*	8	80	801	2190	6000	23.4	27.6	0.18	0.33	+
Geonoma cuneata var. *procumbens*	30	36	1201	2583	6000	21.2	27.6	0.19	0.40	+
Geonoma cuneata var. *sodiroi*	11	247	900	2885	6000	21.2	24.6	0.19	0.35	+
Geonoma densa	11	2183	3085	1159	3412	11.4	16.4	0.27	0.90	−
Geonoma deversa	26	20	1200	3000	6000	20.9	27.3	0.22	0.46	−
Geonoma gastoniana	3	1807	1819	3030	3033	17.8	17.9	0.34	0.34	−
Geonoma interrupta	18	3	1200	2000	4438	20.2	27.2	0.22	0.64	−
Geonoma irena	10	40	300	2813	3318	24.4	27.3	0.34	0.38	+
Geonoma laxiflora	7	200	200	3000	3000	25.9	25.9	0.46	0.46	−
Geonoma leptospadix	20	256	1821	985	6000	18.4	26.9	0.19	0.89	+
Geonoma linearis	2	200	295	5380	5426	26.2	26.7	0.20	0.20	−
Geonoma longepedunculata	17	200	1000	3000	3241	23.1	25.9	0.40	0.47	−
Geonoma macrostachys var. *acaulis*	20	200	604	3000	4536	23.5	25.9	0.29	0.47	−
Geonoma macrostachys var. *macrostachys*	78	200	1119	3000	5884	21.0	25.9	0.21	0.48	−
Geonoma macrostachys var. 1	34	200	1106	3000	5000	21.2	25.9	0.19	0.47	−
Geonoma maxima var. *maxima*	24	200	400	3000	3636	24.7	25.9	0.39	0.48	−
Geonoma orbignyana	29	1396	2899	1300	6000	12.7	20.1	0.19	0.70	+
Geonoma paradoxa	18	935	1917	2364	6000	17.4	22.2	0.18	0.48	−
Geonoma poeppigiana	4	200	300	3000	3000	25.4	25.9	0.46	0.47	−
Geonoma polyandra	10	200	604	3000	3594	23.5	25.9	0.35	0.48	−
Geonoma stricta var. *piscicauda*	70	200	1582	2344	5000	18.5	26.0	0.20	0.53	−
Geonoma stricta var. *stricta*	32	200	1000	3000	4838	23.4	25.9	0.26	0.48	−
Geonoma stricta var. *trailii*	14	200	1000	3000	4155	23.4	25.9	0.34	0.47	−
Geonoma tamandua	16	200	431	3000	4826	24.7	25.9	0.27	0.47	−
Geonoma tenuissima	4	400	566	3032	3084	23.4	24.0	0.33	0.33	+
Geonoma triglochin	12	200	1000	3000	3201	23.1	25.9	0.41	0.47	−
Geonoma undata	45	528	2289	996	6000	15.9	24.6	0.19	1.22	+
Geonoma weberbaueri	9	2000	2791	1692	2845	11.2	16.4	0.24	0.60	−
Hyospathe elegans	74	200	1800	2000	6000	17.1	25.9	0.18	0.53	+
Hyospathe macrorachis	6	1819	2245	3030	3419	16.0	17.8	0.28	0.34	−
Iriartea deltoidea	30	40	1029	2000	5426	20.8	27.3	0.20	0.64	+
Manicaria saccifera	1	16	16	2784	2784	27.2	27.2	0.43	0.43	−
Mauritia flexuosa	9	200	800	2116	4339	23.7	25.9	0.28	0.59	−
Mauritiella armata	5	227	290	3000	3503	25.5	25.9	0.41	0.48	−
Oenocarpus bataua var. *bataua*	23	3	1100	2344	4536	21.1	27.3	0.24	0.53	−
Oenocarpus mapora	14	100	800	2000	5426	23.6	26.7	0.20	0.62	−
Parajubaea cocoides	2	100	2307	740	2755	16.4	25.1	0.39	2.06	+
Pholidostachys dactyloides	23	40	1316	1016	6000	21.5	27.3	0.19	0.86	+
Pholidostachys synanthera	7	604	1819	2000	6000	17.8	24.1	0.19	0.61	−
Phytelephas aequatorialis	14	3	1200	776	5426	20.5	27.3	0.20	1.69	+
Phytelephas tenuicaulis	16	200	664	3000	4536	23.2	25.9	0.25	0.48	−
Prestoea acuminata	32	600	2527	1093	6000	14.8	25.3	0.18	0.73	+
Prestoea carderi	4	1819	2245	3030	3419	16.0	17.8	0.28	0.34	−
Prestoea decurrens	14	99	1206	1000	6000	20.9	27.2	0.19	1.20	+
Prestoea ensiformis	20	40	1877	1572	6000	16.9	27.3	0.16	0.78	+
Prestoea schultzeana	49	200	1571	3000	6000	18.5	25.9	0.19	0.48	−
Socratea exorrhiza	24	40	1000	2000	5967	21.2	27.3	0.19	0.64	−
Socratea rostrata	13	400	1582	2116	6000	18.5	24.5	0.19	0.59	+
Syagrus sancona	5	3	710	1300	4542	23.2	27.2	0.27	0.77	+
Syagrus smithii	2	200	604	3000	3594	23.5	26.0	0.35	0.47	−
Synechanthus warscewiczianus	22	3	600	985	6000	23.0	27.3	0.20	0.89	+
Welfia regia	4	204	422	2875	3736	24.0	24.7	0.25	0.36	−
Wettinia aequalis	11	180	630	2813	6000	22.8	25.9	0.22	0.38	+
Wettinia aequatorialis	3	1582	1854	2456	3081	17.4	18.5	0.32	0.42	−

Table 1. Continued.

Species	Number of Records	Altitude Above Sea Level (m)		Mean Annual Precipitation (mm)		Mean Annual Temperature (°C)		Humidity Index		Tolerance of a Dry Season
Wettinia anomala	4	1033	1704	2923	6000	18.8	21.7	0.19	0.29	−
Wettinia drudei	1	400	400	3000	3000	24.7	24.7	0.44	0.44	−
Wettinia fascicularis	3	1799	2000	4158	6000	17.0	17.9	0.18	0.25	−
Wettinia kalbreyeri	7	600	2000	1300	3045	16.6	23.1	0.27	0.57	+
Wettinia longipetala	2	1000	1000	3000	3000	23.4	23.4	0.42	0.42	−
Wettinia maynensis	21	215	1800	2074	5000	18.5	25.9	0.21	0.70	−
Wettinia minima	1	1601	1601	3957	3957	17.9	17.9	0.26	0.26	−
Wettinia oxycarpa	6	600	1197	2344	6000	20.2	25.7	0.19	0.53	−
Wettinia quinaria	12	100	1100	2344	6000	22.9	27.3	0.19	0.53	−
Wettinia radiata	1	824	824	4600	4600	24.2	24.2	0.27	0.27	−
Wettinia verruculosa	2	1494	1600	1546	1572	20.2	20.8	0.78	0.78	−

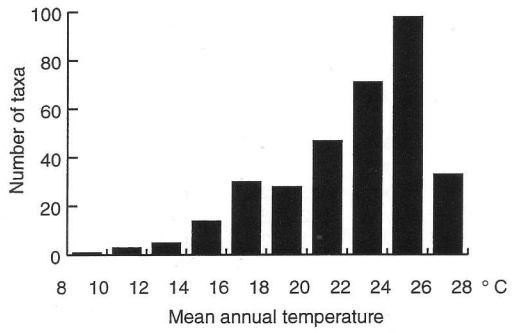
precatoria was not made, as we were at the time uncertain of their delimitation in Ecuador.

Bactris gasipaes, Cocos nucifera, and *Elaeis guineensis,* together with a number of introduced garden ornamental palms, were omitted from the study although present in Ecuador. We did this for two reasons. First, the focus of the study was on naturally occurring palms. Second, herbarium vouchers of the mentioned species are very scarce or absent, and clearly do not give a representative reflection of the conditions under which these palms are grown.

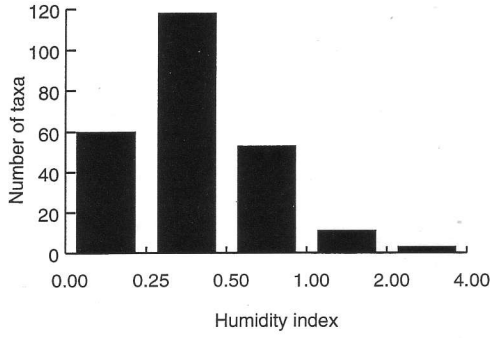
Each herbarium collection was georeferenced using available maps. Information about elevation above sea level, annual average temperature, humidity, precipitation, and presence or absence of a dry period (i.e., one or more months in which potential evapotranspiration exceeds precipitation) for the collection site was extracted from a GIS model, described in detail in a separate paper (Skov and Borchsenius, in press). The humidity index presented is calculated as the ratio between potential evapotranspiration and precipitation, summarized over the whole year. Values below one thus indicate a net yearly precipitation surplus (wet conditions), while values above one indicate a deficit (dry conditions).

Results and Discussion

A list of the 129 native palm taxa known from Ecuador and their recorded ranges of ecological conditions in the wild is given in Table 1. Most palms prefer, not surprisingly, a warm and moist climate (Figs. 1,2). Of the 129 Ecuadorian palm taxa, 98 (76%) demand a mean annual temperature of at least 18°C, and 58 (45%) demand more than 23°C. The highest number of species (98) is found in the temperature range between 24° and 26°C, while only 1–5 species occur in each of the intervals 8°–10°, 10°–12°, and 12°–14°. Similarly, only 11 taxa (9%) are found in areas with a net annual precipitation deficit (humidity index > 1), while 76 species (77%) are restricted to areas



1. The number of palm taxa found in areas of Ecuador with different mean annual temperatures.



2. The number of palm taxa found in areas of Ecuador with different humidity index.

where the yearly precipitation is at least twice as high as the potential evapotranspiration (humidity index ≤ 0.5). Finally, the occurrence of a dry season has a marked influence on the species diversity. Only 39 taxa (30%) are able to tolerate a dry season of any length. The hardiest palm species in the Ecuadorian flora is *Ceroxylon parvifrons*, able to grow at 3500 m elevation with a mean annual temperature of only approximately 9°C, and *Aiphanes eggersii*, found in warm areas with only 600–1 500 mm precipitation and a dry season of 6–8 months.

The presented list of ecological amplitudes of Ecuadorian palms growing in the wild may serve as a rough guideline for ecologists and palm growers, who wish to have an idea of the climatic conditions under which these palm taxa occur in nature. It should, however, be remembered that the list is based on existing herbarium vouchers and estimates of the environmental conditions calculated from available meteorological and topographical information. Many species are not so well collected that their full ecological amplitude is appreciated, and other species may have a wide ecological tolerance under certain conditions, but a much narrower optimum for growth. Finally, the basic information about climate is still scarce for some remote parts of Ecuador, and the extrapolations necessary to construct the climatic model for the entire territory of the country automatically add a certain amount of uncertainty to the results. This is particularly true for low-elevation cloud forest found on mountain ridges in western Ecuador, e.g., in the coastal mountain range and in the Andean foothills, where precipitation and temperature data may be relatively poor predictors of the humidity conditions experienced by the plants. Apparent tolerance of dry conditions indicated for the species *Aiphanes tricuspidata*, *Chamedorea pinnatifrons*, *Geonoma undata*, and *Prestoea decurrens*, which in our judgement demand moist conditions, can probably be explained by their occurrence in that type of habitat.

Acknowledgments

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Vegetable Ivory and Other Palm Nuts/Seeds as an Art/Craft Medium

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The purpose of this article is to describe the use of some palm nuts or seeds as a medium for arts and crafts, instead of their normal roles in reproduction, as a food source, etc. I will attempt to keep this article at a low technical level, but will refer to more technical papers, when I am aware of them.

For many years people have been using vegetable ivory to make a variety of items. According to Schabillion (1989), the tagua nut from South America was brought to England in small quantities during the 1820s and 1830s. Toys, umbrella handles, and carvings were made from the nuts. A few tons made it to Germany in the late 1850s. By 1862 button factories were being established in France and England, in Leeds, Massachusetts in 1864, in Canada in 1870, and by the German-American Button Company Rochester, New York in the early 1880s. By 1887, it was recorded that two or three million nuts were used each year by the factories in London and Birmingham, England. During the Victorian age many items were crafted by hand-carving or turning on an ornamental or conventional lathe; included were thimbles and thimble cases with threaded lids, needle cases with threaded lids, tape measures with spindles, ear rings, dice, and rings. Most of these were highly ornamented. The greatest utilization and consumption of vegetable ivory were in the production of buttons, between the end of the 19th century and the beginning of World War II (Barfod 1989). The tagua nut, the seed of *Phytelephas* (Phytelephantoideae, Uhl and Dransfield 1987), was probably the source of most of the vegetable ivory of that period. The other two genera in subfamily Phytelephantoideae (*Ammandra* and *Aphandra*, Barfod 1991) were a contributing source. The genera *Hyphaene* from Africa and *Metroxylon* from Asia were also used in the button-making industry.

My approach will be more from a woodturner's view, than as a palm expert. Numerous articles have been written on the tagua nut as an art/craft medium, but there are very few, if any, reports on *Metroxylon, Hyphaene, Actinorhytis, Veitchia, Bismarckia, Mauritia,* and *Areca,* to name only a few of the many more out there that I have not had an opportunity to try yet! I will relate my experiences with many of the genera that I have tried, and provide details of the turning process on seeds of Phytelephantoideae and *Metroxylon.*

Actinorhytis

There are two species in the genus *Actinorhytis* (Uhl and Dransfield 1987), *A. calapparia* native to New Guinea and the Solomon Islands and *A. poamau* in the Solomon Islands. I have not seen information or fruits from the latter.

A. calapparia. The fruit is very large, about 2.5″ long × 1.5″ wide (6.35 × 3.8 cm), ovoid ±/− beaked, green turning orange-red at maturity, epicarp smooth, mesocarp with thin flesh and fibers, adhering to the endocarp, endocarp thin, hard, stony, adhering closely to what appears to be a thick seed coat, which in turn adheres closely to a deeply ruminate endosperm, with a central irregular hollow. The embryo is basal, and the seed about 2.0″ × 1.25″ (5.0 × 3.2 cm), globose, with a lateral, longitudinal hilum. The adhesion of the endocarp, seed coat, and endosperm is so great, that I have been unable to dry the fruits without the seed cracking. To overcome this problem, I turn the wet nuts on the lathe, removing everything down to the endosperm, then allow it to dry. *A. calapparia* is a very attractive nut, and can be used to make a vase or box. The ruminate pattern, viewed externally, resembles many equally spaced pin holes (Fig. 2).

Areca

There are about 60 species, distributed from India and South China through Malaysia to New

Guinea and the Solomon Islands. The fruit is globose, ovoid, or spindle shaped, often brightly colored, rarely dull brown or green; the epicarp is smooth, shiny, or dull, the mesocarp thin to moderately thick, fleshy, or fibrous, and the endocarp composed of robust longitudinal fibers, usually closely adhering to the seed, possibly becoming free at the basal end. Seed conform to the fruit shape or are slightly hollow at the base; the hilum is basal, the endosperm deeply ruminate, and the embryo basal (Uhl and Dransfield 1987).

A. catechu. The common name is betel nut palm. The fruit is yellow when mature and about 1.8″ long × 1.1″: wide (4.5 × 2.8 cm); the endocarp is thin, hard, and brittle; it adheres tightly to the seed coat, sometimes even when dry. The seed size is about 1.0″ long × ¾″ wide (2.5 × 2.0 cm). The ruminate endosperm is very attractive in a vase.

A. ipot. The seed is similar to *A. catechu,* except for being slightly oval in horizontal section.

Bismarckia

B. nobilis. The single species in the genus *Bismarckia,* common name Bismarck palm, is from the drier parts of Madagascar (Uhl and Dransfield 1987). The fruit has a smooth, shiny, rich brown epicarp, somewhat speckled with lighter brown, the mesocarp is fibrous, +/− aromatic, and the endocarp about 1.7″ long × 1.1″ wide (4.3 × 2.8 cm), thick, irregularly flanged and pitted, and with a conspicuous central intrusion at the base. Seed are basally attached with homogeneous endosperm, but grooved to match the endocarp intrusions, and have apical embryos. This nut makes an attractive vase (Fig. 1).

Hyphaene

The genus *Hyphaene* probably consists of about ten species (Uhl and Dransfield 1987). One common name is Doum palm. The species are distributed in the drier parts of Africa, Natal, Madagascar, Red Sea Gulf of Eilat coasts, coastal Arabia, and the west coast of India.

H. thebaica. The fruit is somewhat variable in shape, but tends to be between ovoid and spherical and taller than wide. The epicarp is smooth, generally shiny, and from light brown to almost black. The mesocarp is fibrous, often aromatic, and referred to as the gingerbread palm, apparently because of its similar taste. I have received some that have the aroma of wine. The endocarp is a hard fibrous material. The seed is basally attached, and taller than wide, about 1.25″ long × 1.0″ wide (3.2 × 2.5 cm). It is larger at the base, has a brown seed coat, and homogeneous endosperm (vegetable ivory) with a central hollow and an apical embryo. My experience with the light brown fruits is that many times the seed is small, with the seed coat not or only partially attached to the endosperm. The embryo appears to be developed, but I have not tried germination. The very dark brown fruits seem consistently to have large well-developed seeds, with the seed coat tightly attached to the endosperm, and work well for making vases.

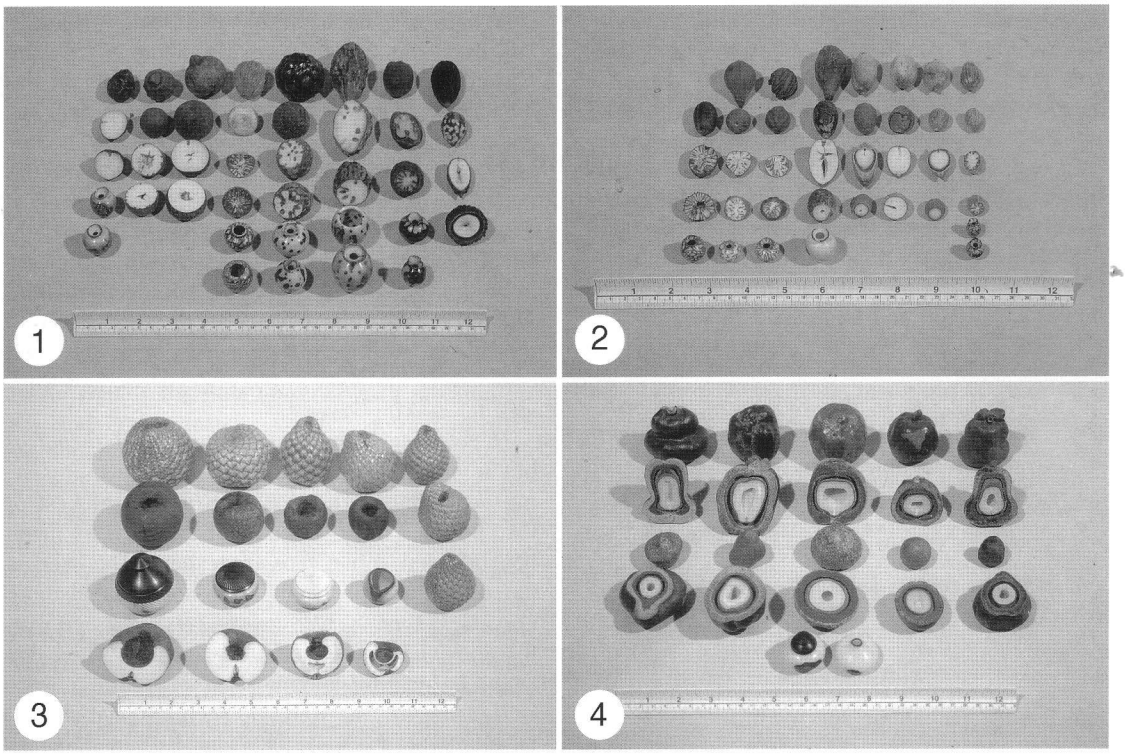
H. petersiana. The fruit is similar to *H. thebaica,* but is more spherical, although at times approaching pear shape. The endocarp is the thickest of the species I have worked with, and I have made box lids and goblet tops from them. The seed is flat at the base, nearly round in horizontal section, about 1.1″ long × 1.25″ wide (2.9 × 3.2 cm) with the apex slightly peaked at the embryo. The basic shape is ideal for making boxes.

H. coriacea. The fruit and seed are pear shaped to spherical, the seed is about 1.0″ in diameter (2.5 cm), with a central hollow. The species has the same basic fruit characteristics as *H. thebaica* and is suitable for making vases (Fig. 4).

Mauritia

There are two species distributed in the wetter parts of Trinidad, Colombia, Ecuador, Peru, Venezuela, Guyana, Surinam, French Guiana, and Brazil. The common name is Mauritia palm. Fruit is +/− rounded, very large, usually one seeded, with apical stigmatic remains. The epicarp is covered in many neat vertical rows of reddish-brown reflexed scales, the mesocarp is rather thick and fleshy, and the endocarp not differentiated. The seed is rounded, attached near the base, with a blunt apical beak, thin seed coat, homogeneous endosperm, and basal embryo (Uhl and Dransfield 1987).

M. flexuosa. The seeds I received were cleaned down to the seed coat; the embryo is subbasal-lateral, the endosperm homogeneous, and solid, without central cracks like the tagua. The seed is about 1.4 × ⅞″ (3.5 × 2.2 cm). The disadvantage is the position of the embryo, but that can be designed around. This nut can be used to make vases and small lidded boxes (Fig. 1).



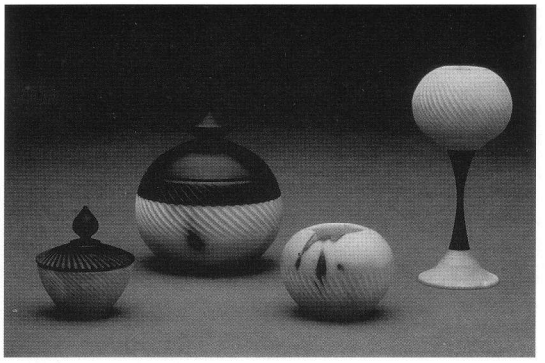
1. Vertical rows from left to right: *Mauritia flexuosa*, *Orania* spp., *Orania trispatha*, *Areca catechu*, *Raphia farinifera*, *R. australis*, *Bismarckia nobilis*, *Wodyetia bifurcata*. 2. Vertical rows from left to right: *Actinorhytis calapparia*, *Normanbya normanbyi*, *Verschaffeltia splendida*, Phytelephantoideae (tagua), *Veitchia joannis*, *V. montgomeryana*, *V. arecina*, *V. merrillii*. 3. Vertical rows from left to right: *Metroxylon amicarum*. *M. warburgii*, *M. vitiense*, *M.* spp. (*M. upolense*?). 4. Vertical rows from left to right: *Hyphaene* spp., *H. thebaica*, *H. petersiana*, *H. coriacea*, *Hyphaene* spp.

Metroxylon

Metroxylon is composed of five species, according to Rauwerdink (1986). *M. sagu* has the widest distribution, including Malaysia, Indonesia, Mindanao, and New Guinea. The remaining four species are endemic to the following areas: *M. vitiense* in Fiji, *M. salomonense* in the Solomon Islands, Santa Cruz Islands, and Papua New Guinea, *M. warburgii* in Western Samoa and New Hebrides, and *M. amicarum* in Guam and Micronesia. The fruits of *Metroxylon* are covered with longitudinal rows of scales, and contain a single seed. The seed is composed of a dark-brown seed coat, and the endosperm is a hard ivorylike, homogeneous mass (vegetable ivory); it is horseshoe shaped in vertical section, with a large cavity at the apex, and a small cavity containing the embryo at the base. *M. sagu* and *M. salomonense* are exploited for their sago, which is a starchy substance that forms in the pith, at the base of the tree, and is used as food. The fruit of *M. amicarum* (one common name is ivory nut palm) is reported to have been used in the button-making industry. *M. amicarum* is the only species of the five that is pleonanthic (does not die after fruiting); the remaining four species are hapaxanthic (die after fruiting) (Fig. 3).

M. sagu. Unable to acquire fruit or seed to date.

M. vitiense. The fruit is turbinate to pear shaped, yellowish-tan, about 2.75″ long × 2.25″ wide (7 × 5.7 cm), with 27(28) longitudinal rows of scales. The seed is variable in size, but averages about 1.5″ long × 1.75″ wide (3.8 × 4.4 cm). It is also variable in shape, mainly in the area around the opening or lip of the large apical cavity; sometimes a portion of the lip is receding or much lower than the remainder of the lip. This seed germinates very rapidly; on seeds that have started germination there tends to be an extension of the embryo cavity, radiating out in a horseshoe shape, surrounded externally by the outside wall of the endosperm, and internally by the inside wall of the large apical cavity. This embryo cavity



5. Palm nut turnings. The largest is from *Metroxylon amicarum* and African Blackwood. The others are *M. salomonense* and African Blackwood. Photo by Gregg Krogstad.

extension is filled with a soft, pithy substance, apparently caused by endosperm breakdown during the germination process. On the trees that I observed, the germination process seemed almost instantaneous with dropping to the ground. In both *M. vitiense* and *M. warburgii*, the presence of the cavity limits the amount of useful vegetable ivory.

M. warburgii. The fruit is pear shaped, about 3.5″ long × 3.25″ wide (9.0 × 8.3 cm), covered with 24 longitudinal rows of tan-brown scales. The seed is slightly larger than that of *M. vitiense*, about 1.75″ long × 2.0″ wide, less variable in shape, but with the same embryo cavity extension on seeds starting to germinate; see above for *M. vitiense.*

M. salomonense. The fruit is globose, depressed at apex and base, about 2.5″ long × 3.5″ wide (6.5 × 9.0 cm), and covered with 24–27 longitudinal rows of straw-colored scales. The seed is about 1.75″ long × 2.0″ wide (4.4 × 5.0 cm), and is consistently the most symmetrical of the five species. It also has the smallest opening to the large apical cavity, in proportion to seed size, thus allowing greater flexibility in design of items made from this nut (Fig. 5).

M. amicarum. The fruit is globose to apple shaped, about 4.25″ long × 4.0″ wide (10.8 × 10.2 cm), covered with 24–28 longitudinal rows of chestnut-brown scales. The seed is about 2.25″ long × 2.5″ wide (5.8 × 6.4 cm), but tends to be less symmetrical at the opening or lip of the apical cavity than *M. salomonense.* However, it is the largest of the genus, and an excellent nut (Fig. 5).

Woodturning

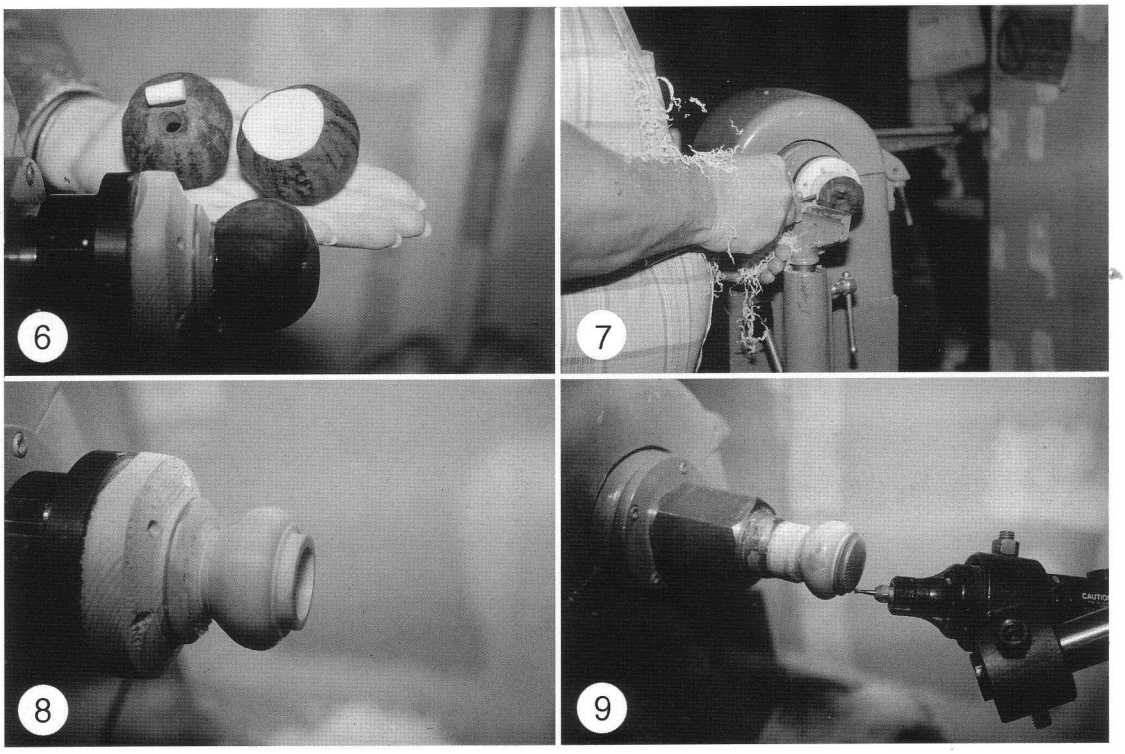
For those readers who are not familiar with woodturning, I will attempt to cover the basics briefly. Woodturning is done on a wood lathe, which has a headstock driven by an electric motor; there is normally some means to change the speed of the headstock. The material to be turned is mounted horizontally to the lathe's headstock, which usually has a threaded shaft, to accept a faceplate, on which the material to be turned is attached. The lathe also has a bed, running horizontally to the headstock shaft. The bed provides a means of adjustment and locking for the tailstock and tool rest. The tailstock may be used as needed to support the end of the material opposite the headstock. The tool rest is adjustable and provides support for the tools, which are handheld in woodturning.

Safety Precautions

A face shield or safety goggle is recommended; at a minimum safety glasses should be worn. Also loose clothing around the hands and arms is very dangerous, as well as long hair, which should be tucked in a hat or contained by other means.

Making a Round Box

After receiving my first *Metroxylon* seed (nut) in October 1993 (*M. amicarum*) I allowed it to dry in its scaly shell for two months at room temperature. The shell was then removed and the brown corklike material was removed from the outside and from inside the large cavity of the nut, leaving just the seed coat attached to the endosperm. The horseshoe shape in vertical section looked perfect for making a round box, a lid to be added from other material. The only problem was the void left by the embryo in the base of the nut. This problem was solved, by drilling a hole from the embryo cavity into the large void, then reaming the hole with a taper reamer and fitting the cavity with a tapered plug, made from a scrap *Metroxylon* nut. The base of the nut is sanded flat, then coated with medium thickness Super glue (Hot Stuff brand—yellow label). The wood waste block is sprayed with accelerator to decrease the curing time for the glue. Once the nut is centered on the waste block and firmly glued, the lathe is turned on. I use a ¼″ spindle gouge to shape the outside of the box as before, and dental picks and a small scraper to hollow the large cavity. The large cavity must be kept as small as possible, since this will be the lip of the box, to which the lid is fitted. When the outside, lip, and inside cavity are shaped, they are sanded starting with 240 grit,



6–9. Sequence for a *Metroxylon* box. 6. A tapered plug ready to glue, a plug glued and sanded flat, and a nut glued to a waste block. 7. Shaping the outside of the box. 8. The rough-shaped box. 9. Cutting flutes in the top of the lid.

then 320, 400, 600, and polished with a buffing compound (white). The lip is made to its final dimension, and then it's time to make a lid. My lids are usually made of exotic woods, but may be made of *Metroxylon* or other material. Presently the *Metroxylon* box lids have all been a threaded or screw-on type, which requires threading the inside of the lid and the outside of the lip of the box. The wood for the lid should be oriented, such that end grain is at the top and bottom of the lid. Lids made in this fashion are the most stable and least affected by humidity changes. Since this particular lid is to be threaded, the wood should be hard, dense, and tight grained, my favorite being African Blackwood (*Dalbergia melanoxylon*). The faceplate holding the box is removed from the lathe, and another installed with a waste block. The material for the lid is glued to the waste block as before. The lid is shaped inside with the gouge, scraper, and parting tool, leaving the inside wall of the lid parallel and 0.080″ (2.0 mm) smaller in diameter than the lip of the box. This dimension only corresponds to the 16 tpi (threads per inch) that I am using. The inside of the lid is sanded as before. The faceplate with the lid attached is removed, and a high-speed 60° v-shaped cutter is mounted on the headstock spindle. A threading attachment is mounted to the bed, and the faceplate with the box is mounted on the threading attachment spindle. The threading attachment (t.a.) depth of cut hand wheel is adjusted so the box just touches the cutter flutes, then the t.a. depth of cut (d.o.c.) scale is zeroed, the box is moved away from the cutter with the t.a. spindle handwheel, and the desired depth of cut is set, using the d.o.c. handwheel and scale. The box is advanced toward the cutter using the t.a. spindle handwheel, in turn cutting the thread to the depth setting on the d.o.c. dial, in this case 0.020″ (0.51 mm) to cut a full thread. I usually make three small passes to produce a smoother thread. The lid is threaded in the same manner, the only difference being an internal rather than external thread. When satisfied with the fit, the threading attachment and cutter can be removed and the faceplate with the lid installed. The lid is removed from the waste block with a parting tool, the faceplate with the box installed, the lid screwed on

securely, and the final form given to the top of the lid, with a gouge, sanding as before but not buffing. I then add some fluting to the top of the lid; usually 48 flutes are cut in the top, using a 1/8 cutter driven by a Dremel tool, held in a jig made for this purpose. The lathe I am using has 48 indexing holes. For those not familiar with headstock indexing, it is only used when the lathe is turned off and provides a means to divide one revolution of the headstock into, in this case, 48, 24, 16, 12, 6, 3, or 2 segments. If the pin is inserted in every hole, then the box lid will have 48 partial revolutions to complete one full revolution. With a flute being cut at each indexing hole the flutes total 48. The lid is given a coat of Watco oil finish, which is allowed to penetrate a few minutes and the excess removed with a clean rag. The box is parted off the waste block, and a groove is cut in the waste block to match the lip of the box. The lip is inserted in the groove, and nylon reinforced tape is used to bind the box and waste block together. The bottom of the box is thus exposed for finishing, with a gouge and scraper, and finally sanded, buffed, and signed (Fig. 5).

Normanbya

N. normanbyi. This genus has a single species from the rain forests of northern Queensland, Australia, whose common name is Australian black palm. The hard, dark wood was used by the Aborigines for making spears, and more recently for canes and walking sticks. Fruit is ovoid to obpyriform, pointed distally, dull salmon pink to purplish-brown at maturity, with the stigmatic remains (apical) forming a short beak. The epicarp is somewhat fleshy, drying wrinkled, and the mesocarp is rather thin, with longitudinal, branched, straw-colored fibers adherent to the smooth endocarp. Seed are about 1.2″ long × 1.0″ wide (2.9 × 2.5 cm), and laterally attached with a long unbranched raphe, lateral hilum, ruminate endosperm, and basal embryo (Uhl and Dransfield 1987).

Oenocarpus

This genus has a single species with two subspecies, distributed in Panama and South America.

O. bataua. The seed is ellipsoidal, with a basal hilum, narrow tapering raphe, and ruminate endosperm, with a hollow in the center; the basal embryo is very large, extending beyond the middle of the seed (Uhl and Dransfield 1987), about 1.1″ long × 7/8″ wide (2.8 × 2.2 cm) (Fig. 2).

Orania

The genus has three species in Madagascar, the rest occurring in SE Asia. I have received seed from one. The endocarp was still present, globose in shape with a rounded cap apically. The seed was globose with a brown seed coat, subapical embryo and homogeneous endosperm with a central cavity.

O. trispatha. The seed is about 1.25″ (3.2 cm) in diameter and can be used for making a box or vase (Fig. 1).

Subfamily Phytelephantoideae

The genera, species, and subspecies within the subfamily Phytelephantoideae are distributed in northwestern South America and Central America, including the following countries: Peru, Ecuador, Columbia, Brazil, Bolivia, and Panama (see Barfod [1991] for detailed description of distribution).

The infructescences, fruits, and seeds of the phytelephantoid palms vary in both size and numbers, depending on the genus and individual tree. The numbers and sizes listed below are from Barfod (1991), and are the combined minimums and maximums of all the genera and not necessarily applicable to any one genus. The infructescences are somewhat spherical in shape and can number from 5 to 25 on a tree and can be as large as 45 cm. The infructescences have from 4 to 45 fruits and the fruits from 2 to 9 seeds (nuts). The seeds are surrounded by a fibrous mesocarp within the fruit, and further covered with a thin hard endocarp. Under the endocarp is the seed with a dark-brown seed coat; the endosperm is homogeneous. The embryo is usually located toward the smaller diameter end of the seed, but its location is variable (Fig. 10).

The tagua nuts that I use have the endocarp removed and are dry when purchased. The size varies from approximately 1.25″ to 2.5″ (3.2 to 6.4 cm) long, and 1.0″ to 2.0″ (2.5 to 5.0 cm) in diameter. The shape is also variable; most are longer than wide. Some tend to be rather flat in horizontal section, while others are pyramidal in horizontal section, with one side rounded and two sides flat. The endosperm varies in color from snow white to a deep amber; giving the appearance of old or fossilized ivory. Many exhibit a grain pattern similar to that of elephant ivory or the growth ring pattern

(*Continued on p. 208*)

Principes, 41(4), 1997, pp. 190–191

Wallichia disticha in Thailand

JOHN DRANSFIELD
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Wallichia disticha is an easily recognized palm that has been much prized as an ornamental. Never very frequent in cultivation, its scarcity probably reflects the difficulty in obtaining seed. It is the only member of the genus and, indeed, of the tribe Caryoteae to which it belongs, to have its leaves arranged in two rows, i.e., distichously. It is this unusual leaf arrangement that makes it such a handsome and desirable palm.

Wallichia disticha was first described by Thomas Anderson in the *Journal of the Linnean Society*, Volume 11, in 1871, based on material collected in gorges from the Sikkim Himalaya. Kurz also recorded the palm from Pegu in Burma, though there is some possible confusion here, as Kurz described the leaves as being arranged in a one-third spiral rather than being distichous—a tristichous *Wallichia disticha* would be desirable indeed! *W. disticha* has also been recorded for China (see Pei, S.-J. and Chen, S.-Y., *Flora of China: Palmae.* 1991). There are very few herbarium collections of this most distinctive palm and, as is so often the case with palm herbarium specimens, most of these are of poor quality and lack important field notes. That the leaves are distichous, for example, is almost never mentioned, despite its being such a striking and unusual feature.

In January 1994, on my way to Brunei for fieldwork, I spent time in Thailand to have a few days in the field with my student Sasha Barrow, who was just starting her monographic study of *Phoenix*, to introduce her to the problems of making good palm specimens. We planned a short visit up the valley of the Kwai Noi River in Kanchanaburi Province, the river made famous by the film "Bridge on the River Kwai." It flows from north to south, draining a large area of Thailand adjacent to the border with Myanmar (Burma). The upper reaches of the river have been dammed to form a large reservoir for generating electricity and providing water for irrigation. Until recently the upper part of the Kwai Noi was rather inaccessible, but now the construction of the dam has opened up the area to agricultural development, and there is an excellent road that goes right to the border of Myanmar at the Three Pagodas Pass. The upper part of the valley is an area of outstanding beauty, with varied topography and an abundance of karst limestone hills. Although some natural forest remains, much of the land accessible from the road has been cleared for agriculture.

Before we left Bangkok for Kanchanaburi we spent a morning in the Forest Herbarium of the Royal Forest Department. While Sasha looked at the specimens of *Phoenix*, I went through the palm collections. Mr. Thawatchai Wongparsert, of the Saraburi Botanical Garden, who planned to look after us on our short trip, introduced himself and dragged me away from the dead specimens to show me a young palm in the Forest Herbarium's nursery nearby that he had collected in Tung Yai Wildlife Sanctuary in the northern part of Kanchanaburi Province. The narrow praemorse induplicate leaflets proclaimed that the palm was either a species of *Arenga* or of *Wallichia*, but the leaflets were far too narrow for the palm to be *W. siamensis*, and the leaflet arrangement was unlike that of any *Arenga* known to me and, although there were only three leaves, they seemed to be arranged distichously. I guessed that it was probably *W. disticha*. Later, in the Forest Herbarium, I looked more carefully at the material of *Wallichia* and one collection, *Larsen et al.* 8965, clearly belongs to *W. disticha*. It was collected in 1961 by Kai Larsen, from southeast of Sai Yok, also in Kanchanaburi.

The following day we drove off to the valley of the River Kwai to Thong Pha Phum, stopping whenever we saw *Phoenix*. The *Phoenix* here is for the most part a dwarf shrubby species, always associated with limestone, but, despite this, it seems not to grow on the tops of the limestone hills, but more at the base, or in open boulder fields in dry deciduous forest. Which species it is yet to be determined. This is one of several forms of *Phoenix loureiri*.

1. *Wallichia disticha* growing on a limestone hill near the Three Pagodas Pass, Thailand. 2. Close-up view of *Wallichia disticha* showing the distichous leaf bases. Photos: J. Dransfield.

On our second day out, within sight of the Three Pagodas Pass, we stopped to look at a population of *Phoenix* on a travertine slope of a limestone hill, and, almost immediately found *Wallichia disticha,* growing in dry deciduous forest on limestone at the base of the hill. Unfortunately the plants were all young and there were no signs of flowers or fruit; however, the distichous arrangement of the leaves proclaimed its identity. The record is vouchered by *Dransfield et al.* 7343 in the Herbarium of the Royal Forest Department (BKF) and Kew. Later in the day we saw two more populations, both at the foot of limestone hills and neither flowering nor fruiting.

It thus seems that *Wallichia disticha* occurs in a relatively large area, stretching from Sikkim southwards to Thailand, to at least 14° north. It seems surprising that up until now, this very distinctive palm should not have been identified as occurring in Thailand. It is also worth noting that, whereas the palm in the north of its range seems to occur on sandstone, in the south of its range it occurs on limestone.

Principes, 41(4), 1997, pp. 192–197, 211–217

A Revision of Linospadix in Australia, with the Description of a New Species

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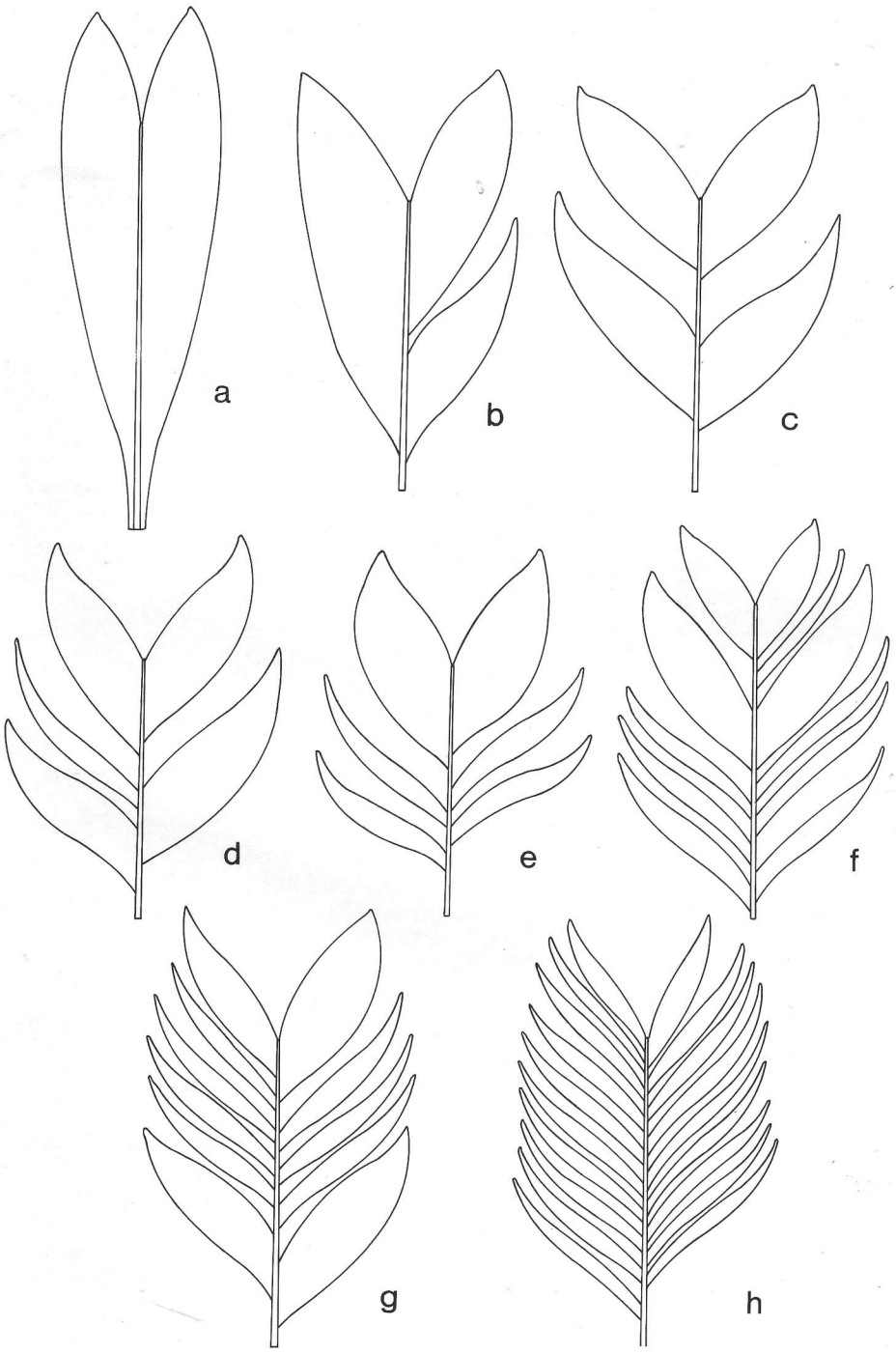
Linospadix (commonly known as walking-stick palms) is a genus of understory palms occurring in Eastern Australia and New Guinea. The features that have historically been used to characterize the genus are as follows: a spicate inflorescence; leafbases not forming a tubular crownshaft; prophyll partially hidden within the leafbases; peduncle long and bare, semiterete to dorsiventrally flattened; peduncular bract tubular, attached at the distal end of the peduncle below the fertile portion (rachis) and fully enclosing the fertile portion; peduncular bract papery, withering early and eventually deciduous, leaving either a clean scar or persistent bract remnants; flowers in triads, sessile, spirally arranged in shallow pits in the proximal three-fourths of the rachis, paired or single staminate flowers in distal one-fourth; staminate flowers globose, bullet-shaped, or angled/pyramidal in bud, widely or not widely opening at anthesis; stamens few to many; anthers dorsifixed or approaching basifixed; pistillode absent, or small with three apical lobes; pistillate flowers globose to ellipsoidal, but same size or smaller than the staminate flower when in bud, stigma trifid, moderately protruding at anthesis; fruit small, globose, ellipsoidal, turbinate, or cylindrical, with stigmatic remains apical, colored yellow, pink, or red at maturity; endocarp adhering to the seed; endosperm homogeneous.

Related genera—*Calyptrocalyx, Howea, Laccospadix,* and *Paralinospadix* (which along with *Linospadix* comprise the subtribe Linospadicinae: tribe Areceae: subfamily Arecoideae)—have historically been separated on characters such as the condition of the endosperm (ruminate or homogeneous), habit (solitary or clustering), size, the position of attachment of the peduncular bract (either toward the base or the apex of the peduncle), and the type of stamen attachment (dorsi- or basifixed). Uhl and Dransfield (1987) suggested that these genera could be regarded as subgenera of a single genus, though preliminary examination of relationships by Ferrero and Dowe (in preparation) suggests that there is sufficient heterogeneity within the group to justify maintaining the present generic distinctions.

C. T. White (1936) was understating identification difficulties when he said of *Linospadix* . . . "differences between the various species are rather difficult to follow." This can particularly apply in the field when two or more species occur together. All the Australian species are very variable in leaf form, having, apart from irregular pinnate forms, evenly and finely segmented forms. Variation of leaf segmentation is presented in Figure 1. The manner in which the leaf segments change into either single pinnae or groups of united pinnae has influenced some authors to create new species based on this aspect [e.g., *L. aequisegmentosa* (Domin) Burret = *L. palmeriana* (F. M. Bailey) Burret, and *Bacularia intermedia* C. T. White = *L. minor* (W. Hill) F. Muell.]. Fruit color at maturity can vary, being either yellow or red in *L. apetiolata, L. microcarya, L. minor,* and *L. palmeriana,* though it is red only in *L. monostachya.* There is some variation, which is of diagnostic value in flower and fruit structure, based on shape and orientation of petals, stamen number, the degree to which petals open at anthesis, and lamina morphology. A composite inflorescence with bracts and fruit of all species is presented in Figure 2.

Taxonomic History

Wendland (1875) established the genus *Linospadix* to include a single species, *Linospadix mon-*



1. Variation of leaf segmentation within *Linospadix* in Australia. The species in which each form occurs are as follows. a: *L. apetiolata* only. b: All except *L. monostachya*. c: All except *L. monostachya* and *L. apetiolata*. d: All except *L. monostachya*. e: All except *L. monostachya* and *L. apetiolata*. f: *L. monostachya* only. g: *L. apetiolata* and *L. microcarya* only. h: All except *L. apetiolata*. Drawing by Lucy Smith.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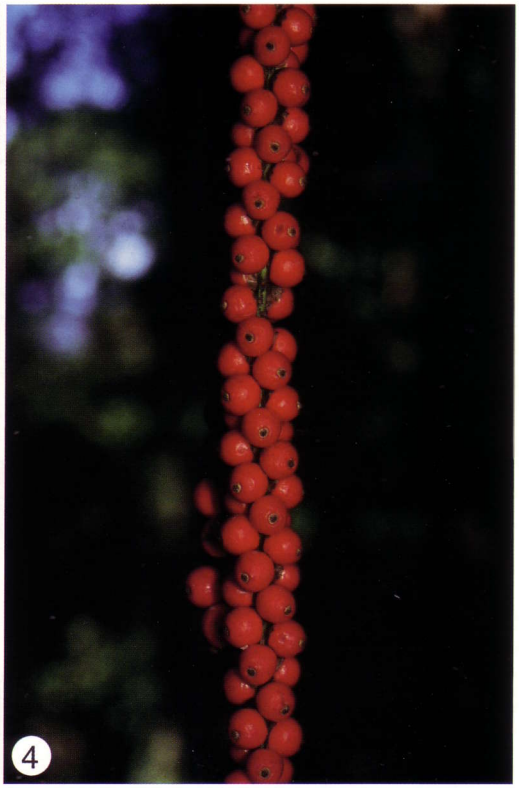
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ostachya, which Martius (1837) had originally placed as *Areca monostachya* and Mueller (1870) as *Kentia monostachya.* To this was added the future *L. minor,* first described by Hill (1874) as *Areca minor* and then as *Kentia minor* by Mueller (1878). Also around this time Mueller transferred these two species to *Bacularia,* an imprecise and obscure genus, which he erected to account for the Australian taxa in *Linospadix.* Refined and expanded descriptions of both *Linospadix* and *Bacularia* were subsequently published by Hooker (1883), with differences between the genera based on stamen number (6–12 for *Bacularia* and 6–9 for *Linospadix*), anther attachment (either basi- or dorsifixed), and geographical location (*Bacularia* in Australia and *Linospadix* in New Guinea). The name *Bacularia* was first used by Mueller (1870) who suggested it as an alternative generic name in discussion under *Kentia monostachya.* Also under *Bacularia minor,* Mueller (1878) suggested that a possible correct name for this species was indeed *Linospadix minor,* though he never published this combination. The basis of separation between *Linospadix* and *Bacularia* was not made clear by Mueller and the characters used by Hooker to define the two genera are now considered to be variable and inconsistent.

Subsequently, Bailey (1889) described *L. palmeriana* (as *B. palmeriana*) from Bellenden-Ker; *L. aequisegmentosa* (now a synonym of *L. palmeriana*) and *L. microcarya* were also described from this area by Domin (1915) (as *B. aequisegmentosa* and *B. microcarya,* respectively). Beccari (1934) described *B. sessilifolia* (=*L. microcarya*), which was collected from near the type locality of *L. microcarya,* and White (1936) described *L. intermedia* (as *B. intermedia*), which is now a synonym of *L. minor. Linospadix apetiolata* has been recognized as a distinct species for some time, with Jones (1996) listing it as *L.* sp. Mt. Lewis and Queensland Herbarium (1994) noting it as *L.* sp. (Mt. Lewis *K. A. Williams 82194*).

The most recent revision of *Linospadix* was prepared by Burret (1935) in which he transferred all the Australian species described at that time (and some New Guinea taxa) of *Bacularia* to *Linospadix.*

Materials and Methods

Extensive field collections and studies have been made since the early 1970s by AKI and since the early 1990s by JLD. Herbarium research has been undertaken by both authors at BRI, NSW, and QRS, while loans and assistance were received from B, BM, FI, and MEL.

Taxonomic Treatment

Linospadix H. Wendl., Linnaea 39: 177, 188, 198, T. 2, figure 2. 1875; Beccari, Malesia 1: 62. 1877 [*non* H. Wendl. = *Paralinospadix*]; Hooker f. in Benth. & Hooker f., Gen. Pl. 3: 870, 903. 1883; Burret, Notizbl. Bot. Gart Mus. Berlin-Dahlem 12: 330. 1935; Beccari & Pichi-Sermolli, Webbia 11: 56. 1955; Burret & Potztal, Willdenowia 1: 354. 1956; Stanley & Ross, Fl. southeastern Queensl. 3: 270. 1989; Uhl & Dransfield, Genera Palmarum 383. 1987. Type: *Linospadix monostachya* (Mart.) H. Wendl. (*Areca monostachya* Mart.)

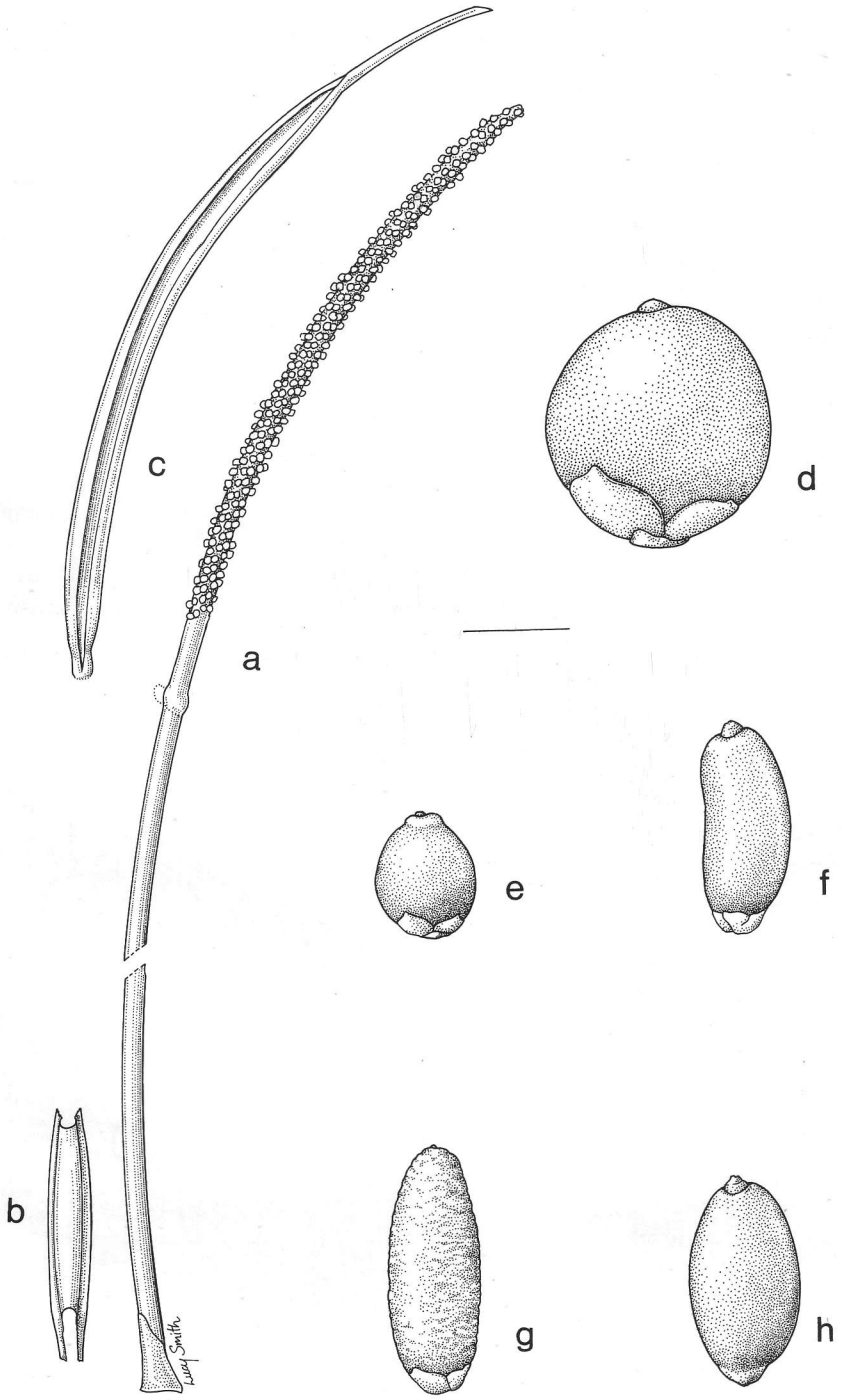
Bacularia F. Muell., Fragm. 7: 103. 1870 [*nomen*]; Fragm. 11: 58. 1878; Hooker f., Bot. Mag. 108: T. 6644. 1882; Hooker f. in Benth. & Hooker f., Gen. Pl. 3: 870, 903. 1883; F. M. Bailey, Queensl. fl. 5: 1679. 1902. Type: *Bacularia monostachya* (Mart.) F. Muell.

[*Kentia* Bl. (in part to include *Bacularia* and *Linospadix*), Bentham, Fl. Austral. 7: 135. 1878.]

Small to moderate, solitary or clustering, monoecious, protandrous palms. Stems very thin to moderately thick, clustering at the base or infrequently aerially branched. Leaves few to many, either simply bifid, irregularly paripinnate with single or united pinnae, or evenly and finely paripinnate with single pinnae; leaf sheaths not forming a distinct crownshaft, splitting opposite the

3–6. (page 194) 3. *Linospadix monostachya* in habitat, 300 m alt., Mt. Warning, New South Wales. 4. Fruit of *L. monostachya.* 5. Broadly segmented leaf form of *L. microcarya,* Josephine Creek, Mt. Bartle Frere, Queensland. 6. Finely segmented leaf form of *L. microcarya,* Crawfords Lookout, west of Innisfail, Queensland.

7–10. (page 195) 7. Fruit of *L. palmeriana.* 8. Large form of *L. minor,* Olivers Creek, Cape Tribulation National Park, Queensland. 9. Fruit of *L. minor* (yellow form). 10. *Linospadix apetiolata* in habitat, 1250 m alt., Mt. Lewis, Queensland.



2. Inflorescence and fruit of *Linospadix*. Inflorescence. a: spike (in bud) with bracts removed (composite). b: Prophyll. c: Peduncular bract. Fruit. d: *L. monostachya*. e: *L. microcarya*. f: *L. palmeriana*. g: *L. minor*. h: *L. apetiolata*. Scale bar: d–h = 6 mm. Drawing by Lucy Smith.

(*Continued on p. 211*)

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CHAPTER NEWS AND EVENTS

Welcome to New Affiliates of The International Palm Society

At the May 1997 meeting, the Directors of the International Palm Society approved affiliation of four more local societies or associations of palm enthusiasts with the IPS. These four groups are Far Northern Queensland Palm & Cycad Association, Association Chambeyronia of New Caledonia, La Asociación Espanola de Amigos de las Palmas of Spain, and South China Palm Association of the People's Republic of China. We welcome these societies and associations into affiliation with the IPS and we look forward to a long and mutually rewarding association.

For more information on these societies, see the IPS Membership Roster, which accompanies this issue of *Principes*.

New Format for Chapter & Affiliate News in Principes

At the May 1997 Board of Directors' meeting, the IPS board decided to change the format and content of Chapter and Affiliate information to be included in *Principes*. Historical, narrative summaries of past meetings will no longer be included, in order to allow more space in the journal for horticultural articles of interest to our membership at large. In their place, we will provide information on 1) local meetings to take place after the expected issue publication date, and 2) articles of general interest which have been published in affiliate journals and newsletters.

The traditional "Chapter News" will be posted on the IPS Internet website on the appropriate Affiliate or Chapter Homepage. We encourage you to read the summary of local events posted there.

Hopefully, you will like the new format. Please let us know whether you like it better this way or with the meeting summaries in the previous format. Send your thoughts by e-mail to Corresponding Secretary Jim Cain, 12418 Stafford Springs Drive, Houston, TX 77077-3910, USA or send via email to palm_dude@compuserve.com if you prefer.

(*Continued on p. 207*)

←

Left
Ceroxylon quindiuense (Karsten) H.A. Wendland

The species of *Ceroxylon*, sometimes called the wax palms of the Andes, are renowned for their beauty and stature. Early explorers found them breathtaking and they remain one of the wonders of the world. We are indebted to Rodrigo Bernal for a particularly beautiful photo of the most famous species, *C. quindiuense*, the national tree of Colombia, at 2500 meters of elevation in the mountains of Quindío, Colombia. It was here that Humboldt and Bonpland first saw them in October 1801. The species may reach 60 m, a record for palms. The photo shows the clouds surrounding the elegant trees, and is unusual in that it includes an infructescence with the reddish-orange fruits, which are eaten by birds including thrushes, toucanets, jays, and a rare, yellow-eared parrot. The solitary trunks are silvery white when mature due to a thick layer of wax that in the 19th century was an important source of wax for candles sold in local markets. *Ceroxylon* is most closely related to *Juania* of the Juan Fernandez Island, *Ravenea* in Madagascar, and *Oraniopsis* from Australia, a fascinating group for biogeographers.—Natalie Uhl

Right
Coccothrinax yuraguana (A. Rich) León

This species has recently been included by Henderson et al. (*Field Guide to the Palms of the Americas*, 1995) in their broadly defined *Coccothrinax miraguama* (Kunth) León. The two species are very similar, and additional study may prove that they are indeed conspecific. *Coccothrinax yuraguana* is from Cuba, where it is found on serpentine soils, i.e., soils high in heavy metals such as nickel and magnesium. The species epithet, "yuraguana," is the common name given to this palm in Cuba. Like so many of Cuba's *Coccothrinax* species, *C. yuraguana* is highly decorative with a sparse crown of stiff, pinwheel-like leaves, which are silvery on the undersides. The fruits are purplish black. This individual was photographed in Pinar del Río, in November, 1994.—Scott Zona

Principes, 41(4), 1997, pp. 201–207

Trachycarpus oreophilus—The Thailand Trachycarpus

MARTIN GIBBONS AND TOBIAS W. SPANNER

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When Dr. John Dransfield of Kew told us that there was "a Trachycarpus" growing in northern Thailand that "needed investigating" it seemed a heaven-sent way to fill the four spare days at the end of the trip to China that we were planning to try to find *Trachycarpus nanus* (Gibbons and Spanner 1993). John told us that the palm had originally been "discovered" in the 1920s by A. G. F. Kerr, renowned British botanist (of *Kerriodoxa* fame) and was well known to the Thai Royal Forestry Department. Originally it had been mistakenly identified as a *Livistona*, and its herbarium specimens (though lacking fruit or seeds) together with a black-and-white photograph, had languished in the herbarium at Kew until the 1970s when John spotted the mistake. It was certainly a *Trachycarpus*, and in the absence of seed material that might indicate which one, it had been identified as *T. martianus*, which it certainly resembled. This assumption was proven wrong when, in the mid-1980s, some fruits were collected by the Royal Forestry Department and were shown to John in Bangkok. They were reniform (kidney-shaped) as opposed to oval-and-grooved, typical of *T. martianus*, and a question mark has hung over its true identity ever since. This puzzle could have been invented for us, and we gladly took up the challenge to throw some more light on the subject.

John kindly suggested the names of two botanists in Bangkok who might be able to help us, and a visit to one of them, Weerachai Nanakorn, on our arrival in Thailand, led to us meeting Rachun Pooma of the Royal Forestry Department in Chiang Mai, who knew of this palm and was as excited as we by the prospect of a trip to see it.

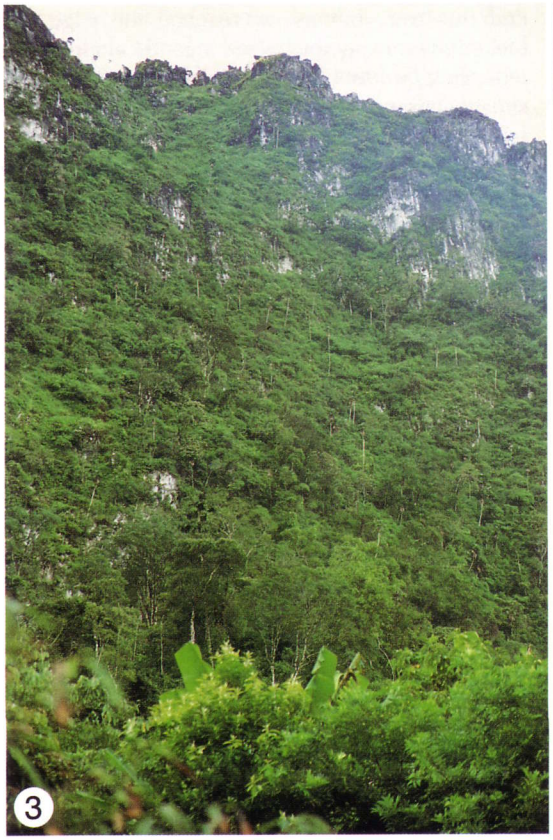
He was extremely helpful, meeting us at Chiang Mai airport, accommodating us at his residence at the Huey Kaew Arboretum, and taking us out that first evening for a wonderful Thai meal. The following day, he arranged a 4-wheel drive jeep, complete with driver, and we picked up a couple of guides en route. We set off at 10 am, stopping on the way to get supplies for the two days we would be away. We then drove out of Chiang Mai and after a couple of hours turned into a side road, heading for the mountain range, where grew our quarry.

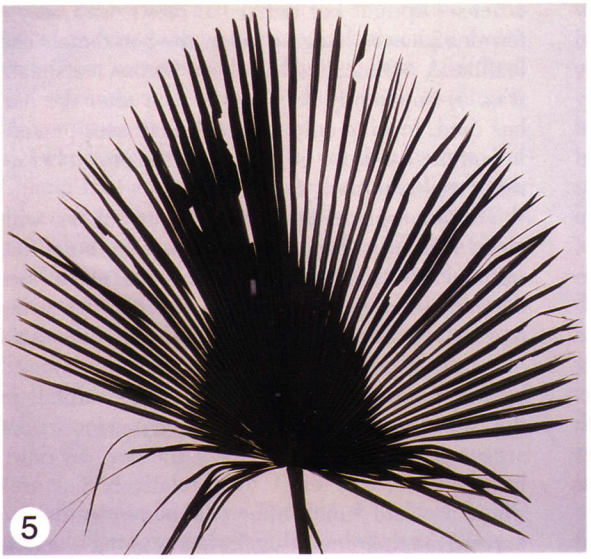
The jeep was very powerful. Rachun sat in the front with the driver, we in the open back, a plank having been fixed athwart to serve as a seat. However, as we began to climb, the road became so rough and bumpy that we were obliged to stand, from which position we had an excellent view of the changing scenery and vegetation. The temperature fell slowly as we went up, and coconut palms gave way to huge *Livistona speciosa*, wonderful and noble trees, growing wild in the forest. This species also grows in north Burma and south China and, apart from some minor differences in the fruit and inflorescence bracts, it is hardly distinguishable from *Livistona jenkinsiana* from northeast India and should perhaps be considered synonymous with it. There were also hundreds of bamboos of all shapes and sizes arching across the road, sometimes forming a tunnel. Other interesting palms we saw were the trunkless *Wallichia caryotoides*, and various rattans, all growing in deep shade.

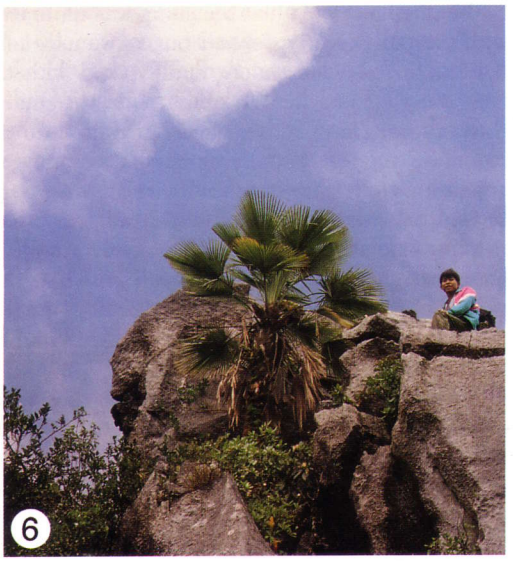
The road became atrocious with deep muddy ruts and areas where the road had been washed away. The 4-wheel drive was quite indispensable as the road was so steep as well as muddy. Sometimes the rear of the vehicle seemed in danger of overtaking the front, and sometimes we slipped dangerously close to the edge of the road and a sheer drop.

We continued in this way for some two hours, upward and ever upward. From time to time we saw our destination through the trees: Doi Chiang Dao—a mysterious and extremely steep, relict

1–2. 1. *Trachycarpus oreophilus*: hundreds of trees could be seen silhouetted on the mountain crest. 2. View from mountain crest.







3–6. 3. (Top left) *Trachycarpus oreophilus*, growing by the hundreds on the steep face of Doi Chiang Dao. 4. (Top right) *Trachycarpus oreophilus*: note the leaf base and distinctive, short fibers. 5. (Bottom left) *Trachycarpus oreophilus*: the distinctive silhouette, showing regular leaf splits. 6. (Bottom right) *Trachycarpus oreophilus* growing among limestone boulders on the ridge crest.

limestone mountain, separated by time and distance from the vegetation of the surrounding countryside. After this difficult journey we arrived at "base camp," an outpost of the Forestry Department, where lived and worked the forest rangers with wives and children, some 10–15 people in all. It was now about 2 pm, not enough time for the climb up so we would stay the night here and set off in the morning.

There was not much to do though we did walk for half an hour to a vantage point to have a closer look at "our" mountain. My goodness it looked awfully steep! With binoculars we could make out hundreds of palm trees silhouetted on its crest (Fig.1). They looked far too exotic to be humble *Trachycarpus*, but that's indeed what they were. On the way we came across some very large *Cycas pectinata*. Some of them must have been hundreds of years old, and were forked and branched. Back at the camp we had some food and the time passed quickly enough. At about 8 pm we retired and slept surprisingly well on the hard and thin mattresses.

We rose at 7 am. The weather was quite cool as the sun was only just rising. There were six of us in the party: Rachun, his assistant, two forest ranger guides who knew the way up to the top, and the two of us. We set off taking the same path as the day before. At first the going was quite easy with the path clearly defined but as we ascended it became less clear, more muddy, and with the vegetation closing in. We climbed up the muddy path, slipping and sliding, and hanging on to the plants for support, tantalizing glimpses of our goal appearing from time to time. Up and up we went, around the side of the mountain. It was very steep in parts and very heavy going. After a couple of hours' tough climb, we departed from what little path there was, to make a direct assault. At this point the going became even more difficult and we were drenched by the wet vegetation.

What appeared from a distance to be short grass turned out to be 6 feet high, and studded with huge limestone boulders the size of cars, and always the dilemma was to go around or to go over them. The palms got closer and closer, but they were absolutely on the ridge crest and demanded a high price for access (Fig. 6). We aimed for one particular palm whose leaves we could see arising from the far side, and slowly inched our way towards it. The last few meters was over the bare rock itself where sharp ridges had been formed by erosion. We slowly made our way towards the crest and this tree, but as we reached the edge and looked over, expecting to see a gentle slope on the other face, we saw that the far side was absolutely sheer; a dropped stone would have been in free fall for several hundred feet.

The palm tree that we had chosen was growing from the sheer face of the far side and quite inaccessible. We worked our way with great difficulty along the ridge in an effort to reach some others, and there were many to choose from, but each required an individual expedition of perhaps 20 minutes, and a slow climb up, over, or around the huge limestone boulders to reach it. Not all these rocks were secure, some moved, some had eroded into huge stones balanced on others. A push would have sent them crashing down.

Well, what of the trees themselves? It must be said that they were quite stunning. They were all growing in the most inaccessible locations on the cliffs and ridges of weathered limestone. We assumed that all the more reachable trees had been cut down for some purpose, and this was later confirmed by one of the guides.

Firstly, the striking thing about them was that they had bare trunks, some up to 30 feet tall and rather slender, closely ringed with leaf scars that were faintly visible under a cover of moss and lichens. All the leaves were stiff and erect forming a dense, upright but rather flat crown with only a few dead leaves hanging below the horizontal. The leafblade, petiole, and the short, fibrous leafsheath (Fig. 4) apparently decompose soon after the leaf has died, leaving only the thick leafbases persisting on the trunk for 50 cm below the crown before they, too, eventually fall.

The atmosphere up here was very moist, with cloud regularly obscuring the view—an incredible sight with the mountain, the palms, and sometimes the hot, steaming lowlands far below, appearing and disappearing in the mist (Fig. 2). Like most of southeast Asia, northern Thailand is influenced by the monsoon and receives copious rainfall in the summer while experiencing a moderate dry season during the winter. We made our way down from this terrible crest to a relatively flat area where we had lunch after which we decided to explore another crest—again heavy going—and as we reached the palms saw that one of them was in full fruit. The tree had five infructescenses, which did not hang down in the manner of *T. fortunei* but projected out stiffly at only slightly below the horizontal.

It was growing, predictably, on the edge of a

precipice that we hardly dared look over. With some difficulty we collected samples of leaves and leaf sheaths as well as several hundred green but ripe kidney-shaped seeds. The fibrous leaf sheaths were quite notable in that they are short, the upper margin being rather furry and lacking any appendages, and of a fine, rather soft texture, rapidly breaking down. The leaf blade was split to a very regular depth (Fig. 5) and was carried on a robust petiole, separated from the blade by a long and prominent hastula.

Seeing these characteristics, our earlier suspicions were certainly confirmed: what we were looking at was a new, undescribed species, clearly distinct and easily separated from all other members of the genus. With our collections adding to our load, we began the return trip which we had been dreading, made considerably worse by heavy rain.

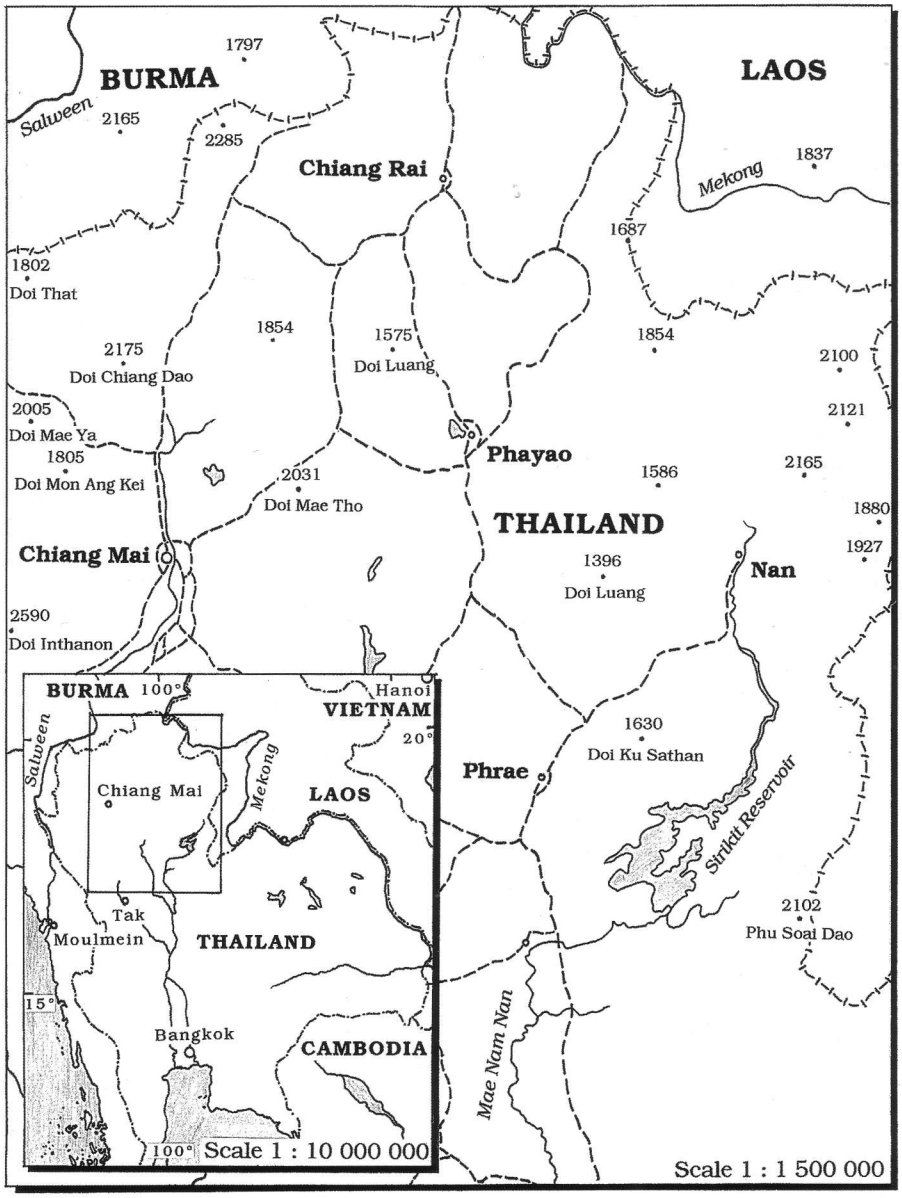
After an exhausting journey slipping and sliding down the muddy path, we were on the original track and heading for home, triumphantly bearing the spoils of our expedition. When we finally reached the base camp, we had a welcome cup of coffee and climbed aboard the jeep for the two-hour drive down the mountain. What had been mud on the way up, had with the rain, become a quagmire, sometimes axle-deep. The going was awful, there was no shelter on the back of the truck and we were again soaked through. Down and down we went, past bamboo and *Livistona*, and miraculously made it safely back to Chiang Mai, with no major problems.

Two years later, in 1994, we returned to Doi Chiang Dao and its *Trachycarpus* to explore a few more remote and less accessible ridges and to collect additional material. Though the climb both up and down was exhausting and dangerous our excitement and pleasure at being able to describe a new species of *Trachycarpus* made the effort and risk well worth while.

Trachycarpus oreophilus *Gibbons & Spanner* **sp. nov.**

Habitu, forma fructu *T. fortunei, T. principi, T. takil* et *T. wagneriano* similis sed vaginis foliorum brevibus, celeriter fatiscentibus et caducis, sine appendiculo, base petioli crassa, hastula prominentissima, lamina regulariter divisa, infra glauca, pedunculo inflorescentiae pistillatae longa differt. Typus: Thailand, Doi Chiang Dao, *Gibbons & Spanner* s.n. (Holotypus K, isotypus BKF).

Solitary, very lightly armed, dioecious palm to about 9 m tall; trunk slender, erect, bare, brown, conspicuously ringed, 10–16 cm in diam., in young plants occasionally clothed in persistent, fibrous leaf sheaths. Leaves about 20, forming a dense upright, rather flat crown; marcescent leaves few, leafblade, petiole and leafsheath soon deciduous, the thick, almost bulbous leafbases persistent at first, covering the trunk for about 50 cm below the crown, eventually deciduous; leafsheath fibrous, about 30 cm long, brown, fine, soft, rapidly disintegrating, thinly tomentose below, separated into short single threads towards the apex, not forming an appendage; petiole about 50 cm long, stiff, robust, 2 cm wide near the middle, flattish above, depressedly triangular to rounded below, margins minutely toothed and thinly tomentose, base thick and robust; adaxial hastula prominent, to 3 cm long, triangular, acute; leafblade palmate, 3/4 to nearly 4/4 orbicular, about 70 cm long from the hastula and about 100 cm wide, leathery, green above, glaucous below, parted to a nearly even depth for more than ½ its length into about 60 stiff, deeply folded, linear segments, tapering towards the apex from their broadest point; central segments about 70 cm long, lateral segments gradually shorter to 40 cm, apex acute-notched, shortly bifid for a few centimeters. Inflorescences about 4, solitary, interfoliar, 90–100 cm long; staminate inflorescence erect, peduncle short; prophyll two-keeled, 25 cm long; peduncular and rachis bracts five, 15–25 cm long, base tubular, inflated distally, apex acute; rachillae short; flowers globose, very small; sepals very small, ovate, joined at the base for ¼ to ⅕ of their length; petals rounded with a blunt tip, 2.5 times as long as the sepals; stamens 6; filaments ventricose; anthers broadly ovate-sagittate with nearly disjoint cells, not apiculate; pistillodes (2-) 3, half as long as the stamens; pistillate inflorescence stiff, slightly arching or nearly horizontal in fruit, densely branched to three orders; peduncle about 50 cm long oval in cross section, 3.5 × 2 cm; prophyll two-keeled, apex acute; peduncular bracts three, 35 cm long, long and tubular; rachis bracts two, the basal one 25 cm long, similar to peduncular bracts, the distal one small and much reduced; rachillae 3–10 cm long, greenish (in fruit); flowers not seen. Fruit on short stalks, reniform, wider than long, epicarp thin, green, not seen when fully mature; mesocarp thin, fibrous; seed reniform, wider than long, 6 mm long, 11 mm wide; endocarp very thin, with a crustaceous sand-



7. Map showing the location of habitat of *Trachycarpus oreophilus*.

like layer of small, irregular scales; endosperm homogenous. Germination remote-tubular, eophyll simple, plicate, papery, 1 cm wide. Seedling leaves narrow, erect and very finely divided.

Distribution. NW-THAILAND: Doi Chiang Dao, a large, isolated limestone mountain about 70 km N of Chiang Mai, forming large colonies on steep, rocky hillsides and exposed cliffs among lichen- and moss-covered shrubs and stunted trees on the mountain's several peaks, between 1700 and 2150 m.

Conservation Status. The population on Doi Chiang Dao is the only one known in Thailand and there is no evidence to suggest that it might occur in similar sites outside Thailand, in Burma for instance. The Doi Chiang Dao population consists of a few thousand trees and is protected in a forestry reserve. It appears to be in a good state though all the more accessible sites have long since been cleared of palms by tribes of people and there are no seedlings and few young plants

present at them. However, the vast majority of the palms grow in very steep, practically inaccessible sites (Fig. 3) and as pressure on these stands by man or beast is negligible, their future seems secure. We would categorize it as "rare." *Trachycarpus oreophilus* has only very recently been introduced into cultivation. There are no mature palms of this species outside its native habitat.

Specimens Examined. Thailand, Doi Chiang Dao, 5500–5900 ft (1680–1800 m) a.s.l., Jan. 25th 1913, *A. F. G. Kerr 2872A* (K); 1700–2100 m a.s.l., Jun. 4th 1921, *A. F. G. Kerr 5600* (K); 1700–2100 m a.s.l., Jun. 4th 1921, *A. F. G. Kerr 5600A* (K); A. S. Barfod, R. Pooma, T. Burholt *45209* (AAU); 2000 m a.s.l., Oct.1993, *M. Gibbons, R. Pooma, T. W. Spanner* s.n. The specific epithet (*L. oreophilus*, cloud-loving) relates to the fact that this palm and its habitat are often totally obscured by clouds. Note: As there is no recent taxonomic treatment of the genus *Trachycarpus* (but see Beccari 1931 and Kimnach 1977), relationships of *T. oreophilus* will be dealt with in a conspectus of the whole genus, which will appear in a later publication.

Acknowledgments

We would like to take this opportunity to thank Dr. John Dransfield of the Royal Botanic Gardens, Kew, for bringing this species to our attention, for his continued support and his help with the manuscript, and Weerachai Nanakorn and the Royal Thai Forestry Department—especially Rachun Pooma—for their indispensable help. Additionally, our thanks are due to Anders Barfod, University of Århus, Denmark, who supplied a herbarium sheet much needed to complete our description.

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CHAPTER NEWS AND EVENTS (*Continued from p. 200*)

Palm & Cycad Societies of Australia

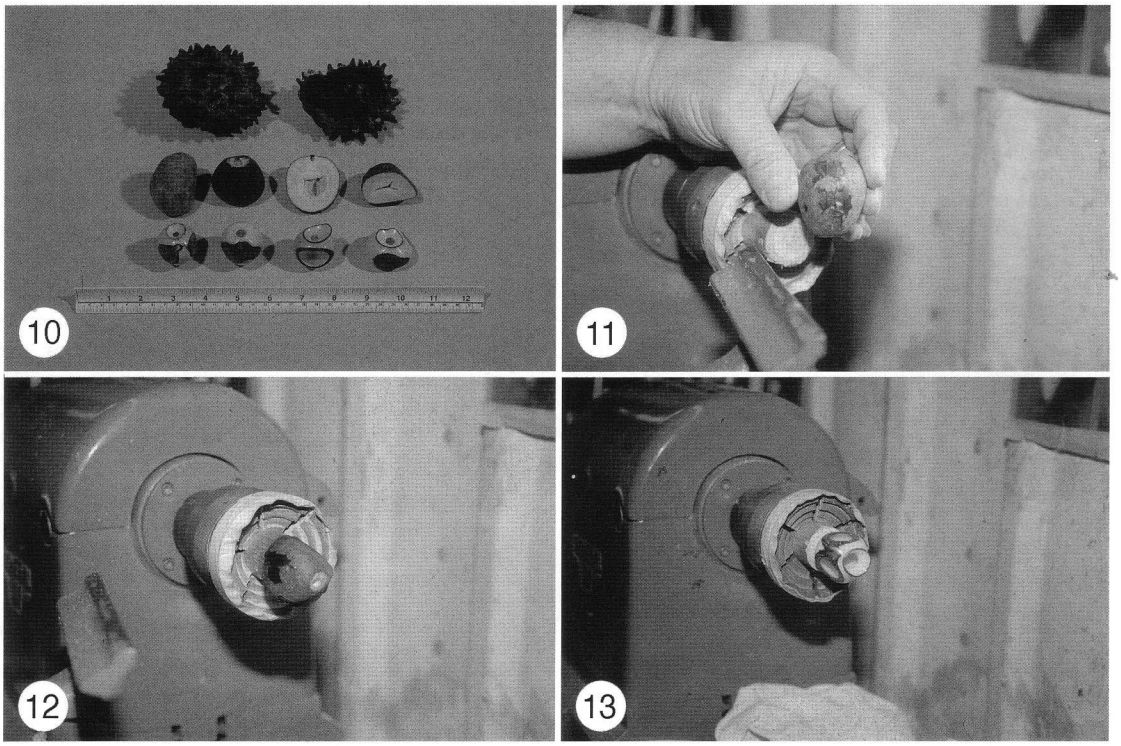
The January–March 1997 issue (number 54) of *Palms & Cycads*, Magazine of the Palm & Cycad Societies of Australia, included a diverse collection of interesting articles. It opened with "The Rockhampton Botanic Gardens and Its Palm Collection" by John and Jeanne Price, followed by several articles on Cuba: "Copernicia in Sancti Spirtus, Cuba" by Celio E. Moya Lopez of Cuba, "Coccothrinax in Cuba" by Rolf Kyburz and an article of tribute to Carlos Moya Lopez, also by Rolf. Dennis Johnson provides an interesting photographic "Album of Handicraft Palm Products" and Roy Osborne provides a most interesting book review on "The Island of the Colour Blind", written by Oliver Sacks. The "Letters" section included "An Interesting Experiment in Cross Pollination between Cycads" by Shri Dhar in India and a beautiful photograph of *Allagoptera arenaria* (with another on the rear cover).

The next issue of *Palms & Cycads* was a combined issue (numbers 55 and 56), featuring the palms and cycads of Papua New Guinea and Irian Jaya with articles by Michael Fererro, Tony Huntington, and others.

P.A.C.S.O.A. as a whole generally holds only one annual meeting during the first quarter of the year. However, the various individual branches meet on a regular basis throughout the year. The current branches of P.A.C.S.O.A. are South Queensland Group, Sydney Branch, Sunshine Coast Group, Gulf Coast Tweed Palm & Cycad Society, Palm & Cycad Society of South Australia, Northern Territory Palm & Cycad Society, North Queensland Palm Society, Palm & Cycad Society of Mackay, and Rockhampton Palm & Cycad Society. For further information, write P.A.C.S.O.A., Ltd., P. O. Box 1134 Milton, Queensland 4064, Australia or contact via email on pacsoa1@ozemail.com, pacsoa2@ozemail.com or pacsoa3@ozemail.com (see your Membership Roster for which email will best suit your needs).

(*Continued on p. 210*)

(*Continued from p. 189*)



10–13. A tagua nut turning sequence. 10. Phytelephantoideae, left to right: outside of infructescence, inside of infructescence, nut with endocarp, nut with seed coat, nut in vertical section, in horizontal section, and finished vases. 11. A tagua nut before turning. 12. The nut mounted on the lathe. 13. The completed vase.

of a tree. All the tagua nuts I have seen and turned have a void, or cavity, originating in the center of the endosperm, usually running on the same axis as the void for the embryo. Cracks radiate from this central void toward the outer surface of the nut, and limit the amount of material that can be removed from the surface of the nut, without exposing a crack, and must be a design consideration. I am unaware of a method for identification of a genus or species from the tagua nut alone, so they are all tagua nuts to me at this point.

Turning a Tagua Nut Vase

The ideal tagua nut shape for making a vase is round in horizontal section, with the embryo centrally located at one end and vertically inserted. A flat area is sanded on the end opposite the embryo, approximately ¾″ (2.0 cm) in diameter. This flat area will become the base of the vase and will also be where the nut is attached to the lathe. A flat is sanded on the base of the nut for mounting to the lathe spindle as before, and glue is applied to the flat and accelerator to the waste block. The nut is pressed against the waste block and securely attached, keeping the embryo void as close to the center line of the lathe as possible (Fig. 12). The tool rest is adjusted to about ⅛″ from the farthest protrusion of the nut, determined by hand rotation of the lathe. Using a ¼″ spindle gouge, the outside of the vase is formed, stopping the lathe occasionally, to check the depth of cut and the pattern created by the remaining seed coat. A portion of the seed coat is retained to add contrast and interest to the vase. When the outside form is complete, the inside of the vase is hollowed out. A hole is made in the top of the vase using a drill bit or ⅛″ gouge, with the hole extending down through the center of the vase to within about ⅛″ of the base. At this point dental picks, which are formed and ground to various shapes, are used to complete the hollowing of the vase. This is all accomplished with the lathe running and the vase rotating. If all goes well, the void from the embryo becomes the inside neck of the vase and disappears. Because the opening in the neck is normally small, the inside is not sanded.

The inside flare of the neck and the complete outside is sanded and buffed as before. The vase is removed from the lathe using a small parting tool, cutting it off at the glue line. Normally the vase will be remounted using a friction chuck to hold it. A friction chuck is nothing more complicated than a waste block mounted to the lathe, with a tapered hole sized to grip the shoulder of the vase. The vase is inserted into the chuck, neck first, to expose the base for finishing. It may take several tries of adjusting the vase in the friction chuck to make it run true. Once accomplished the base is finished with a small scraper, by making very light cuts so as not to dislodge the vase from the chuck. The base is sanded, buffed, and signed. There is no finish applied to the vase. Liquids or creams should not be stored in the vase, as they may soften and ruin it. It takes me about two hours to complete a vase (Fig. 13).

Raphia

There are about 28 recognized species, mostly in Africa.

R. farinifera syn. (R. ruffia). The fruit is globose, covered with 12–13 longitudinal rows of dark-brown scales at maturity, about 2.0″ in diameter (5.0 cm), epicarp thin, mesocarp thick, mealy, endocarp not differentiated. Seed are obovoid, about 1.5″ long × 1.3″ wide (3.8 × 3.3 cm). The endosperm has large ruminations and a lateral embryo.

R. australis. The seed is elliptical, about 2.8″ long × 1.5″ wide (7.1 × 3.8 cm). See *R. farinifera* for remaining data.

Veitchia

The genus *Veitchia* has about 18 species; I will only discuss the species I have turned. The distribution is New Hebrides, Fiji, and the Philippine Islands (Uhl and Dransfield 1987). *V. joannis, V. montgomeryana,* and *V. arecina* exhibit the same drying problems as noted with *Actinorhytis calapparia*; they must have their seed coats removed, prior to drying. This genus is used to make vases.

V. joannis. This is the largest *Veitchia* seed I have turned, and possibly the largest of the genus. The common name is Joannis palm. The fruit is about 1.8″ long × 1.1″ wide (4.5 × 2.8 cm), ovoid, beaked, red to orange at maturity, with a thin epicarp, yellowish thin-fleshy mesocarp, with two to several fibrous layers, and a thin hard and brittle endocarp. The seed is ovoid to ellipsoidal, about 1.4″ long × ⅞″ wide (3.5 × 2.2 cm) and has a thick hard seed coat adhering to the homogeneous endosperm. The embryo is basal (Fig. 2).

V. montgomeryana. The common name for this species is Montgomery palm. The fruit is ellipsoid, about 1.5 × 1.0″ (3.8 × 2.5 cm). The seed is more ellipsoid than *V. joannis,* and its size is about 1.25″ long × ¾″ wide (3.2 × 2.0 cm). The remainder of the data for *V. joannis* applies.

V. arecina. The common name is Arecina palm. The fruit is ovoid, about 1.25″ long × 1.0″ wide (3.2 × 2.5 cm). The seed is also ovoid, the size about 1.0″ long × ¾″ wide (2.5 × 2.0 cm). For remaining data see *V. joannis.*

V. macdanielsii. The common name is sunshine palm. The fruit is ovoid, about 1.1 × ⅞″ (2.8 × 2.2 cm). The seed is ovoid, about ⅞″ long × ⅝″ wide (2.2 × 1.6 cm). I have been successful at drying these fruits without cracking. See *V. joannis* for remaining data.

V. merrillii. Common names are Christmas palm and Manila palm. The fruit is ovoid, about 1.0″ long × ¾″ wide (2.5 × 1.9 cm). The seed is also ovoid and about ¾″ long × ½″ wide (2.0 × 1.3 cm) with a thin, brown seed coat and ruminate endosperm. See *V. joannis.* for remaining data.

Verschaffeltia

V. splendida. A single species is confined to the islands of Mahe, Silhouette, and Praslin in the Seychelles. The fruit is moderate, spherical, brownish-green, the epicarp smooth, mesocarp thin, fleshy, and endocarp thin, ridged and flanged. The endosperm is about ¾″ in diameter (2.0 cm), conforming to endocarp shape, deeply ruminate, with a small central hollow, and basal embryo (Fig. 2).

Wodyetia

W. bifurcata. A single species, from northeastern Queensland, Australia, is confined to the southwest, south and southeast sides of the Melville Range. The common name is foxtail palm. The fruit is globose-ovoid, orange-red at maturity, with apical stigmatic remains forming a conical beak. The epicarp is thin with very short, stout fibers below the epidermal layers, the mesocarp is fleshy, orange-yellow when ripe, thin with longitudinal fibers, some forked. The endocarp is complex with outer distinctive thick, flat, branched fibers and an inner layer of horizontal fibers. Seed are about 1.2″ long × ⅞″ wide (2.9 × 2.2 cm),

ellipsoidal, beaked, and have medium, anastomosing, slightly impressed raphe branches, a homogeneous endosperm and, basal embryo (Uhl and Dransfield 1987) (Fig. 1).

The palm seeds discussed here are those I have tried. I am most interested in hearing from readers about other seed available, on a purchase or trade basis. I am searching for large, symmetrical, homogeneous, or ruminate seed, with an endosperm that is hard when dry.

Acknowledgments

The accompanying photographs are by the author, unless otherwise stated.

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CHAPTER NEWS AND EVENTS (*Continued from p. 207*)

Sydney Branch, P.A.C.S.O.A., Chapter of the IPS

The Sydney Branch of P.A.C.S.O.A. regularly meets on the third Tuesday of the month. Their venue has recently changed to the First Ashfield Scout Hall, Corner Orchard Crs. and Murrell Street, Ashfield, NSW. For more information on the Sydney Branch Chapter of the IPS, see the accompanying Membership Roster's section on chapters and affiliates or contact Paul Anderson at (61)-043 691422 by telephone or palmnut@msn.com by email.

The *Principes Minor* July 1997 issue (No. 87) featured the genus *Syagrus*, with a nice summary list of species, each with a brief description, by Ian Edwards, followed by discussions and comments on *Syagrus* culture experiences. Also featured in this issue was a rather comprehensive list of "Palms for the Sydney District—What will Grow?".

Palm & Cycad Society of Western Australia

The Palm & Cycad Society of Western Australia (P.A.C.S.O.W.A.) generally meets at 8:00 p.m. on the third Monday of each month at the Leederville Town Hall, Cambridge Street, Leederville. There are some exceptions, so for the latest information on upcoming meetings, write to P.A.C.S.O.W.A., P.O. Box 170, Como, W.A., 6152, Australia. Alternatively, you may wish to call Barry Shelton (66-9-458-3627) or contact Darryl Hardie at dhardie@agric.wa.gov.au by email.

In addition to local society news, the April issue of the Newsletter of P.A.C.S.O.W.A. carried "Palms of Gascoyne Park" by George Sevastos—a comprehensive list of the over 2000 palms (96 species in 38 genera) planted there. Each newsletter issue includes an interesting installment of "Palm Spotting in Perth" by Barry Shelton, of interest to both residents and visitors to the Perth area.

Hawaii Island Chapter

The June 1997 *Pritchardia*, newsletter of the Hawaii Island Chapter of the IPS, included an article on "High Elevation Palm Growing in Puna—Interview with Jon Hermsdorf" by Bo-Göran Lundkvist, which will be of interest to others growing palms in high tropical altitudes. John's garden in Hawaii is at 2600 feet (790 meters) elevation. For information on the Island of Hawaii Chapter, see the accompanying Membership Roster.

(*Continued on p. 218*)

(*Continued from p. 197*)

petiole with margins moderately fibrous; petiole short to long or completely lacking; pinnae 2–30 per leaf, terminal pinnae usually broader than lateral pinnae. Inflorescence spicate, interfoliar; peduncle with an extended bare portion between the apex of the prophyll and attachment of peduncular bract; prophyll short, dorsiventrally compressed, persistent, partially concealed within the leaf sheath; peduncular bract long and tubular, attached in the distal portion of the peduncle immediately below the rachis, and completely enclosing it, eventually splitting longitudinally, withering to a papery texture and deciduous; rachis from one-half to one-quarter the peduncle length. Flowers sessile, spirally arranged, triads in the proximal portion, with paired or solitary staminate flowers in the distal portion. Staminate flowers globose, bullet-shaped, or angled/pyramidal in bud, petals valvate, partially or widely opening at anthesis; petals much longer than sepals; stamens 4–20, arising from a staminal ring at the base of the pistillode (when present), shorter than the petals, remaining compactly grouped at anthesis; filaments very short; anthers dorsifixed or approaching basifixed; pistillode absent or small, wide with longitudinal ribs, apex trifid. Pistillate flower globose, about same size as, or smaller than, the staminate flower; sepals imbricate; petals apically valvate; stigma trifid. Fruit globose, turbinate, elongate/cylindrical, yellow, pink, or red at maturity; epicarp smooth, irregularly rugose, or with shallow longitudinal striations; mesocarp soft, moist, and succulent, with a single layer of fibers appressed to the endocarp, undivided, parallel, extending for length of fruit; endocarp thin, crustaceous, adhering to the seed. Seed globose, ovoid, or elongate/ellipsoid; hilum lateral; endosperm homogeneous; embryo basal. Eophyll bifid.

Distribution. Australia (5 spp.) and New Guinea (3–5 spp.), in moist closed forests (rain forest) from sea level to over 2 000 m elevation. In Australia up to 1 600 m elevation, mostly confined to within 35 km of the coast, but up to 110 km inland in isolated upland locations in southern Queensland and northern New South Wales. In Queensland distributed in southern McIlwraith Range, then continuously and commonly from about 25 km south of Cooktown to Mission Beach though absent from Atherton Tableland west of Tarzali and Jaggan. A large disjunct occurs south of Mission Beach until just north of Gympie (southeast Queensland) from where it occurs more or less continuously to John's Mt., near Hastings River just north of Taree in New South Wales.

Habitats and Phenology. Occurring in coastal lowland and upland moist closed forest, in Complex Mesophyll Vine Forest to Simple Microphyll Vinefern Thicket, but absent from Semi-deciduous Mesophyll Vine Thicket and Complex Notophyll Vine Forest, which are seasonally drier forests with higher light on the forest floor. Flowering occurs throughout the year but with fruiting in two distinct periods: January to March and May to August.

Etymology. Though Wendland did not specifically mention the derivation of the name *Linospadix,* it may be inferred that he was referring to the very thin inflorescence: *line*—an early botanical measurement of about 2 mm (one-twelfth of an inch) and *spadix*—a fleshy axis bearing sessile flowers.

Key to Species of Linospadix in Australia

1. Habit solitary: moderately tall understory palms; staminate flowers angled/pyramidal; fruit globose or elongate/cylindrical (Gympie, S.E. Qld to John's Mt., Central NSW) ..... 1. *L. monostachya*
1. Habit clustering: small understory palms (if solitary the result of damage to basal growths or basal growths still to develop); staminate flowers rounded, either elongate or globose; fruit globose/turbinate or elongate/cylindrical.
   2. Fruit globose/turbinate, yellow or pink to red at maturity (Mt. Spurgeon, Mt. Lewis, Mt. Bellenden-Ker, Malbon Thompson Ra. and Mt. Bartle Frere) ..... 2. *L. microcarya*
   2. Fruit elongate/cylindrical: yellow or red at maturity.
      3. Petiole present approximately one-quarter length of leaf
         4. Leaf segments usually two per side but also evenly pinnate forms with up to 24 pinnae; palms less than 2 m tall, leaf lamina rigid, secondary ribs prominent on both surfaces of leaf (Mt. Bellenden-Ker and Mt. Bartle Frere) ..... 3. *L. palmeriana*
         4. Leaf segments more than three per side but also evenly pinnate forms with up to 24 pinnae; palms usually over 2 m tall, leaf lamina lax, chartaceous, veins prominent only on upper leaf surface (S. McIlwraith Range, and Mt. Amos to Mission Beach) ..... 4. *L. minor*
      3. Petiole absent or very short: leaf bifid, or infrequently partially segmented or pinnate (Mt. Spurgeon and Mt. Lewis) ..... 5. *L. apetiolata*

Key to Species of Linospadix in Australia based on leaf material at 10× magnification

1. Lamina with few to numerous scattered elongate clear "cells" parallel to midrib and veins ..... 2. *L. microcarya*
1. Lamina without elongate clear "cells," but with few to

numerous small or large circular clear "cells" in rows parallel to midribs and veins
2. Circular clear "cells" large and scattered, with secondary veins thin and not (or very infrequently) raised on the abaxial surface; interveinal septa not well defined ..... 4. *L. minor*
2. Circular clear "cells" small and densely arranged; secondary veins prominent on both surfaces of leaf; interveinal septa well defined
3. Secondary veins regularly and closely spaced, more or less uniform in thickness
4. Interveinal septa thin, most often connecting only few veins, some secondary veins as thick or nearly as thick as midrib ... 3. *L. palmeriana*
4. Interveinal septa thick, most often crossing over many veins; secondary veins much thinner than midrib ..... 1. *L. monostachya*
3. Secondary veins irregularly and distantly placed, of variable thickness ..... 5. *L. apetiolata*

Morphological characters used to differentiate species are listed in Table 1.

Table 1. Morphological characters used to differentiate species of Linospadix *in Australia.*

1. Habit: clustering or solitary
2. Stem: thin or thick
3. Segmentation pattern of leaf: unsegmented, unevenly or evenly segmented
4. Structure of leaf lamina: with or without elongate clear "cells," ribs and veins strong or weak; veins prominent on only one surface or on both surfaces
5. Inflorescence: length
6. Flower shape: globose, bullet-shaped, or angled/pyramidal
7. Number of stamens: 4–20
8. Petal spread of staminate flower at anthesis: narrow or wide
9. Fruit: globose/turbinate or elongate/cylindrical; colored either yellow or red or only red

1. Linospadix monostachya (Mart.) H. Wendl., Linnaea 39: 199. 1875 [as *L. monostachyos*]. *Areca monostachya* Mart., Hist. Nat. Palm. 3: 178. 1837; F. Muell., Fragm. 5: 49. 1865. *Kentia monostachya* F. Muell., Fragm. 7: 82, 103. 1870; 8: 235. 1874; Bentham, Fl. Austral. 7: 136. 1874. *Bacularia monostachya* (Mart.) F. Muell., Fragm. 7: 103. 1870; F. M. Bailey, Queensl. fl. 5: 1679. 1902; Domin, Biblioth. Bot. 20(85): 499. 1915; Evans & Johnson, Contrib. NSW Herb. 21: 6. 1962; Stanley & Ross, Fl. South–east Queensl. 3: 270. 1989. Lectotype (here designated): Mart., Hist. Nat. Palm. 3: T. 155. figure 4. 1837.

Solitary small to moderate palm. Stem 1.3–6 m tall, 2–5 cm diam.; internodes elongate, green to grey with age; crown with 5–10 leaves; leaf bases persistent immediately below crown. Leaves to 130 cm long, irregularly segmented with united or single pinnae, or regularly pinnate with single pinnae; petiole 24–80 cm long, 5.5–8 mm wide; pinnae 10–30 per leaf, to 30 cm long, 5–200 mm wide, glossy mid- to dark green above, lighter green below, truncate with toothed apices; midrib and veins prominent on both surfaces; lamina, when backlit under 10× magnification, has numerous circular clear "cells" to 0.1 mm wide, linearly parallel to midrib and veins. Inflorescence to 100 cm long; peduncle 30–60 cm long; prophyll 20–30 cm long; rachis to 50 cm long. Staminate flowers pointed in bud, angular/pyramidal, 6–13 mm long; petals rigid, apically pointed, acutely heeled, green at anthesis, not widely opening at anthesis, 6–13 × 7–10 mm, with deep longitudinal striations in the dried state; stamens 8–12; connective apiculate and extending beyond attachment of anthers; anthers subulate. Fruit globose to ovoid to elongate/cylindrical, 12–15 × 5–10 mm, red at maturity; epicarp smooth. Seed elongate/ellipsoid (Figs. 3, 4).

Distribution. From just north of Gympie (Qld)—Home Logging area—at 26°05′S to John's Mt. just north of Taree (NSW) at 31°30′S, in rain forest from sea level to 1 200 m elevation, primarily on basalt soils, less common on metamorphics and alluvial soils.

Etymology. In reference to the inflorescence being a single spike.

Common name and uses. Walking-stick palm; stem once used for walking-sticks and umbrella handles.

Phenology. Fruiting December to June.

Conservation. Not threatened or rare.

Representative specimens. QUEENSLAND: Wide Bay. Home Logging Area, SF 502, N of Gympie, 26°05′S, 152°43′E, 170 m alt., 5 Oct 1993, *Bean 6681* (BRI); Moreton. Mooloolah R., Jowarra Reserve, on Track #1, 1 km from start, 26°50′S, 152°55′E, 20 m alt., 1 Apr 1996, *Dowe 0305* (BRI); Main Range NP, SW side of Mt. Bell, Terriot Brook, 28°13′S, 152°29′E, 880 m alt. 9 Aug 1995, *Forster 17409* (BRI): Mt. Barney, saddle between peaks, 28°17′S, 152°41′E, 1 100 m alt., 7 Oct 1992, *Forster 11909* (BRI).

NEW SOUTH WALES: Mt. Warning, SE slopes, on track to summit, 28°25′S, 153°20′E, 600 m alt., 31 Mar 1996, *Dowe 0302* (BRI, FTG); Mt. Warning, SE slopes, on track to summit, 28°25′S, 153°20′E, 850 m alt., 31 Mar 1996, *Dowe 0303* (BRI, FTG); Whian Whian SF, 1953–

58, *Webb & Tracey s.n.* (BRI); Byron Bay, 28°30′S, 153°30′E, 30 Nov 1970, *Bell 311* (BRI); Brunswick R., main arm, 27 Aug 1936, *White 10516* (BRI); Dorrigo SF, 830 m alt., 4 Oct 1930, *White 7472* (BRI); John's R., Jul 1915, *Boorman s.n.* (NSW [47061]).

Martius' (1837) protologue for *L. monostachya* (as *Areca monostachya*) refers to an unnumbered A. Cunningham collection from the Hastings River, New South Wales. This collection appears to be no longer extant, and therefore Martius' illustration Tab. 155. figure 4 has been designated here as the lectotype. *Linospadix monostachya* is a common species occurring in the rain forests of southern Queensland and northern New South Wales. It is the largest species of the genus in Australia, and is distinguished by pointed angular/pyramidal staminate buds, mature flowers that are approximately twice the size as those in other species, globose fruit, and solitary habit.

2. Linospadix microcarya (Domin) Burret, Notizbl. Bot. Gart. Mus. Berlin-Dahlem 12: 331. 1935. *Bacularia microcarya* Domin, Biblioth. Bot. 85: 499. 1915. Type: Australia, Queensland, Harvey's Ck., 1889, *Bailey s.n.* (holotype: BRI[AQ75431]).

Bacularia sessilifolia Becc., Atti Soc. Tosc. Sc. Nat. Pisa Mem. 44: 133. 1934: Type: Australia, Queensland, Cook District, Russell R., 1886, *Sayer s.n.* (FI).

[*Bacularia sessilifolia* var. *multisecta* Becc., *nom. invalid,* in Martelli, Nuovo Giorn. Bot. Ital. 42: 30. 1935. (Mss in Herb.). Type: not designated.]

[*Linospadix microcarya* var. *multisecta* (Becc.) Burret, *nom invalid,* Notizbl. Bot. Gart. Mus. Berlin-Dahlem 12: 331. 1935. Type: not designated.]

Clustering small palm. Stems 1–6, to 3 m tall, 7–25 mm diam., internodes elongate, green; crown with 5–9 leaves. Leaves 28–70 cm long, irregularly segmented with united pinnae, segments with broad bases, or regularly pinnate; petiole 1–23 cm long, 3–6 mm wide; pinnae 3–23 per leaf, 11–36.5 cm long, by 0.9–7.4 cm wide, semiglossy, lettuce to mid-green above, sometimes dark green when in deep shade, lighter green below; midrib and secondary veins prominent on both surfaces; terminal pair broader than adjacent laterals and often basal pair broader than laterals; lamina, when backlit under 10× magnification, with numerous scattered clear elongate "cells" 0.5–1 mm long linearly parallel to midrib and veins. Inflorescence to 80 cm long. Staminate flowers globose to squatly bullet-shaped in bud, 2–5 mm long; petals three times the length of sepals, apically rounded, without longitudinal striations, cream/dull yellow at anthesis, not widely opening; stamens 8–12; connective not extending beyond the anther. Fruit globose to turbinate, 5–9 × 5–8 mm, yellow-orange, or pink to red at maturity; epicarp smooth. Seed subglobose (Figs. 5, 6).

Distribution. From Mts. Spurgeon and Lewis to just south of Innisfail, most common on the lower slopes of Mts. Bartle Frere and Bellenden-Ker, and the Malbon Thompson Range, from near sea level to 1 600 m elevation, in rain forest on granite, or occasionally on basalt and metamorphics.

Etymology. In reference to the small fruit.

Conservation. Rare (Queensland Herbarium 1994). This designation could be revised to Common: distribution covers an area of approximately 120 km in length and the species is common throughout this range.

Representative specimens. QUEENSLAND: Cook District, Mt. Spurgeon, Platypus Ck., 20 Sep 1936, *White s.n.* (BRI, QRS); Summit of Mt. Spurgeon, 1 300 m, 12 Aug 1971, *Stocker 780* (BRI, QRS); TR 140, Cow LA., 16°30′S, 145°10′E, 1 150 m, 27 Sep 1973, *Irvine 654* (QRS); Mt. Lewis, SFR 143, North Mary LA., 1 000 m, 16°30′S, 145°16′E, 4 Oct 1973, *Irvine 662* (QRS); Mt. Lewis, 15 km N of Rex Hwy., 16°30′S, 145°15′E, 900 m alt., 13 Feb 1996, *Dowe 0260* (BRI, FTG); Mt. Lewis, 9 km from Rex Hwy., on Mt. Lewis Rd., 16°35′S, 145°16′E, 350 m alt., 5 Apr 1996, *Dowe 0319* (BRI, FTG); Harvey's Ck., 17°15′S, 145°55′E, 100 m, 31 Oct 1974, *Irvine 1033* (BRI, QRS); Boonjee SFR 1230, 17°25′S, 145°45′E, 720 m, 23 Jan 1973, *Irvine 445* (QRS). North Kennedy, head of Culla Ck., 1.4 km S of Cooroo Peak, 14 km NW of South Johnstone, 17°31′S, 145°53′E, 60 m alt., Oct 1988, *Jessup GJM2559, Guymer & McDonald* (BRI).

Bailey's 1889 collection from Harvey's Creek (BRI [AQ75431]), cited by Domin in his 1915 protologue, is the type specimen for *Linospadix microcarya.* This species is the most common *Linospadix* in the Mt. Bellenden-Ker and Mt. Bartle Frere area. *Linospadix microcarya* stands apart from the other species due to some unique features: the leaf lamina contains elongate clear "cells" that are visible under 10× magnification, fruit is turbinate

(infrequently globose), and staminate flowers do not open widely at anthesis.

3. Linospadix palmeriana (F. M. Bailey) Burret, Notizbl. Bot. Gart. Mus. Berlin-Dahlem 12: 331. 1935. *Bacularia palmeriana* F. M. Bailey, Report on a Government Scientific Expedition to Bellenden-Ker 67. 1889; Synop. Queensl. Fl., 3rd Supplement 77. 1890; Queensl. fl. 5: 1680. 1902; Comp. Cat. Queensl. Pl. 573, figure 554. 1913. Lectotype (here designated): Australia, Queensland, Mt. Bellenden-Ker, 700 m, 1889, *Bailey s.n.*, (BRI [AQ77548]).

Linospadix aequisegmentosa (Domin) Burret, Notizbl. Bot. Gart. Mus. Berlin-Dahlem 12: 331. 1935. *Bacularia aequisegmentosa* Domin, Biblioth. Bot. 85: 500. 1915. Lectotype (here designated): Domin, Biblioth. Bot. 85: T. 18. figures 1–8. 1915.

Clustering small palm. Stems 1–6, to 2 m tall, 8–20 mm diam.; internodes elongate, green; crown with 8–12 leaves. Leaves regularly segmented with united pinnae, most often with two segments either side of rachis, infrequently simply bifid, segments with broad bases, or regularly and finely pinnate; petiole 5.5–13 cm long; pinnae 2–24 per leaf, dull to semiglossy dark green above, lighter green below; midrib prominent on both surfaces, veins numerous and prominent on both surfaces, terminal pinnae broader than laterals; lamina, when backlit under 10× magnification, with numerous circular clear "cells" to 0.1 mm wide, linearly parallel to midrib and veins. Inflorescence to 60 cm long. Staminate flowers squatly bullet-shaped in bud, glabrous, to 3 × 2 mm; petals apically rounded, green at anthesis, not widely opening, deeply striated in the dried state; stamens 6–9; connective not extending beyond the anthers; anthers oblong. Fruit elongate/cylindrical, 10–15 cm × 5–7 mm, yellow or red at maturity; epicarp smooth or with barely discernible rugose appearance. Seed elongate/ellipsoid (Fig. 7).

Distribution. Confined to Mts. Bartle Frere and Bellenden-Ker, in rain forest, on granite, metamorphics, and occasionally on shallow basalts overlying metamorphics, from 300 to 1 600 m elevation.

Etymology. Named for Edward Palmer, M. L. A., of whom Bailey wrote "indebted for much useful information as to the uses made by the aboriginals of our indigenous plants."

Conservation. Rare (Queensland Herbarium 1994).

Representative Specimens. QUEENSLAND: Cook District. Mt. Bellenden Ker, ridge between cableway and north peak, 17°15′S, 145°51′E, 1 500 m alt., 3 Sep 1986, *Clarkson 6569* (MBA, QRS); Mt. Bellenden-Ker, 17°16°S, 145°52′E, 1 500 m, 20 Dec 1994, *Gray 5873* (QRS); Summit of Bellenden-Ker, Centre Peak, 1 400 m, undated, *Webb & Tracey 13688* (QRS); Mt. Bartle Frere, from the base of the mountain, undated (1889?), *Bailey s.n.* (MEL); Mt. Bartle Frere summit walking track, 17°22′S, 145°45′E, 750 m alt., 15 Feb 1996, *Dowe 0276* (BRI, FTG); 25 Aug 1996, *Dowe 0370 & Smith* (BRI); Boonjee, SFR 755, 17°30′S, 145°40′E, 680 m, 8 Jul 1971, *Dockrill 189* (QRS).

In the protologue for this species, Bailey refers to the distribution of this species on Mt. Bartle Frere "... the base of the leading spur, at about 2 000 feet, and from that to the summit of the south peak, an altitude of over 5 000 feet." Of what were possibly many specimens collected from this area, at least two are extant: BRI [AQ75548] from Meston's Spur at high elevation and MEL [unnumbered] from "the base of the mountain" to quote Bailey's hand-written notes attached to this collection. The former is chosen here as the lectotype as it best represents the taxon as interpreted in this work.

4. Linospadix minor (W. Hill) F. Muell., Fragm. 11: 58. 1878. *Areca minor* W. Hill, Report on Brisbane Botanic Gardens 1874 6. 1874. *Kentia minor* F. Muell., Fragm. 8: 235. 1874; 9: 195. 1875; 10: 121. 1877; Bentham, Fl. Austral. 7: 137. 1878. *Bacularia minor* F. Muell., Fragm. 11: 58. 1878; F. M. Bailey, Queensl. fl. 5: 1679. 1902. Lectotype (here designated): Australia, Queensland, Bellenden-Ker Ranges, undated, *Hill s.n.* (MEL [79769]).

Bacularia intermedia C. T. White, Proc. Royal Soc. Queensl. 47(5): 83. 1936. Type: Australia, Queensland, Mowbray R., 21 Jan 1932, *Brass 1975* (holo: BRI [AQ24160]).

Clustering small palm. Stems 1–5 m tall, 7–20 mm diam.; internodes elongate, green; crown with 7–12 leaves. Leaves to 110 cm long, irregularly segmented with united pinnae, segments with broad bases, or regularly pinnate with narrow pinnae; petiole 3.6–51 cm long, 1–4 mm wide; pinnae 3–24 per leaf, semiglossy dark green above, lighter green below, midrib prominent on both sur-

faces, veins not prominent on lower surface; lamina chartaceous, irregularly corrugated, when backlit under 10× magnification, with scattered, circular clear "cells" to 0.1 mm wide linearly parallel to midrib and veins. Inflorescence to 80 cm long. Staminate flowers squatly bullet-shaped in bud, to 3 × 2 mm wide; petals apically rounded, with conspicuous longitudinal striations, green at anthesis, not widely opening; stamens 7–20, attached at different levels in the staminal cluster; connective not extending beyond the anther; anther lobes irregular or uneven. Fruit elongate/cylindrical, 8–18 × 3–8 mm, yellow or red at maturity, epicarp irregularly rugose when fruit is fully mature. Seed elongate/ellipsoid (Figs. 8, 9).

Distribution. Recorded from the southern McIlwraith Range where it has limited distribution, and abundantly from just south of Cooktown (Mt. Amos area) to Mission Beach (Licuala State Forest) and as far inland as Windsor Tableland, from sea level to 1 200 m elevation, in rain forest on basalt, granite, and metamorphics. Reported in New Guinea, but identification is not certain.

Etymology. Named for its smaller stature as compared to *L. monostachya*, the only other species known at the time of its description.

Conservation. Not threatened.

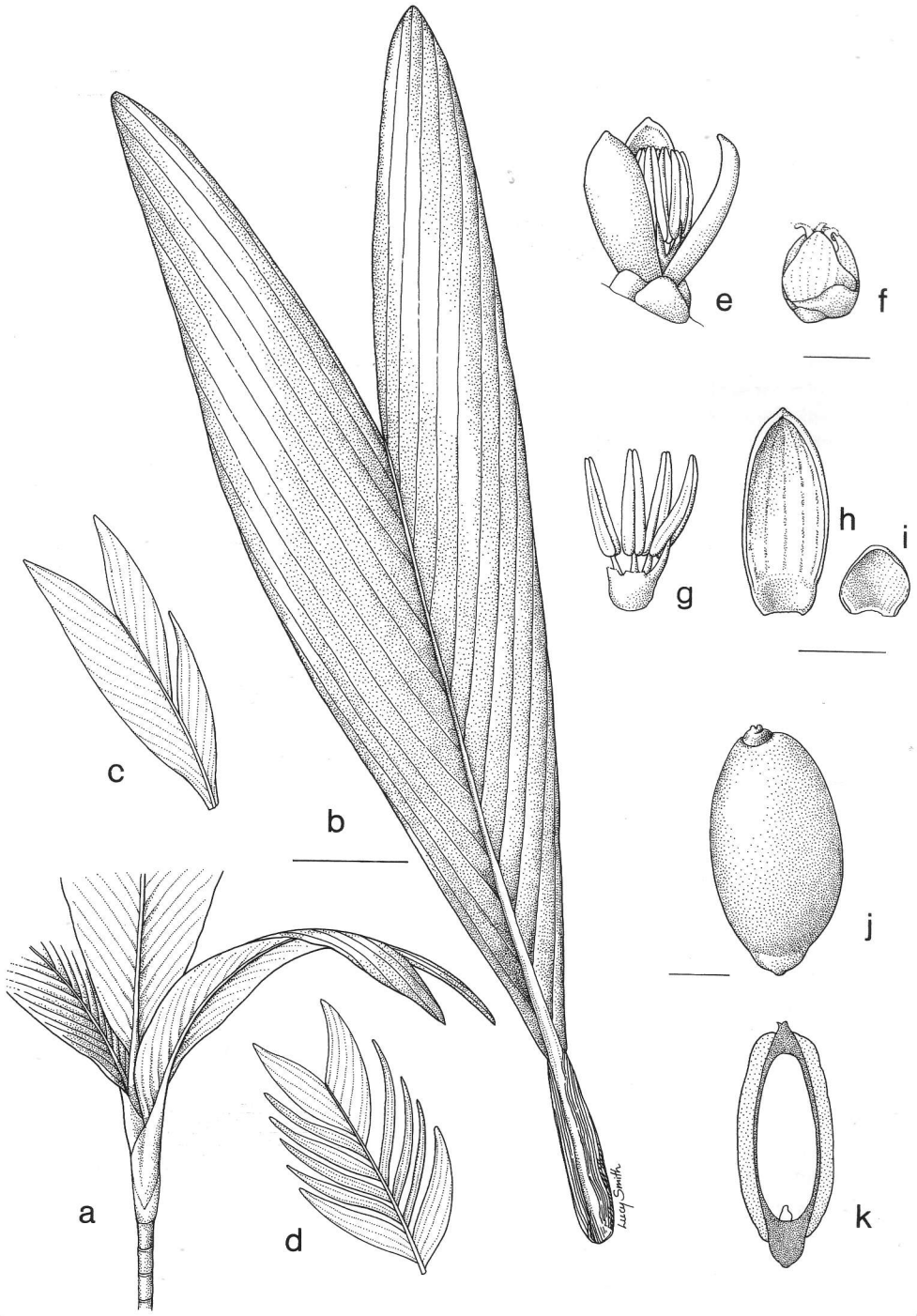
Representative Specimens. QUEENSLAND: Cook District. Leo Ck., upper Nesbit R., 420 m alt., 16 Aug 1948, *Brass 19868* (BRI); Upper Nesbit R., 13°26′S, 143°10′E, 400 m, Sep 1974, *Webb & Tracey 13472* (BRI, QRS); TR 14, 13°40′S, 143°20′E, 450 m, 21 Sep 1972, *Irvine 364* (QRS); Leo Ck., TR14, 13°44′S, 143°23′E, 360 m alt., 19 Jun 1995, *Forster 16845* (BRI); McIlwraith Range, head of Lankelly Ck., 13°52′S, 143°20′E, 600 m alt., Oct 1969, *Webb & Tracey 9527A* (BRI); Annan R., upper Parrot Ck., 400 m alt., 17 Sep 1948, *Brass 20271* (BRI); TR 146, Tableland LA., 15°45′S, 145°15′E, 700 m, 8 Jul 1975, *Irvine 1488* (QRS); Daintree NP, Olivers Ck., 50 m alt., 13 Feb 1996, *Dowe 0256* (FTG); TR 55, Whyanbeel, 16°20′S, 145°20′E, 220 m, 25 Jul 1975, *Irvine 1458* (QRS); Mt. Lewis, 15 km from Rex Hwy., 16°35′S, 145°15′E, 900 m alt., 13 Feb 1996, *Dowe 0263* (FTG): SFR 143, Little Mossman LA., 16°35′S, 145°20′E, 350 m, 15 Apr 1975, *Irvine 1324* (QRS); SFR 1137, Jurs Ck., 17°55′S, 146°05′E, 15 m, 31 Oct 1974, *Irvine 1045* (QRS); Licuala SF, Licuala Forest Drive, 1 km from Tully/Mission Beach Rd., 17°56′S, 146°03′E, 40 m alt., 16 Feb 1996, *Dowe 0283* (BRI, FTG).

Although Hill (1874) did not mention a specific collection in his protologue, his collection from Bellenden-Ker (MEL [79769]) is here chosen as the lectotype. *Linospadix minor* is the most vegetatively variable species in the genus. Plants may be sparsely or densely clustered, and leaves may be small to large with few to many segments.

5. **Linospadix apetiolata** Dowe & A. K. Irvine **sp. nov.** (Figs. 10, 11).

Palma parva caespitosa a speciebus affinibus petiolo semper carenti et habendo basi folia surcularia magna bifida differt; aliquot formae ubi adultae retinent folia magna bifida vel alioquin folia partim secescerunt sed apice magno bifido praedita; perianthium segmentis viridibus; flores staminati sub anthesi late aperientes 9–12 staminibus praediti; fructus cylindrici flavi rubrive sub maturitate. Typus: Australia. Queensland. Cook District. Mt. Lewis, off forestry road 27 km from Rex Hwy., 100 m E of Ranger's hut, 16°28′S, 145°16′E, 1 220 m, 24 Aug 1996, *Dowe 0369, Ferrero & Smith* (holotypus BRI; isotypi K, QRS).

Clustering small palm. Stems 1–6, 2–5 m tall, 15–25 mm diam.; internodes elongate, green; vegetative aerial growths from nodes common; crown with 6–14 leaves. Leaves 30–90 cm long by 10–20 cm wide, simply bifid or with broad bilobed terminals and evenly segmented laterals on both sides of midrib and broader pinnae or with one lobe entire and running the length of the rachis and the other lobe segmented into pinnae; dull or semiglossy light green above, lighter green below, with a metallic sheen on both surfaces; midrib very prominent on both surfaces; secondary veins prominent on both surfaces; petiole absent or rarely very short to 3 cm long; lamina thick, opaque to partially translucent, when backlit under 10× magnification, with scattered, circular clear "cells" to 0.1 mm wide linearly parallel to midrib and veins. Inflorescence to 80 cm long. Staminate flowers squatly bullet-shaped in bud, 2.8–4 mm long; petals with conspicuous longitudinal striations, apex shortly acute to rounded, green at anthesis, widely opening at anthesis; stamens 4–7; connective not extending beyond the anthers; pistillode lacking. Fruit elongate/cylindrical, 10–15 × 5–6 mm, yellow or red at maturity; epicarp moderately rugose when fully mature. Seed elongate/ellipsoid, 9–10 × 3–4 mm.



11. *Linospadix apetiolata*. a: Crown, showing leaf attachment and lack of petiole. b: Leaf (bifid form). c: Leaf (partially segmented form). d: Leaf (segmented form). e: Staminate flower. f: Pistillate flower. g: Stamens. h: Petal of staminate flower. i: Sepal of staminate flower. j: Fruit. k: Fruit in longitudinal section with position of embryo indicated. b from *Dowe 0323* (BRI); e, g–i from *Irvine 639* (QRS); j–k from *Gray 5934* (*spirit #11980*) (QRS). Scale bars: b = 55 mm. e–f = 2 mm. g–i = 2 mm. j–k = 3 mm. Drawing by Lucy Smith.

Distribution. Confined to Mts. Spurgeon and Lewis, above 800 m elevation, on soils derived from granite in Simple Microphyll Vine forest.

Etymology. In reference to the lack of a petiole on the leaf.

Conservation. Listed as K (Queensland Herbarium 1994) but here proposed as rare.

Representative Specimens: QUEENSLAND: Cook District. Mt. Spurgeon, rock site N side of junction of Platypus Ck. and Mossman R., 16°30′S, 145°15′E, 1300 m, 9 Dec 1972, *Webb & Tracey 11328* (QRS); Mt. Spurgeon, near Christensen's Clearing, Zarda LA, TR 142, 16°30′S, 145°10′E, 1150 m alt., 24 Sept, *Irvine 639* (QRS); Mt. Lewis, SFR 143, North Mary LA., 16°30′S, 145°15′E, 1000 m, 12 Feb 1975, *Irvine 1158* (QRS); Mt. Lewis, Carbine LA, SFR 143, 16°29′S, 145°15′E, 1200 m alt., 25 Jan 1995, *Gray 5934* [spirit No 11980] (QRS); Mt. Lewis, 15 km from Rex Hwy., 16°35′S, 145°15′E, 900 m alt., 13 Feb 1996, *Dowe 0262, 0264 & 0270* (BRI, FTG).

The type specimen for *L. apetiolata* is *Dowe 0369, Ferrero & Smith* collected from Mt. Lewis, at 1220 m elevation. It represents some of the variation that occurs in the species, particularly those forms in which the leaves are bifid, with one lobe entire and running the full length of the rachis, the other lobe segmented into pinnae. Some forms retain the bifid leaf into maturity while others have leaves which are evenly pinnate though with the apical segments united to remain strongly bilobed, and the basal pinnae either slightly broader or much broader than the laterals.

Acknowledgments

The authors would like to thank the directors and staff of those herbaria (B, BM, BRI, FI, MEL, NSW, QRS) that loaned specimens or gave access to the collections and assistance with literature. Dr. Les Pedley of Queensland Herbarium provided the Latin diagnosis and Ms. Lucy Smith of Townsville prepared the line drawings.

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CHAPTER NEWS AND EVENTS (*Continued from p. 210*)

Palm Society of South Texas

The Palm Society of South Texas (PSST) generally meets monthly, with some exceptions, on the first or second Saturday of the month. For latest information on the next upcoming meeting, contact President Bill Bittle (email: sabal@shelley.dbstech.com) or the Secretary, Jan Cartwright, 15 Curlew, Rockport, TX 78382, USA.

In addition to news about local chapter meetings and events, the Summer 1997 issue of the *Bulletin of the Palm Society of South Texas* included several articles of interest, including "Growing Palms from Seed ... Small Amounts of Money, Large Amounts of Time" by Don Tollefson and Bill Bittle; "The Never-Ending Battle to Fight Frost" by Thad Magyar; "A History of Severe Freezes in the Lower Rio Grande Valley [of Texas]," by Richard Travis; and "How to Optimize Cycad Seed Germination" and "A Growth Medium For Cycads," both by Tom Broome, President of the Central Florida Chapter of the IPS.

Palm Beach Palm & Cycad Society [Florida]

The June–July 1997 *Bimonthly Newsletter of the Palm Beach Palm & Cycad Society* included an interesting article on "Some Colorful Palms" by Paul Craft. Included were write-ups and descriptions of palms with colorful crownshafts, palms with silvery blue leaves, palms with colorful emerging leaves, and palms with silvery or bronzy undersides of leaves. August marked the inaugural issue of the Palm & Cycad Times, a revamped chapter newsletter. In addition to local chapter news, the issue included "The Road to Extinction may be Paved with Good Intentions" by Chuck Hubbuch, a summary by Paul Craft of the "IPS Directors Meeting" recently held in Richmond, U.K., and "Ten Great Palms for South Florida" also by Paul.

The Palm Beach Chapter will hold their ninth annual Palm & Cycad Fall Show at Morikami Park on October 11–12. Sale hours will be 9:00 a.m. to 5:00 p.m. on Saturday and 9 to 4 on Sunday. For more information on the Palm Beach Chapter, write to them at 16652 Velazquez Boulevard, Loxahatchee, FL 33470, USA or contact Paul Craft at palmnut@icanect.net via email (see the accompanying Membership Roster for additional contact information).

Central Florida Palm & Cycad Society

In addition to numerous short articles on local chapter news and events, the May 1997 issue (Vol. 17, issue 3) of the *Central Florida Palm & Cycad Society Newsletter* included a number of articles of interest to other palm enthusiasts on disease and pest control and prevention. Included were "Keeping your Palms Fern-Free," "A Fight with a Palmetto Weevil", "Palm Insects and Their Control," and an in-depth article on a "New Pest [*Aulacaspis yasumatsui*] Threatens Cycas." The issue also featured an update on the chapter's Seed Distribution (partially through the IPS email listserver, IPSC) and a summary of some recent email traffic on the IPSC listserver. Mike Dahme also presented an interesting analysis of *Borassus* seeds distributed in and from south Florida.

The Central Florida Chapter will meet on October 5th at Harry P. Leu Gardens in Orlando, for both an interesting lecture by Larry Noblick of the Montgomery Foundation and the chapter's annual plant auction. For more information on this active group, contact Membership Chairman John Strykjewski, 5155 Wildwood Avenue, Merritt Island, FL 32953, USA or contact at membership@cfpacs.palms.org via email.

South Florida Chapter

The South Florida Chapter of the IPS will hold their "grandaddy of all palms sales" on November 1–2, 1997 at Fairchild Tropical Garden. For more information on the Fall Palm Show and Sale or information about other upcoming events of the South Florida Chapter, contact Bill Olson, 30150 S.W. 170 Ave., Homestead, FL, 33030 USA or contact Rick Leitner at FitnessUSA@aol.com via email.

Southern California Chapter

The Southern California Chapter of the International Palm Society usually meets bimonthly on weekends at various palmy venues throughout southern California. For information on upcoming meetings, call the Chapter Secretary Rebecca

Rodolff (619-563-1594) or contact President Gary Wood at palmnut@telis.org by email.

The July 1997 issue of *The Palm Journal* was devoted to the monotypic Australian genera. Related articles included "Calyptrocalyx polyphyllus: an exciting palm species from Papua New Guinea and its potential for ornamental horticulture" by Mike Ferrero of Flecker Botanic Gardens in Cairn, "Australia's Monotypic Endemic Palm Genera: Carpentaria, Normanbya, Wodyetia, Hedyscepe, Laccospadix, Lepidorrhachis, and Oraniopsis" by Don Hodel, and "Experiences with Australian Palms"—a series of individual's comments about their experiences with culture of these palms. The issue also included a number of nice photographs of several of these palms.

Other articles of interest in this issue were "Water Water Everywhere" exploring a concern of all palm enthusiasts and "Your Seed Lady on the Loose," a travelogue by member and seed collector Inge Hoffmann.

Pacific Northwest Palm & Exotic Plant Society

The Pacific Northwest Palm & Exotic Plant Society will hold their next general meeting and elections on November 24, 1997, in the classroom at VanDusen Gardens. For more information on the Pacific Northwest Palm & Exotic Plant Society, contact one of the officers listed in your IPS Membership Roster or send an email to Richard Woo at 72370.1466@compuserve.com via the internet.

The Hardy Palm International Edition number 31 (August 1997) included, in addition to local society news, articles on "Vancouver's West End—Then and Now," "Over-wintering Exotic Plants in Containers," "Palm Fossils Unearthed on Vancouver Island," "Palms in St. Louis, Missouri," "Radical Surgery for Frost-damaged Palms," "Salt Spring Island Bureau," "Hardy Species for Zone 6—They're Out There Somewhere," and "Growing Palms in the Pacific Northwest (Post Planting Techniques)."

News from the Fous de Palmiers

Fous de Palmiers, the French Palm Society, has elected new officers this summer. These are: President (Président) Steve Swinscoe; Vice Presidents Pierre-Oliveir Albano, Violette Décugis, and Jacques Deleuze; Treasurer (Trésorière) Bruno Cara; Secretary (Secretaire) Daniel Jacquemin; and, IPS Correspondent Steve Swinscoe. To contact the chapter by email, send a message to Jacques Deleuze at jbcor@mic.fr on the internet.

For more information on upcoming Fous meetings, contact any of the above officers. The Fous also publishes a very nice journal, *Le Palmier*, which is available with Fous membership.

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Back Cover

Woodturnings from palm endocarps and seeds (all turnings by Gene Doren, photo first appeared in the book *The Art of the Lathe*, courtesy of Chapelle Publishing). See pp. 184–189 and 215–217.


Betel Nut Palm
Giant Raphia
Tagua Nut