PRINCIPES

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THE PALM SOCIETY

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JOURNAL OF THE PALM SOCIETY

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Cover Picture

The inflorescence of *Pritchardia minor* at Kokee, Kauai, Hawaii has woolly bracts and a single flowering branch at its apex. Photo by Mary Grierson. See page 65.

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An Inventory of Palms in Hawaii

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The Biennial Meeting in June 1980 is almost here. The staffs of the various botanic gardens and private collectors in Hawaii have been hard at work inventorying their palms, and our inventory[1] is printed here to let you know what we have (and don't have) so you can better prepare yourselves for the trip.

In the inventory, a code follows the species name. The capital letters designate the garden, the small letters the growth status of the palm. An "f" means the palm has set fruit, an "m" that it is mature (has flowered) but for some reason has not set fruit, an "i" that it is planted in the ground but immature, and an "n" that it is still in the nursery. Many rare and exciting species are still found only in the nursery. Take this with a grain of salt. These could be ready to plant in the ground, or they could be seed several years old, with little hope of germinating. The status used is for the most developed palm of that species in each collection. Thus, if one is fruiting, but ten are in the nursery, "f" is used.

This inventory is a conservative listing of our collections. Excluded are all undetermined species, plants identified only to genus, those under invalid names, and those whose identification is questioned. In a few instances, when transfers have not been made to the appropriate genus or where taxonomic problems may be involved, a valid name is included parenthetically, as in *Pinanga* and *Mauritia*. Of those on the list, I would hope our identifications are 95% correct. There are many more palms in our collections yet to be identified. Who knows what discoveries lie in store.

Oahu

The Honolulu Botanic Garden System includes seven gardens on Oahu administered by the Department of Parks and Recreation of the City and County of Honolulu. Foster Botanic Garden is the parent institution which handles the accession data for all the gardens and distributes the plants to them according to the theme of each garden and the proper environment. Three of the gardens have substantial palm collections—Foster, Wahiawa, and Koko Crater. Paul Weissich has directed the system since 1957.

Foster Botanic Garden lies on ap-

[1] This inventory results from the efforts of many people. I would like to thank the following for their sustained cooperation: Paul Weissich and Godfrey Chun of Foster Garden, Gilbert Yamada of Wahiawa Botanic Garden, Wesley Teraoka, Douglas Okamoto, and David Silva of Lyon Arboretum, Keith Woolliams of Waimea Arboretum, Hiram Fong of the Senator Fong Plantation Garden, Dr. William Theobald and Scott Lucas of Pacific Tropical Botanical Garden, Donn Carlsmith, Tom Kunichika, Jean Herbst, and Toshio Imoto of Onomea, Howard Horiuchi of the Hilo Nursery Arboretum, Don Hodel of the Kona Botanic Garden for information on collections, and Dr. H. E. Moore, Jr. of the L. H. Bailey Hortorium for checking the taxonomy and nomenclature of the list. Any errors are my own.

proximately 15 acres at 50 N. Vineyard Boulevard in downtown Honolulu. It was the estate of Dr. William Hillebrand, author of *The Flora of the Hawaiian Islands*, from 1853 to 1871, during which time he introduced many new species to Hawaii and planted them on the grounds. In 1880, Thomas R. and Mary Foster bought the land and added to the earlier plantings. The Hawaiian Sugar Planters Association (HSPA) in 1918 set up a plant introduction nursery adjacent to the property, and under the direction of Dr. Harold L. Lyon many of these introductions were planted in the Fosters' yard. In 1930, the land was deeded to the City and County of Honolulu. Due partly to Dr. Joseph Rock's interest in palms, a palm garden was established in 1933, now filled with many mature specimens. Other major collections include orchids, bromeliads, cycads, aroids, and economic plants. The garden also maintains an important botanic library.

Wahiawa Botanic Garden is at about 1000 ft elevation on the Schofield Plateau of Oahu. It receives 100 in of rain a year and is considerably cooler than Honolulu. The 27-acre garden is situated in the large gulch of an intermittent stream, and was originally another test site for plantings by HSPA. The New Caledonian palms thrive there. Other collections include gingers, heliconias, ferns, aroids, and native Hawaiian plants.

Koko Crater receives less than 25 in of rain a year. The 208-acre site is contained entirely within an old volcanic cone east of Diamond Head and houses a collection of cactus, succulents, and desert palms.

The Harold L. Lyon Arboretum is located in the back of Manoa Valley, where it receives 160 in of rain a year on steep topography at 450 to 1300 ft elevation. Sunbathers at Waikiki Beach, 4½ miles away, may often find their view of the valley head blocked by rain and framed by a rainbow. Originally named the Manoa Arboretum, it was started in 1918 by HSPA as a reforestation test site. Thus Foster Garden, Wahiawa Botanic Garden, and Lyon Arboretum shared a long period of plant introduction under Dr. Lyon. In 1953, the University of Hawaii assumed control of this 124-acre rain forest which is now concerned mainly with research and instruction. A research library and herbarium support this work. Other collections include aroids, Marantaceae, heliconias, gingers, ferns, *Eucalyptus*, *Ficus*, bromeliads, native Hawaiian plants, economic plants, Hawaiian ethnobotanic plants, and ornamental ti (*Cordyline terminalis*).

Waimea Arboretum, on Oahu's north shore, is part of a private tourist attraction, Waimea Falls Park. The arboretum is only six years old but progress has been impressive. Most of the palms are not yet mature, but a major palm planting is just getting under way. The park includes 1800 acres, but so far the arboretum is restricted to the wind-protected, steep-sided valley of Waimea Stream. The arboretum runs the length of the stream from Waimea Falls, where rainfall is 75 in per year, to the estuary and sandy beach at the ocean, with a rainfall of 20 in per year. The park includes a restaurant and shuttle bus service and there is an entrance fee. Emphasis is on Hawaiian plants, plants of the Ogasawara Islands, *Hibiscus*, peperomias, aroids, heliconias, gingers, Liliaceae, Commelinaceae, and Acanthaceae. Some Hawaiian archeological sites are also being restored.

At the urging of Dr. Joseph Rock, parts of the University of Hawaii campus at Manoa at one time were designated a botanic garden and planted

with many rare trees and palms. Unfortunately, this practice has been discontinued. A good collection of mature palms remains and is worth the visit, especially for seed collecting.

The Senator Fong Plantation Garden is still in the development stage on Oahu's windward side. Two small valleys of this 150-acre garden have been devoted to palms and with time this should become a collection worth seeing. Former Senator Hiram Fong intends to build a restaurant and a political library, and to have tours of the plantings of fruit trees and colorful ornamentals. Also planned are a bamboo garden and various ethnic gardens—Japanese, Chinese, Filipino, Hawaiian, and European.

Kauai

The Pacific Tropical Botanical Garden occupies 186 acres of Lawai Valley on the southern coast of Kauai. Adjacent lands are available to it in the future and it oversees two other gardens and three preserves on Kauai, Maui, and Hawaii. The congressionally chartered garden is privately funded and emphasizes research and education. A collection of coconuts and Hawaiian *Pritchardia* is being developed at Kahanu Gardens on Maui. Other collections at PTBG include economic plants, erythrinas, and gingers. Rainfall at Lawai is about 44 in per year with relatively dry summers and wet winters.

Hawaii

Donn Carlsmith, the present president of The Palm Society, has been collecting palms at Onomea, just north of Hilo, for 14 years. Through the seed bank and other friends, he has gathered together an important collection. The 31 acres of land was mostly used for sugar cane plantings in earlier years. It has good soil with 120 in of rain per year. Those palms preferring a cooler climate go to Keolahou at 6000 ft elevation.

The Hilo Nursery Arboretum was started in 1920 on 19.4 acres of land in Hilo. Most of its palms are mature specimens, isolated enough for good photographs, and many are fruiting. The arboretum also contains a large number of fruit and timber trees.

Don Hodel's collection is included here since he has travelled widely, collecting many of his rarer species himself. He has also generously distributed his palms to other botanic gardens, filling important gaps in their collections. Most of Don's palms are still in pots, wellgrown, and he hopes eventually to be able to start a permanent collection in the ground. He manages the Ho'olau Nursery in Kealakekua, Hawaii.

The diversity of soil types and microclimates in Hawaii offers good growing conditions for practically every type of palm. Of the roughly 2500 types of palms known, about 650 are presently being tried in a collection somewhere in Hawaii. However, a mere 30 kinds of palms may be said to be commonly used in landscaping or available in the nurseries.

List of Palms Cultivated in Hawaii

Explanation of abbreviations: f, fruiting; i, planted but immature; m, mature; n, nursery; C, Donn Carlsmith's collection at Onomea (Hawaii); DH, Don Hodel's collection at Kealakekua (Hawaii); F, Foster Botanic Garden (Oahu); H, Hilo Nursery Arboretum (Hawaii); HF, Senator Fong Plantation Garden (Oahu); K, Koko Crater Botanic Garden (Oahu); L, Harold L. Lyon Arboretum (Oahu); P, Pacific Tropical Botanical Garden (Kauai); U, University of Hawaii, Manoa Campus (Oahu); W, Wahiawa Botanic Garden (Oahu); WA, Waimea Arboretum (Oahu).

Acanthophoenix rubra (A. crinita), F-n, C-n, DH-n
Acoelorrhaphe wrightii, F-f, W-i, L-f, WA-i, U-f, HF-i, P-i, H-f
Acrocomia aculeata, P-n
ierensis, U-f
media, F-f
mokayayba, F-n, C-n
totai, F-n
vinifera, F-n
spp., F, L, C
Actinokentia divaricata, F-n, W-m, L-i, WA-n, C-n, DH-n
Actinorhytis calapparia, F-n, L-i, P-i, DH-n
sp. (New Guinea), W-i, L-i, C-i
Aiphanes acanthophylla, F-i, W-i, L-f, WA-n, P-i
caryotifolia, W-i, L-f, HF-i, P-i, C-n, H-f, DH-n
corallina, F-f, L-i, U-f
erosa, L-i, WA-n, P-i
lindeniana, F-f, L-f, P-n, C-i, H-f, DH-n
simplex, F-n
sp., W, WA, C
Allagoptera arenaria, C-n, DH-n
Alloschmidia glabrata, F-n, W-i, L-n, C-n, DH-n
Ammandra decasperma, L-n, P-n, C-i
Archontophoenix alexandrae, F-f, L-f, HF-i, P-f, C-f, DH-n
alexandrae var. beatricae, WA-n
alexandrae (weeping), C-i
cunninghamiana, F-f, L-f, C-f
sp. (purple crownshaft), F-i, W-f, L-n, WA-n, P-n, C-i, DH-n
Areca aliceae, F-f, L-i, C-f, H-f, DH-n
catechu, F-f, L-f, WA-n, HF-f, P-f, C-f, H-f, DH-i
catechu (white fruit, Tikopia Island), L-i
concinna, F-f, L-f, WA-n, C-f, DH-n
glandiformis, F-i, W-i, L-f, P-n, DH-n
guppyana, L-f, WA-n, C-i, DH-n
hutchinsoniana, L-n, WA-n, DH-n
ipot, F-n, L-n, WA-n, C-n, DH-n
macrocalyx, F-n, L-n, WA-n, P-n, C-n, DH-n
macrocarpa, WA-n, DH-n
triandra, F-f, L-f, P-n, C-n, DH-n
vestiaria, F-f, W-f, L-f, HF-i, P-i, C-f, DH-n
whitfordii, L-n, DH-n
spp., F, W, L, WA, C, DH
Arecastrum romanzoffianum, F-f, L-f, U-f, HF-i, P-i, C-f, H-f
Arenga ambong, W-i, L-i
australasica, F-n, W-i, WA-n, HF-i, P-n, C-i, DH-n
caudata, F-n, W-m, L-i, WA-n, HF-i, P-i
engleri, F-m, L-f, WA-n, P-i, C-f
microcarpa, F-i, L-i, C-i
obtusifolia, F-f, L-i, U-f, P-i, C-i
pinnata, F-f, L-f, WA-n, P-n, C-n, H-i, DH-n
porphyrocarpa, F-f, W-i, L-f, P-i, C-f
tremula, F-i, L-i, WA-n
undulatifolia, F-m, L-m, P-n, C-i
westerhoutii, F-i, L-i
wightii, F-i, C-n
spp., F, L, WA, C
Arikuryroba schizophylla, F-f, L-f, HF-i, P-n, C-n, DH-n
Asterogyne martiana, F-n, DH-n
Astrocaryum aculeatum, L-n
confertum, L-i
malybo, L-n
murumuru, F-i
standleyanum, F-n, L-i, P-n, C-i, H-f, DH-n
standleyanum var. calimense, F-n, L-n, DH-n
tucuma, F-i
vulgare, L-n
spp., F, L, WA, C
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Bactris baileyana, F-n
balanoidea, F-n, W-m
cruegerana, L-n
gasipaes, F-i, W-i, L-i, P-n, H-f
guineensis, L-i
longiseta, L-n
major, F-n, L-n, P-n
setosa, F-n
setulosa, P-n
spp., F, L, P, C, H
Balaka longirostris, F-n, W-f, L-f, WA-n, C-n, DH-n
microcarpa, F-n, C-n, DH-n
rechingerana, F-n, C-n
seemannii, L-m, P-i, C-n, DH-n
siliensis, F-n, W-m, C-n, DH-n
tuasivica, L-i
spp., F, L, WA, C, DH
Barbosa pseudococos, F-n
Basselinia eriostachys, F-n, W-i, L-n, C-n, DH-n
pancheri, F-n, C-n, DH-n
tomentosa, F-n, W-i, C-n, DH-n
spp., F, C, DH
Bentinckia condapanna, F-n, P-n, C-n, DH-n
nicobarica, F-f, L-f, P-i, C-i, DH-n
Bismarckia nobilis, F-n, L-i
Borassodendron machadonis, F-i, L-n
Borassus aethiopum, K-i
flabellifer, F-m
Brahea aculeata, F-n, K-i
armata, F-n, K-i, L-n, U-f, C-n
bella, K-i, L-n, C-i, DH-n
berlandieri, K-i
brandegeei, F-n, K-i, L-i, U-f, P-i, C-n
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elegans, K-i

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sp. (B. "calcarea"), K-i
spp., F, K
Brassiophoenix drymophloeoides, L-i, WA-i, P-i, C-i, DH-n
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tanga, F-n, L-i
Cyrtostachys lakka, F-i, L-m, HF-i, P-i, C-i, DH-n
renda, F-i, W-i, L-n, C-i, DH-n
spp., F, L, C

Daemonorops angustifolia, W-i
hystrix, W-i, C-i
longipes, W-i, C-n
mollis, F-i, WA-n, DH-n
periacantha, F-n
spp., F, L, HF, P, C
Deckenia nobilis, F-n, L-i, P-n, C-i, DH-n
Desmoncus orthacanthos, F-n, L-i, P-n, C-i
polyacanthos, F-n WA-n
sp., DH
Dictyocaryum fuscum, F-n
Dictyosperma album, F-f, W-i, L-i, WA-n, U-f, HF-i, P-i, C-i, H-f, DH-n
album var. aureum, F-m, W-i, L-f, WA-n, C-i
Drymophloeus beguinii, F-f, P-i, C-f, DH-n
oliviformis, F-n, L-f, WA-n, P-i, C-i, DH-n
oninensis, C-i
pachycladus, F-n, L-n, WA-n, DH-n
samoensis, F-n, C-n, DH-n
subdistichus, F-n, L-n, DH-n
Dypsis gracilis, F-n
sp., F, L, C

Elaeis guineensis, F-m, L-f, WA-n, HF-i, P-i, C-f, H-i
oleifera, F-m, L-i, P-n, H-f
Euterpe controversa, F-n, P-n, C-n
edulis, L-i, P-n, C-i
microcarpa, F-n, P-n, DH-n
oleracea, F-n, L-n, WA-n, C-i
precatoria, F-n, P-n, C-n, DH-n
spp., F, L, WA, P, C, H, DH

Gaussia attenuata, F-f, L-i, H-f, DH-n
princeps, F-m, L-f, C-i, H-i
Geonoma aspidiifolia, C-n
interrupta, C-i
oxycarpa, F-n, P-n
pinnatifrons, C-n, DH-n
schottiana, F-n
sodiroi, F-n, C-n
spp., F, W, L, C
Gronophyllum microcarpum, L-n
ramsayi, F-n, C-n
Gulubia costata, F-n, DH-n
macrospadix, F-n, W-i, C-n, DH-n
palauensis, F-n, L-n, P-n, C-n, DH-n
spp., L, WA, C

Hedyscepe canterburyana, W-i, DH-n
Heterospathe elata, F-f, W-i, L-f, WA-i, U-f, HF-i, P-i, C-i, DH-n
minor, F-m, L-n, P-n, C-n, DH-n
negrosensis, L-n, DH-n
salomonensis, L-n
sensisi ?, F-n, DH-n
woodfordiana, F-m, L-n, C-f, DH-n
spp., F, W, L, WA, P, C, DH
Howea belmoreana, F-m, W-f, L-m, WA-n
forsterana, F-m, L-i, WA-n, C-i, DH-n
Hydriastele beccariana, L-n, P-n, C-n
kasesa, L-i
microspadix, L-n
wendlandiana (H. douglasiana), F-n, L-i, C-n, DH-n
spp., F, L, WA, HF, P, C, DH
Hyophorbe indica, W-i
lagenicaulis, F-f, L-m, U-f, HF-i, C-i, H-i, DH-n
verschaffeltii, F-f, L-f, U-m, HF-i, P-i, C-i, DH-n
lagenicaulis × H. verschaffeltii, F-m, L-m
sp., WA
Hyospathe lehmannii, F-n, C-n, DH-n

Hyphaene coriacea, P-n
crinita, F-m, P-n, DH-n
schatan, K-i
thebaica, F-f, C-i
thebaica × H. crinita, HF-i

Iriartea gigantea, F-n, L-n, WA-n, DH-n
Iriartella setigera, C-n

Jessenia bataua (J. polycarpa), F-n
spp., F, L, WA, P, C, DH
Johannesteijsmannia altifrons, F-n, WA-n
Juania australis, F-n, C-n
Jubaea chilensis, L-i, C-n
Jubaeopsis caffra, F-i, L-i

Kentiopsis oliviformis, F-n, W-i, L-n, WA-n, P-i, C-n, DH-n
Korthalsia rubiginosa, F-n, C-n

Laccospadix australasica, F-n, W-i, L-n, WA-n, P-n, C-i, DH-n
Latania loddigesii, F-m, L-m, WA-i, U-f, P-i, C-i, H-m, DH-n
lontaroides, F-f, L-n, C-i, DH-n
verschaffeltii, F-f, L-m, C-n, DH-n
verschaffeltii × L. loddigesii, U-f, HF-i, H-m, DH-n
Leopoldinia piassaba, C-n
Lepidocaryum spp., C
Licuala ferruginea, F-i, C-i
flabellum, W-m
glabra, F-n
glabra var. selangorensis, L-i, C-n
grandis, F-f, L-m, WA-i, HF-i, P-i, C-m, H-f, DH-n
lauterbachii, F-m, W-i
paludosa, P-i, C-n, DH-n
peltata, L-i, C-i
petiolulata, F-n
ramsayi, F-n, L-i, WA-n, P-n, C-i, DH-n
rumphii, L-n
spinosa, F-f, W-i, L-i, HF-i, P-i, C-i, H-i, DH-n
"elegans" (of W. Sumawong), W-i, L-i, C-i, DH-n
spp., F, L, WA, P, C
Linospadix minor, C-n, DH-n
monostachya, L-m, HF-i
palmerana, L-n, DH-n
spp., F, L, C, DH
Livistona alfredii, F-n, P-n
australis, F-n
benthamii, F-n, P-n, C-n
chinensis, F-f, L-i, WA-i, U-f, HF-i, P-m, C-i
chinensis var. boninensis, WA-i
chinensis var. subglobosa, P-i, H-i
decipiens, P-n
drudei, F-n, L-i, WA-n, DH-n
eastonii, F-n, L-n, P-n, DH-n
humilis, F-n, P-n, C-n, DH-n
inermis, F-n, L-n, DH-n
loriphylla, F-n, P-n, C-n
mariae, F-m, WA-n, P-n
muelleri, F-n, L-i, WA-n, P-n, C-n, DH-n
robinsoniana, L-n, WA-i, H-f, DH-n
rotundifolia, L-i, WA-n, U-f, HF-i, P-m, C-i, H-f, DH-n
rotundifolia var. luzonensis, F-f, L-n, WA-n, DH-n
saribus, F-f, L-i, WA-i, HF-i, P-m, C-i, DH-n
speciosa, F-n, WA-n
woodfordii, F-n, P-n, C-i, DH-n
spp. F, W, L, WA, HF, P, C, DH
Lodoicea maldivica, F-m, C-i
Loxococcus rupicola, F-n, L-n, P-n, DH-n

Mackeea magnifica, F-n, L-n, C-n, DH-n
Manicaria saccifera, F-n, C-n
Mauritia aculeata?, F-n
armata, F-n, DH-n
flexuosa, F-n, C-n
sp. (Mauritiella pacifica), F-n
sp., F, C
Maximiliana maripa, C
Metasocratea hecatonandra, F-n, C-i, DH-n
Metroxylon amicarum, F-f, L-i, C-i, H-f
sagu, L-i
salomonense, F-n
upolense, F-n, L-n, WA-n, P-n, C-i, DH-n
vitiense, F-i, C-i
warburgii, F-n, L-n, WA-n, P-i, C-n, DH-n
Microcoelum insigne, L-n
weddellianum, W-f, L-f, HF-i, P-n, C-f, DH-n
Myrialepis scortechinii, F-n

Nannorrhops ritchiana, F-n, L-n, WA-n, P-i, C-n
Nenga pumila, C-n
Nengella spp., F, L, P, C, DH
Neodypsis baronii, F-n, L-n
decaryi, F-f, L-i, WA-n, P-i, C-i, DH-n
lastelliana, F-n, L-n, P-n, C-n, DH-n
spp., F, L, P, C
Neonicholsonia watsonii, F-n, P-n, C-n, DH-n
Neophloga spp., F
Neoveitchia storckii, F-n, L-n, WA-n, P-n, C-i, DH-n
Nephrosperma vanhoutteanum, F-m, W-i, L-n, WA-n, P-i, C-m, DH-n
Normanbya normanbyi, F-f, W-i, L-i, WA-n, P-n, C-i, H-i, DH-n
Nypa fruticans, F-n, WA-i, P-n

Oenocarpus bacaba, C-i
distichus, F-n
dryanderae, F-n

huebneri, G-n
multicaulis, C-n
panamanus, F-n, L-m, P-n
spp., F, L, P, C, DH
Oncosperma fasciculatum, F-n, W-i
horridum, W-i, L-n, DH-n
tigillarium, F-f, W-i, L-i, C-i, DH-n
Opsiandra maya, F-i, L-f, C-n, DH-n
Orania appendiculata, F-n, P-n, C-n, DH-n
archboldiana, P-n
decipiens var. montana, L-n, DH-n
disticha, P-i, C-n
lauterbachiana, F-n, L-n, C-n, DH-n
palindan, F-i, L-i, WA-n, P-i, DH-n
sylvicola, F-n, W-i, L-n
spp., W, C, DH
Orbignya cohune, F-f, L-i, P-n, C-i, DH-n
cuatrecasana, F-n
guacuyule, W-i
lydiae, L-n
martiana, F-i
spectabilis, F-i
sp., F

Palandra aequatorialis, WA-n, C-i
Parajubaea cocoides, W-i, L-n, P-n
sp., WA, C
Parascheelea sp., F, P, DH
Pelagodoxa henryana, F-f, W-i, L-i, WA-n, P-i, C-i, DH-n
Phloga nodifera, F-n, L-n, C-n, DH-n
sp., F, P, C
Phoenicophorium borsigianum, F-f, W-i, L-i, HF-i, C-i, DH-n
Phoenix acaulis, F-f, P-i, C-n, DH-n
canariensis, L-n, WA-i, P-n, C-i
dactylifera, F-i, K-i
loureirii, F-n, W-m, L-m, DH-n
pusilla, F-m, L-n, C-i
reclinata, F-i, K-i, L-i, WA-n, P-n, C-i, H-f, DH-n
roebelenii, F-f, L-f, WA-i, U-m, HF-i, P-i, C-f, H-f, DH-n
rupicola, W-m, L-i, U-i, C-n, DH-n
sylvestris, F-m, DH-n
spp., F, L, U, HF, P, C
Pholidocarpus macrocarpus, L-n
majadum, F-n, WA-n, P-n, C-n, DH-n
Physokentia dennisii, F-n, L-i, P-n, C-n, DH-n
insolita, L-i, C-n
rosea, F-n, P-n, C-n
thurstonii, F-n
Phytelephas macrocarpa, DH-n
Pigafetta filaris, F-n, W-i, L-i, WA-i, HF-i, P-n, C-i
Pinanga barnesii, DH-n
copelandii, L-n, WA-n, DH-n
coronata, L-f
dallasensis, F-n, C-n
densiflora, W-i
elmerii, DH-n
geonomiformis, F-n, L-n, WA-n, C-n, DH-n
grandis, F-i
insignis, F-f, L-f, WA-n, C-n, DH-n
isabelensis, DH-n
javana, W-i, WA-i, C-n
kuhlii, F-f, L-f, WA-i, HF-i, C-f, H-f, DH-n
latisecta, C-i
limosa, F-n
maculata, F-n, W-i, L-n, DH-n
malaiana, F-n, L-i, WA-n, DH-n
modesta, DH-n
noxa, DH-n
patula, L-n, C-i, DH-n
punicea, C-n
scortechinii, F-m
speciosa, L-n, DH-n
sp. (Pseudopinanga aristata), C-n
sp. (Pseudopinanga pilosa), F-n, C-n
spp., F, W, L, WA, U, HF, P, C, DH
Pododoccus barteri, F-n
Polyandrococos caudescens, F-f, W-i, L-f, WA-n, P-n, C-n, DH-n
Prestoea acuminata, F-n
montana, F-n, L-n, WA-n, C-f
pubigera, F-i, L-f, C-n, DH-n
spp., F, L, C
Pritchardia affinis, F-i, W-i, L-n, WA-n, P-n, C-i, DH-n
affinis var. gracilis, F-n, W-i, L-i, WA-n, P-n, C-n, DH-n
affinis var. halophila, WA-n, DH-n
affinis var. rhopalocarpa, F-i, L-i
arecina, F-f, L-i
aylmer-robinsonii, F-n, WA-n, P-i, DH-n
beccariana, F-i, W-i, L-n, WA-n, C-i, DH-n
beccariana var. giffardiana, F-i, W-i, L-i, WA-n, C-n, DH-n
brevicalyx, F-n, W-i, DH-n
donata, WA-n
eriophora, F-i, P-n, DH-n
eriostachya, F-n, W-i, L-i, WA-n, U-f, C-i, DH-n
forbesiana, W-i, L-i, WA-n, C-n, DH-n
gaudichaudii, F-f, W-i, L-i, WA-n, DH-n
hardyi, W-i, L-n, WA-n, P-i, DH-n
hillebrandii, F-f, L-f, WA-n, U-f, HF-i, P-n, DH-n
insignis, F-i
kaalae, F-f, W-i, L-n, WA-n, P-n, DH-n
kaalae var. minima, F-n, W-i, WA-n, P-n
kahukuensis, F-i, W-i, L-i
kamapuaana, F-i, W-i
lanaiensis, F-i, P-n
lanigera, F-m, U-i
lowreyana, F-i, WA-n, U-f, HF-i, C-i
macdanielsii, F-n, W-i
macrocarpa, F-f, W-i, L-i, WA-n
(aff.) maideniana, L-n, WA-n, DH-n
martii, F-i, W-i, L-f, DH-n

martioides, F-n, W-i, L-f
minor, F-n, W-i, WA-n, P-n, DH-n
munroii, F-n, L-n, WA-i, P-i, DH-n
pacifica, F-f, L-i, WA-i, C-i, DH-n
remota, F-i, W-i, K-i, L-f, WA-i, P-i, DH-n
rockiana, DH-n
thurstonii, F-f, L-n, WA-n, U-f, HF-i, P-i, C-i, DH-n
viscosa, F-i, L-i
vuylstekeana, F-i
weissichiana, F-n, W-f, P-n, DH-n
spp., F, W, L, WA, U, HF, P, C, H, DH

Pseudophoenix sargentii, L-n, P-i
sargentii ssp. saonae, F-i
vinifera, F-n, WA-n, P-n, C-n

Ptychococcus lepidotus, C-i
paradoxus, F-m
spp., F, W, L, C, DH

Ptychosperma ambiguum, W-i, L-n, DH-n
burretianum, F-n, L-n, P-n, C-n, DH-n
elegans, F-f, L-f, WA-n, U-f, P-i, C-f, DH-n
hosinoi, F-n, C-i, DH-n, L-f
lauterbachii (P. hollrungii), L-i
ledermannianum, F-i, L-n, C-i, DH-n
macarthurii, F-f, W-f, L-f, WA-i, U-f, HF-i, P-i, C-f, H-f, DH-n
microcarpum, F-n, W-m, L-i, WA-n, HF-i, P-i, C-i, DH-n
propinquum, F-f, L-f, WA-i, C-n
salomonense, F-f, W-m, L-i, DH-n
sanderanum, F-f, L-n, U-f, C-f, DH-n
schefferi, DH-n
vestitum, P-n
waitianum, P-n, C-n
spp., F, W, L, WA, HF, P, C, H, DH

Raphia farinifera, F-i, L-f, HF-i, C-i
hookeri, F-n
monbuttorum, F-n
vinifera, L-i
spp., F, W, DH

Ravenea glauca, F-n, P-n, C-n, DH-n
latisecta ?, F-n
madagascariensis var. monticola, F-n, DH-n
robustior, F-n, L-n, HF-i, P-n, C-n, DH-n
spp., F, P

Reinhardtia gracilis, W-f, L-n, WA-n, P-m, C-i, DH-n
gracilis var. gracilior, F-m, W-i
gracilis var. rostrata, F-n
koschnyana, P-n
simplex, F-m, L-f, HF-f, P-n, C-n

Rhapidophyllum hystrix, L-i, C-n

Rhapis excelsa, F-m, L-m, WA-i, U-f, HF-i, DH-n
excelsa "dwarf", F-i, L-n, WA-n
humilis, F-i, L-i, WA-i, P-m
"dwarf Japanese", F-i, W-i, P-i
sp. (Thai, from W. Sumawong), W-i, L-m, WA-n, P-m, C-n, DH-m
sp. (variegated), F-n, L-n

Rhopaloblaste augusta, F-f, L-i, P-n, C-i, DH-n
ceramica, F-i, L-i, WA-i, P-i, C-i
elegans, F-n, WA-n, C-n, DH-n
singaporensis, HF-i
spp., L, P, C

Rhopalostylis baueri, L-i, C-n, DH-n
cheesemanii, W-i
sapida, W-m, L-n, HF-i, C-n, DH-n

Rhyticocos amara, F-f, HF-i, P-n, C-i, H-f, DH-n

Roscheria melanochaetes, F-n, L-i, C-i

Roystonea borinquena, F-i, W-i, L-i
elata, L-i, P-i, C-i, DH-n
hispaniolana, F-n
oleracea, F-f, L-f, U-f, P-i, C-i, DH-n
regia, F-f, L-i, WA-n, U-f, HF-i, P-i, C-i, DH-n
venezuelana, F-i
oleracea × R. regia, U-f
spp., F, L, C

Sabal bermudana, L-i, WA-n
causiarum, F-f, L-i, WA-i, P-i
etonia, L-n, WA-i, P-n
mauritiiformis, F-f, L-i, WA-i, U-f, C-i, DH-n
mexicana, F-f, L-i, WA-i, P-i, H-f
minor, F-f, L-f, WA-i, P-i, C-i
morrisiana, F-n
palmetto, F-f, L-i, WA-i, HF-i, C-n
parviflora, F-f, L-n, U-f, C-i
princeps (S. beccariana), F-i, L-n, P-i
uresana, F-n
"Riverside", L-n, C-n
spp., F, L, WA, HF, P, C, H, DH

Salacca conferta, F-n
edulis, W-i, L-m, WA-i, HF-i, C-n
wallichiana, W-i
spp., F, L

Satakentia liukiuensis, F-i, W-i, L-i, HF-i, C-i, DH-n

Scheelea butyracea, F-f, L-n, P-n
gomphococca, L-i
macrolepis, P-n
phalerata, F-n
rostrata, L-n
zonensis, L-i
spp., L, C

Serenoa repens, F-f, L-i, HF-i, P-i, C-n

Siphokentia beguinii, F-f, L-m, P-i, C-n, DH-n

Socratea durissima, F-n, L-n, WA-n, C-n, DH-n
exorrhiza, F-n
spp., F, C

Syagrus coronata, F-f, W-i, L-n, DH-n
flexuosa, F-f, P-n, C-i, DH-n
inajai, P-n, C-n
orinocensis, DH-n
sancona, W-i, P-i
spp., F, C, DH

Synechanthus fibrosus, F-n, W-f, L-f, P-n, C-i, DH-n
warscewiczianus, F-n, W-i, P-i, DH-n

Thrinax morrisii, F-f, C-n, H-f
radiata, F-f, L-f, WA-i, U-f, P-m, C-i, H-f, DH-n
spp., F, L, P, C, DH
Trachycarpus fortunei, L-i, WA-i, C-n
takil, W-i, L-i
wagneranus, W-m, L-n
spp., F, W, L, HF
Trithrinax acanthocoma, WA-i
biflabellata, P-n, C-n

Veillonia alba, F-n, C-n, DH-n
Veitchia arecina, F-i, L-f
joannis, F-f, L-f, WA-i, U-f, HF-i, P-i, C-i, DH-n
macdanielsii, F-i, L-f, WA-n, C-n, DH-n
merrillii, F-f, L-f, WA-i, U-f, HF-i, P-f, C-i, H-i, DH-n
montgomeryana, F-f, W-i, L-f, WA-n, HF-i, P-f, C-f, H-f, DH-n
pedionoma, WA-n
petiolata, F-n
sessilifolia, F-f, W-m, L-m, U-i, HF-i, P-m, C-n, DH-n
simulans, F-i, W-i, L-i
spiralis, F-n, L-n, C-n, DH-n
vitiensis, F-n, L-n, C-n, DH-n
vitiensis var. parhamiorum, W-m, L-i
winin, F-n, L-n, WA-n, P-m, C-i, DH-n
spp., F, L, HF, P, C, DH
Verschaffeltia splendida, F-i, L-f, WA-n, P-i, C-i, DH-n
Vonitra fibrosa, F-i

Wallichia disticha, F-n, L-i, WA-n, P-n, DH-n
spp., F, HF, C
Washingtonia filifera, K-i, L-n, WA-n, U-f, HF-i, P-i, H-m
robusta, F-f, L-i, WA-i, U-f, HF-i, P-i
spp., F, C
Welfia georgii, F-n, L-n, WA-n, C-n, DH-n
Wendlandiella polyclada, F-n, DH-n
Wettinia quinaria, F-n
Wissmannia carinensis, F-n, L-i, WA-i, HF-i, P-i

Zombia antillarum, F-i, WA-i

PALM QUESTIONS AND ANSWERS

Q. Have more palms been added to the list of susceptible species to lethal yellowing?

A. Yes. *Ravenea hildebrandti* and *Veitchia montgomeryana* have been added to the list. The revised host list now consists of the 26 species listed below.

1. *Allagoptera arenaria* (Gomes) Kuntze
2. *Arenga engleri* Becc.
3. *Arikuryroba schizophylla* (Mart.) L. H. Bailey (Arikury palm)
4. *Borassus flabellifer* L. (Palmyra palm)
5. *Caryota mitis* Lour. (Cluster fishtail palm)
6. *Chrysalidocarpus cabadae* H. E. Moore (Cabada palm)
7. *Cocos nucifera* L. (Coconut palm)—all varieties, including Malayan dwarf
8. *Corypha elata* Roxb. (Buri palm, gebang palm)
9. *Dictyosperma album* (Bory) H. Wendl. & Drude (Hurricane or princess palm)
10. *Gaussia attenuata* (O. F. Cook) Becc. (Puerto Rican gaussia)
11. *Howea belmoreana* (C. Moore & F. Muell.) Becc. (Sentry palm)
12. *Latania* (all species)
13. *Livistona chinensis* (Jacq.) R. Br. ex Mart. (Chinese fan palm)
14. *Hyophorbe verschaffeltii* H. Wendl. (Spindle palm)
15. *Nannorrhops ritchiana* (W. Griff.) J. E. T. Aitch. (Mazari palm)
16. *Phoenix canariensis* Hort. ex Chab. (Canary Island date palm)
17. *Phoenix dactylifera* L. (Date palm)
18. *Phoenix reclinata* Jacq. (Senegal date palm)
19. *Phoenix sylvestris* (L.) Roxb. (Wild date palm)
20. *Pritchardia affinis* Becc. (Kona palm)
21. *Pritchardia pacifica* Seem. & H. Wendl. (Fiji Island fan palm)
22. *Pritchardia thurstonii* F. Muell. & Drude

(Continued on page 81)

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Notes on Pritchardia in Hawaii

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It is no wonder that the Hawaiian Islands are blessed with a unique and interesting flora, isolated as they are by 2000 miles of ocean from the nearest high island or continental land mass. *Pritchardia*, the only genus of palms native to the Hawaiian Islands, is no exception. *Pritchardia* is a phenomenon of Pacific insular distribution with two species in Tonga and the Fijian islands, *P. pacifica* and *P. thurstonii*, two species in the Tuamotu Islands of French Polynesia, *P. pericularium* and *P. vuylstekeana*, and one species of unknown Polynesian origin, *P. maideniana*, yet nowhere has the genus proliferated as in the Hawaiian Islands. To date, the names of 33 species and 6 varieties of *Pritchardia* have been validly published for Hawaii (Table 1), making Hawaii the richest palm area in terms of species in the United States.

This proliferation into many taxa is a classic example of adaptive radiation that is common with other elements of the Hawaiian flora and it has generated some controversy about speciation in the genus. Several authors, Corner (1966), St. John (1932), Rock (1962), and MacCaughey (1918), have raised doubts about the validity of many Hawaiian *Pritchardia* species. Characteristics used to distinguish species appear to be highly plastic and descriptions have suffered from failure to incorporate ecological factors and from being based on inadequate herbarium material. The existence of ecotypes is very probable and the controversy surrounding several taxa of Hawaiian *Pritchardia* points out the need for new and extensive ecological and taxonomical studies of the genus. The confusion associated with some of the Hawaiian taxa is in evidence at several botanical gardens in Honolulu and at the University of Hawaii campus, where different species of *Pritchardia* were planted together years ago but cannot now be differentiated or have become so modified as to agree no longer with the original descriptions. In addition, there is the problem that pritchardias seem to hybridize freely in cultivation, producing new intermediate types that add further confusion. Seed from *Pritchardia* in cultivation is always suspect unless measures are taken to eliminate the possibility of hybridization. Today, most students of the Hawaiian flora feel that there are not as many valid species of *Pritchardia* as earlier botanists recognized and that further study will bring several nomenclatural changes with a good number of species being reduced to synonymity.

Pritchardias in Hawaii (Figs. 1, 2) are medium to tall, single trunked, unarmed, monoecious, fan palms. *Pritchardia* has been placed in the *Livistona* unit of the *Livistona* alliance of coryphoid palms (Moore 1973), making them most closely related to genera as *Livistona*, *Licuala*, and *Brahea*, among others.

The early Hawaiians were the first people to have contact with *Pritchardia* and named all members of the ge-

Table 1. List of validly published names of Hawaiian Pritchardia*

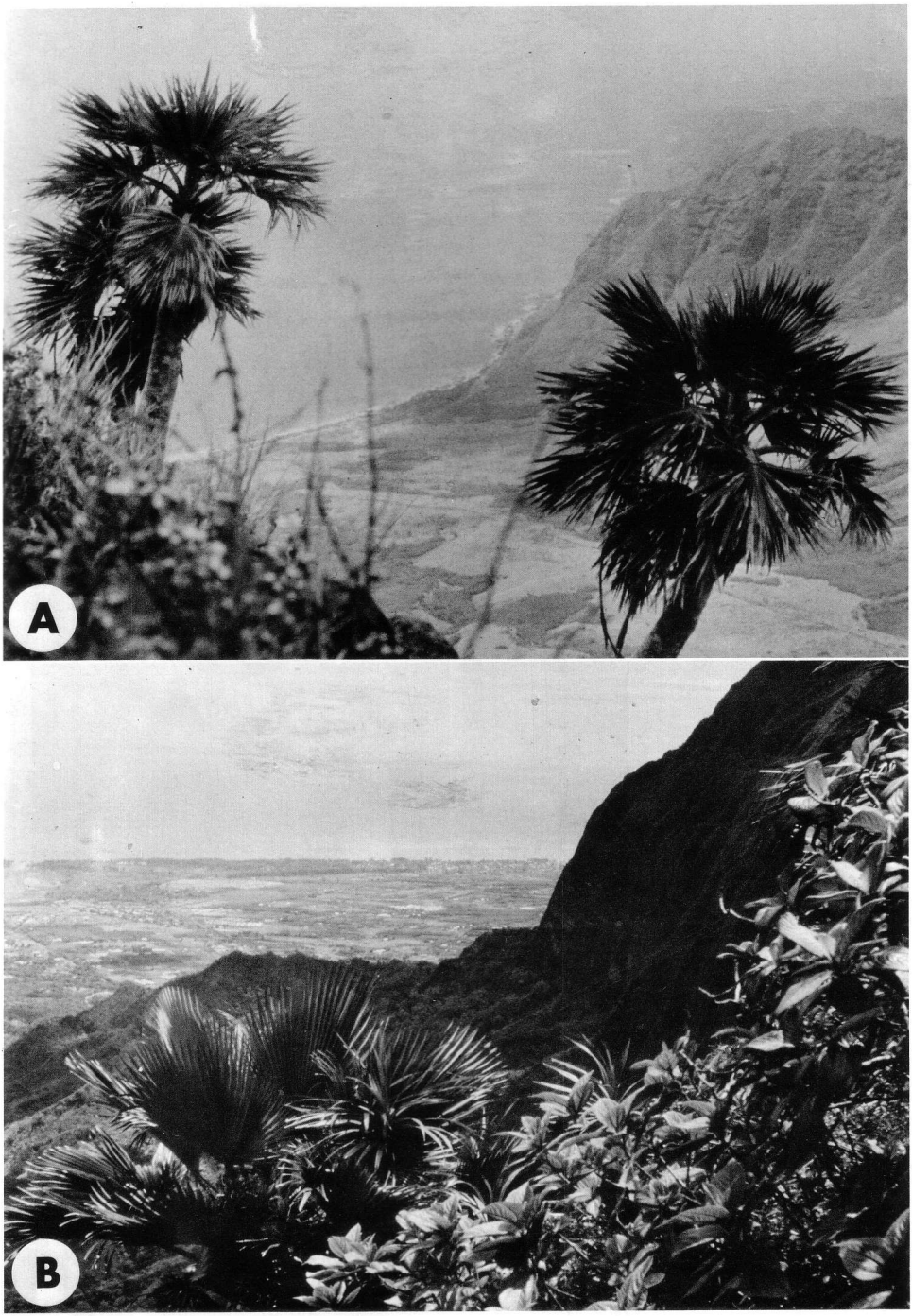
Species	Island	Endangered Status**
P. affinis Beccari	Hawaii	U, C
var. *gracilis* Beccari	Hawaii	U, C
var. *halophila* Beccari	Hawaii	U, C
var. *rhopalocarpa* Beccari	Hawaii	U, C
P. arecina Beccari	Maui	U, C
P. aylmer-robinsonii St. John	Niihau	vR, EN, C
P. beccariana Rock	Hawaii	C
var. *giffardiana* Beccari	Hawaii	C
P. brevicalyx Beccari & Rock	Molokai	U, C
P. donata Caum	Molokai	U
P. elliptica Caum & Rock	Lanai	R, D, EN
P. eriophora Beccari	Kauai	D, EN, C
P. eriostachya Beccari	Hawaii	U, C
P. forbesiana Rock	Maui	U, C
P. gaudichaudii (Mart.) H. Wendl.	Molokai	vL, EN, C
P. glabrata Beccari & Rock	Maui	U
P. hardyi Rock	Kauai	U, C
P. hillebrandii Beccari	Molokai	L, D, EN, C
P. insignis Beccari	Origin uncertain	U, C
P. kaalae Rock	Oahu	L, EN, C
var. *minima* Caum	Oahu	vL, vR, EN, C
P. kahanae Rock & Caum	Oahu	vL, vR, EN
P. kahukuensis Caum	Oahu	—
P. kamapuaana Caum	Oahu	—
P. lanaiensis Beccari & Rock	Lanai	EN, C
P. lanigera Beccari	Hawaii	U, C
P. lowreyana Rock	Molokai	U, C
var. *turbinata* Rock	Molokai	U
P. macdanielsii Caum	Oahu	vL, vR, C
P. macrocarpa Linden ex André	Oahu	prEX, C
P. martii (Gaud.) H. Wendl.	Oahu	C
P. martioides Rock & Caum	Oahu	—
P. minor Beccari	Kauai	U, C
P. montis-kea Rock	Hawaii	prEX
P. munroii Rock	Molokai	vL, vR, EN, C
P. remota Beccari	Nihoa	vL, EN, P, C
P. rockiana Beccari	Oahu	L, C
P. viscosa Rock	Kauai	U, C
P. weissichiana Rock	Kauai	U, C

* Names taken from St. John 1973.

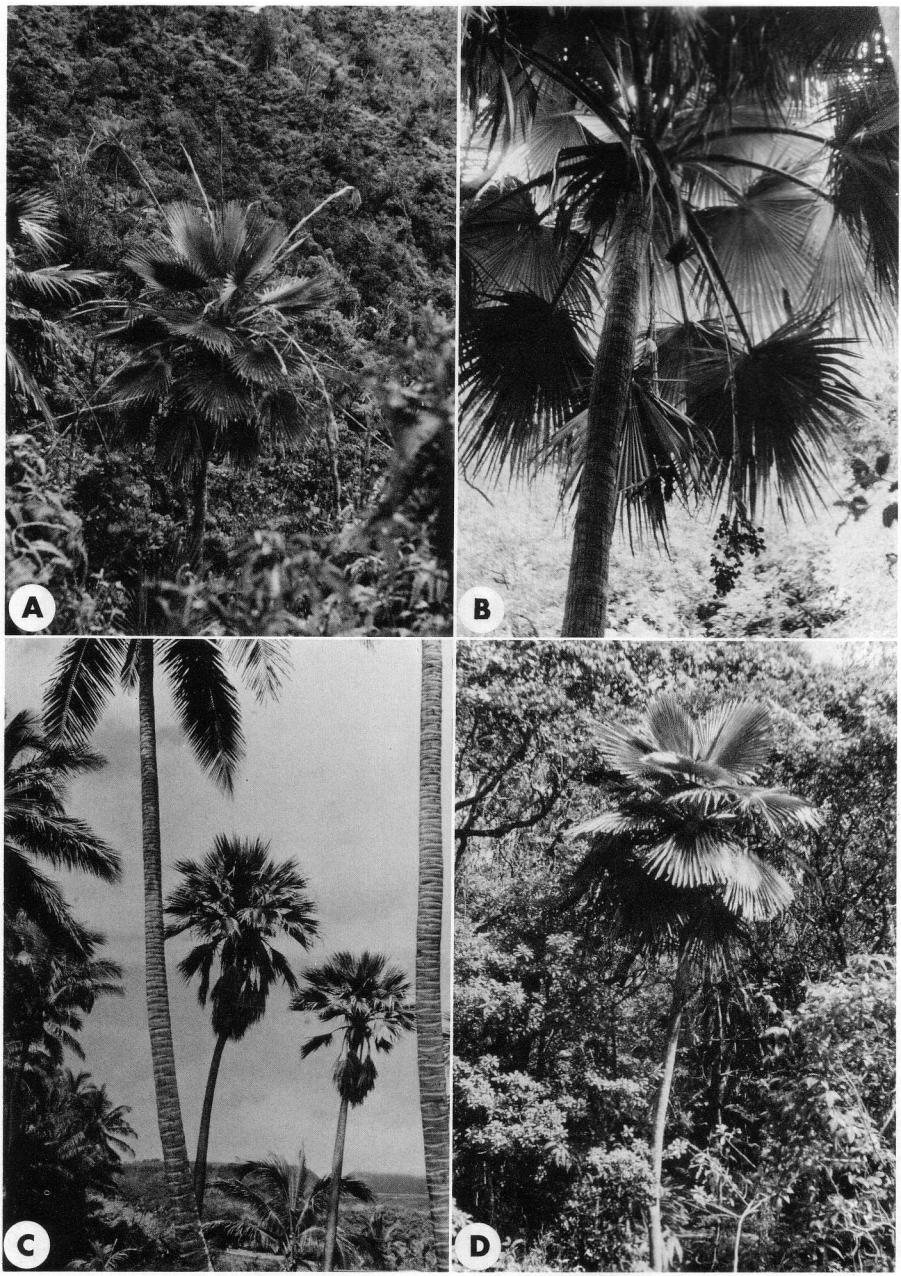
** Adapted and including information from Fosberg and Herbst 1975.

Explanation of symbols: C, in cultivation; D, depleted, much less common over most of its range than formerly, the depletion the result of human activities; EN, endangered, in considerable danger of disappearance; EX, extinct; L, local, found only or principally in one or more restricted areas; P, protected; pr, probably; R, rare, total population low, whether dangerously low or not; U, uncertain, not enough information available; v, very.

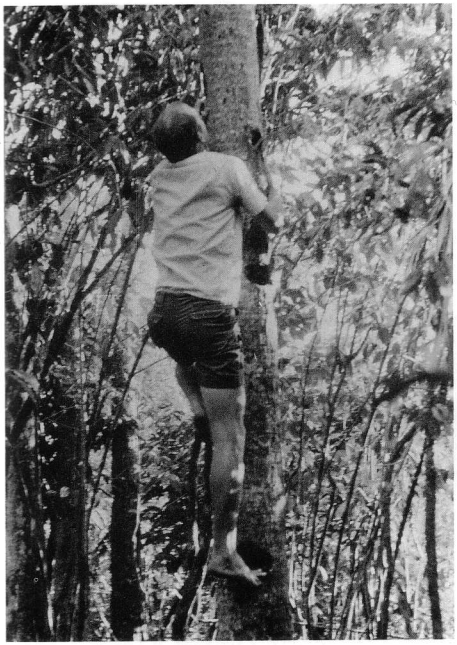
nus *lo'ulu*. Hawaiians utilized *lo'ulu* for fans, umbrellas, hats, baskets, and thatch in addition to prizing the immature fruits, named *hawane*, as a culinary delicacy (Hillebrand 1888, MacCaughey 1918, Beccari and Rock 1921, Neal 1965). It is not uncommon to find footholds carved into trunks of *lo'ulu* palms so that the leaves and fruit could be gathered more easily



1. *Pritchardia* in the Hawaiian Islands. A, *Pritchardia kaalae* var. *minima* on Ohikilolo Ridge, Oahu; B, *P. martii* on Manoa Crest, Oahu.



2. *Pritchardia* in the Hawaiian Islands. A, *Pritchardia weissichiana*, with long inflorescences, grows on the Power Line Trail, Kauai; B, *P. kaalae* at Makaleha Gulch, Oahu; C, *P. affinis* at Punaluu, Hawaii; D, *P. minor* at Kokee, Kauai.



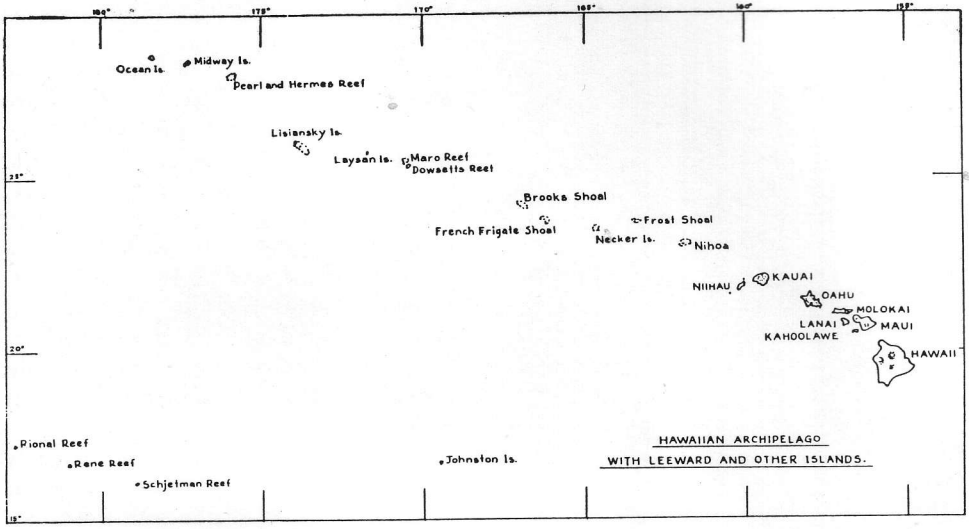
3. James R. Judd, III climbs *Pritchardia affinis* at Holualoa, Hawaii, using steps cut in the trunk.

(Fig. 3). Hillebrand (1888), MacCaughey (1918), and Beccari and Rock (1921) noted that *lo'ulu* was often cultivated around Hawaiian dwellings indicating that the palm played an important role in Hawaiian culture. Even today, old Hawaiian house sites are often marked by *lo'ulu* palms.

Today in Hawaii, *Pritchardia* has a notorious reputation for being located in inaccessible areas. I would say that this reputation is well deserved. A majority of the species are found in dense, impenetrable, wet rain forest where annual rainfall can be as high as 400 inches. These areas are often extremely rugged, mountainous, and dissected by steep canyons thousands of feet deep. There are few roads into these areas and one must walk on hunting trails for hours or even days, in some instances, in order to encounter the palms. In fact, of the 33 species named for Hawaii, only four species can be driven to and observed from the auto in their native habitat. These are *P. beccariana*, found in dense rain forest along Kulani Road outside of Hilo on the island of Hawaii; *P. affinis*, found as scattered individuals or small groups throughout the resort area of the dry Kona Coast on Hawaii; *P. hillebrandii*, scattered along the leeward coast of the island of Molokai; and *P. minor* or *P. eriophora*, located in rain forest overlooking Kalalau Valley at Kokee on the island of Kauai.

Pritchardia has suffered greatly from the ravages of man in Hawaii. Ten species and one variety were listed by Fosberg and Herbst (1975) as depleted, local, rare, and/or endangered due to habitat destruction or disturbance from clearing of land and introduction of goats, sheep, cattle, pigs, and deer. Rats, inadvertently brought by the Hawaiians and western man as stowaways, and the mongoose, introduced in a vain attempt to control the rat, are very likely detrimental to pritchardias. It is probable that regeneration of many of the taxa has been decreased. Finding mature fruits on trees in the wild is the exception rather than the rule. If rats and mongooses do not eat the fruit while it is still on the tree, they will most likely eat it after it has fallen to the ground. Fruits that do happen to escape rats and mongooses and germinate, still may be eaten by pigs and grazing animals.

Two species are probably extinct in the wild (Beccari and Rock 1921). One, *P. macrocarpa*, exists as only one plant in Foster Garden in Honolulu. The other, *P. montis-kea*, was known from just a few individuals in 1909 (Beccari and Rock 1921) and is assumed now to be extinct. Several persons have searched in vain for this palm and unfortunately, no cultivated



4. Map of the Hawaiian Islands.

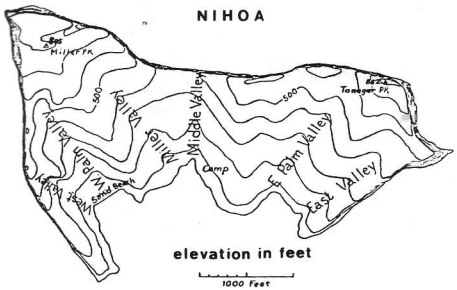
specimens exist. Another species, *P. munroii*, is known from only two remaining individuals on Molokai (Keith Woolliams personal communication) but fortunately this species was introduced to cultivation in 1976. Little is known of the endangered status of the remainder of the Hawaiian species. This underlines the need for new studies of *Pritchardia* before more taxa are lost.

Fortunately, many of the Hawaiian *Pritchardia* are in cultivation. The most outstanding collection of *Pritchardia* in Hawaii, and of all palms for that matter, in terms of number of species and maturity of the plants, has been assembled by Paul Weissich of Honolulu Botanic Gardens at their Foster Garden and Wahiawa Garden facilities. Also in Honolulu, Lyon Arboretum in Manoa Valley has a noteworthy collection.

Island Distribution

The Hawaiian Islands are volcanic in origin and stretch for 1600 miles across the north central Pacific Ocean in a northwesterly to southeasterly direction from the oldest island, Ocean or Kure, to the youngest island, Hawaii (Fig. 4). The older islands in the northwest section of the chain have been reduced to atolls or mere rock outcroppings. The younger islands to the southeast, including the six main windward islands of Kauai, Oahu, Molokai, Lanai, Maui, and Hawaii, are volcanic mountains although volcanic activity is now found only on the island of Hawaii. The Leeward Islands are those islands from Ocean to Nihoa while the Windward Islands are those from Niihau to Hawaii.

Due to the prevailing northeast tradewinds, the east, northeast, and north sides of the mountain slopes from 1000 to 5000 feet elevation are extremely wet. Rainfall amounts can average over 400 inches annually. In contrast, coastal leeward areas are exceedingly dry with precipitation averaging 10–20 inches annually resulting from infrequent cyclonic storms. Higher elevations, though, on the lee-



5. Map of Nihoa showing West Palm Valley and East Palm Valley where *Pritchardia remota* grows.

ward side of some of the islands may have up to 75 inches of rain annually and support a well developed forest.

Pritchardia is found growing on all the Windward Islands from Niihau to Hawaii except for dry, low Kahoolawe. The genus is also found on Nihoa Island of the Leeward group and was reported from Laysan although on Laysan it became extinct near the turn of the century (Christophersen and Caum 1931). The past existence of *Pritchardia* on Laysan is significant since it extended the range of the genus several hundred miles beyond what is known today and it would have been the only atoll existence of the genus in the Hawaiian Islands.

Generally speaking, *Pritchardia* is distributed in the wet, forested areas on the windward slopes from near sea level, as on Molokai, to over 4000 feet elevation as on Hawaii, Maui, Molokai, and Kauai. Notable exceptions to this are *P. affinis* on Hawaii, *P. hillebrandii* and *P. munroii* on Molokai, *P. lanaiensis* on Lanai, *P. kaalae* on Oahu, to some extent the *P. minor–P. eriophora* complex on Kauai, *P. aylmer-robinsonii* on Niihau, and *P. remota* on Nihoa. All are found in dry forests of leeward areas or, as with the latter two species, are found on dry islands too low to have sufficient orographic rainfall and subsequent development of forest.

Location symbols on the maps represent reported sightings of *Pritchardia*, whether it be significant individuals or large colonies. Specific names used were as they appeared in the reference consulted. I did not attempt to verify their taxonomic correctness. In some cases the author of a work did not feel confident to apply a specific name due to the confusion surrounding the genus. These cases appear on the maps as *Pritchardia* sp. undetermined.

Nihoa

Situated 200 miles northwest of Oahu, Nihoa (Fig. 5) is the highest island of the Leeward group. There have been several sightings of *Pritchardia* on Nihoa since the middle of the 19th century. In fact, the palms are quite conspicuous as they are found in two colonies comprised of several hundred individuals. The colonies are located in two valleys, West Palm Valley and East Palm Valley. The location of *P. remota* on Nihoa is determined by soil depth and moisture availability as the colonies are situated on deep soil at the foot of basalt cliffs at the upper reaches of each valley where there is continual water seepage (Kramer and Swedberg 1961).

Niihau

Dry, low Niihau (Fig. 6) is situated just westward of Kauai and reaches a height of 1281 feet. No species of *Pritchardia* were noted from Niihau until St. John (1959) described *P. aylmer-robinsonii*. The fact the island is closed to the public probably explains why no reference to *Pritchardia* was made until such a late date. The palms were found at elevations below 1000 feet on barren, rocky land in the re-

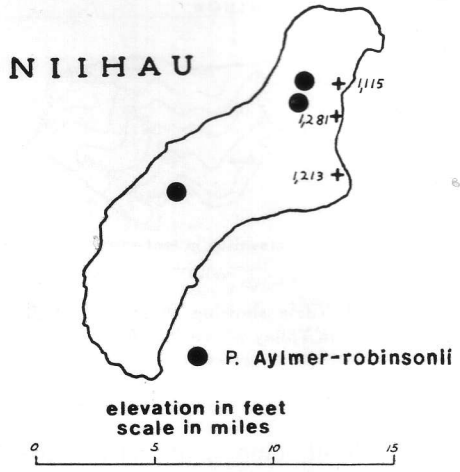
mote valleys of Haao, Mokouia, and Kapaka. At the time, only a few individuals were observed, many in a state of decline. Most recently, in 1975, Keith Robinson (personal communication) located two of the colonies and noted that the palms did not seem to be declining but were, in fact, growing quite well.

Kauai

Kauai (Fig. 7) is the oldest of the main windward islands and is dominated by the centrally located, twin peaks of Waialeale and Kawaikini reaching heights over 5000 feet. The west and south portions of Kauai are dissected by deep Waimea Canyon and its tributaries. The windward north and east sides of Kauai rise abruptly from the coastal plain with the north coast being cut deeply by Kalihiwai, Hanalei, Wainiha, Lumahai, Hanakapiai, and Kalalau Valleys. The interior of Kauai is extremely rugged with no roads and few trails and is little explored. Undoubtedly, new sightings of *Pritchardia* will be reported for these areas when they have been explored more extensively.

Two species, *P. minor* and *P. eriophora*, have been named for the west side of Kauai. There is doubt whether there are two distinct species involved here or simply one species and an accompanying ecotype. Specimens of the *P. minor–P. eriophora* complex are found as scattered individuals in the forested area of Kokee and also extend into lower elevations in Waimea Canyon and valleys west of Kokee.

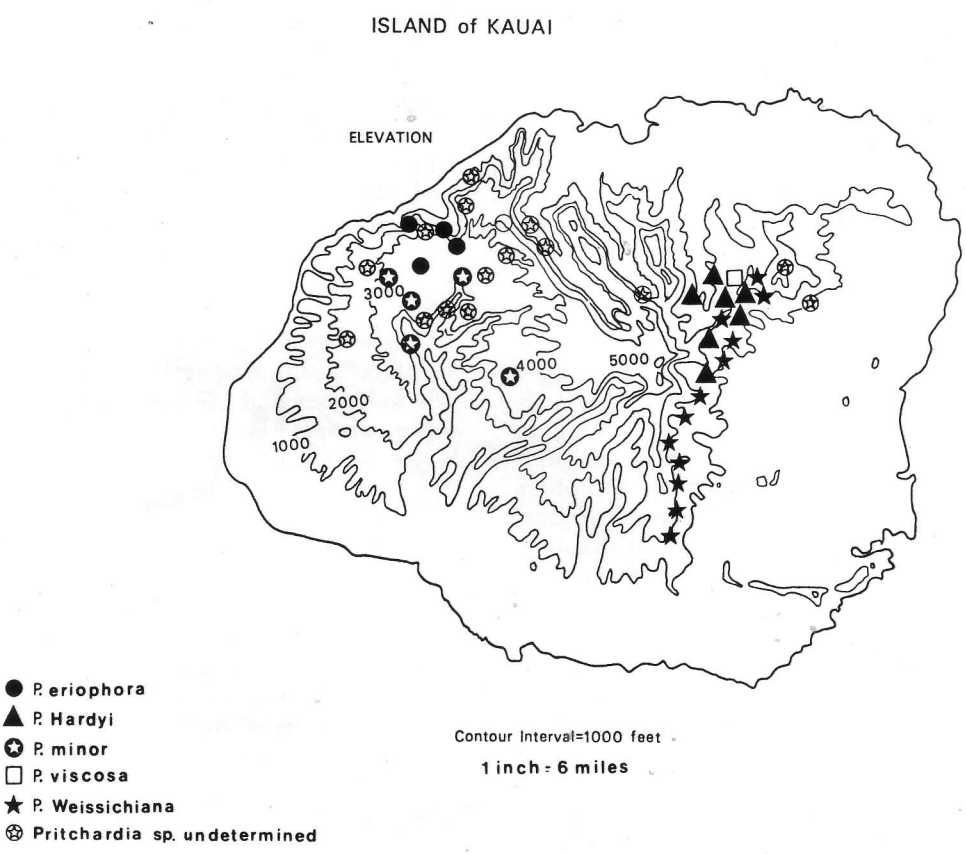
Three species of *Pritchardia* have been named for the east side of Kauai. Beccari and Rock (1921) placed *P. viscosa* slightly north and east of Summit Camp on the Pole Line Trail at 2000 feet elevation on cliffs in the upper



6. Distribution of *Pritchardia aylmer-robinsonii* on Niihau.

drainage of Kalihiwai Valley. Unfortunately, this species seems to have disappeared as no collection or mention of it has been made since the 1920's. Paul Weissich made two visits, one of which was with Dr. Joseph Rock, to Summit Camp in the early 1960's but searched in vain for *P. viscosa*. I have searched for *P. viscosa* on numerous occasions but to no avail as the type locality is very difficult if not impossible to reach.

Also growing near Summit Camp are *P. hardyi* and *P. weissichiana*. This is one of the few places in Hawaii where two distinct species occur side by side. *Pritchardia weissichiana* is found from Summit Camp all along the east frontal face of the Waialeale massif to Kahili in the south. *Pritchardia hardyi* occurs below Waialeale, up to the Summit Camp area, and into the upper drainages of Kalihiwai and Hanalei Rivers. There is speculation that what is presently known as *P. weissichiana* may, in fact, be what is known as *P. hardyi*. It seems that the description of *P. hardyi* by Beccari and Rock (1921) matches what we know today as



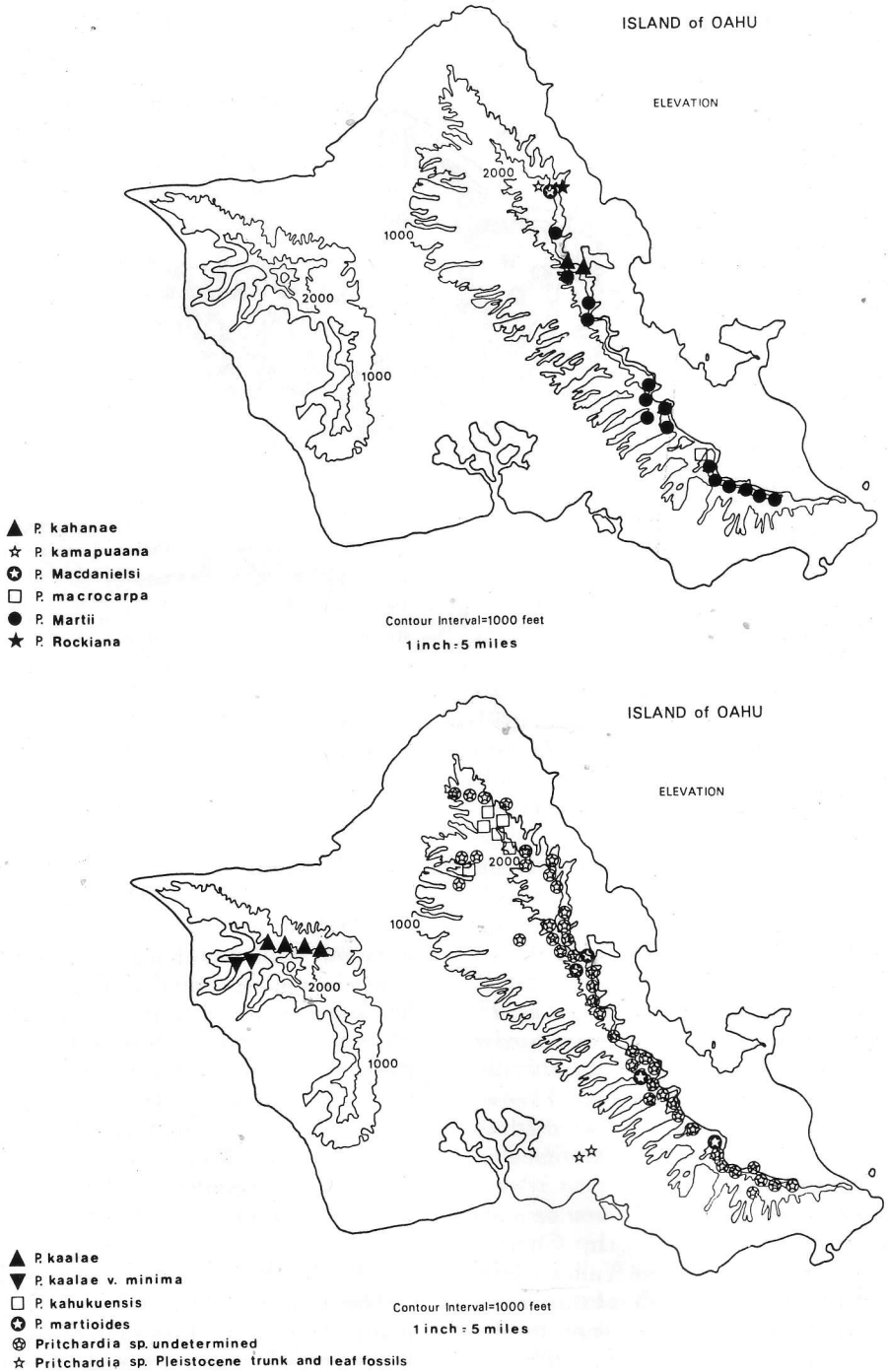
7. Distribution of *Pritchardia* on Kauai.

P. weissichiana but does not depict accurately *P. hardyi*. If future study confirms this, what we know as *P. weissichiana* would become *P. hardyi* and what we know as *P. hardyi* would have to be described and named anew. It remains a mystery how two distinct species could have been confused in this manner.

What I believe to be a new species was discovered recently by Charles Christiansen in Hoolulu Valley along the Na Pali coast. Seeds of this interesting *Pritchardia* were sent to the Seed Bank in February, 1976 as *Pritchardia* sp. Hodel #100. This same species must certainly occur in adjacent valleys along the Na Pali coast. Another unusual *Pritchardia* has been reported from the Makaleha Mountains east of Summit Camp. Robert Hobdy, past Forestry Officer on Kauai, came across this *Pritchardia* and felt it was different from any other taxon on Kauai. Obviously, further study is needed.

Oahu

The island of Oahu (Fig. 8) is the main island in the Hawaiian chain and was formed by two volcanoes. The older Waianae range in the west culminates in Kaala at 4030 feet while the



8. Distribution of *Pritchardia* on Oahu.

crest of the Koolau range behind Honolulu reaches its highest point at Puu Konahuanui at 3100 feet. The windward side of the Koolaus rises vertically 2000–3000 feet along its entire length while the leeward side slopes more gently to the west. Oahu has been explored more extensively than the other islands and thus has the most sightings of *Pritchardia* and the most species named of any island. Accordingly, much of the controversy surrounding *Pritchardia* is centered on the Oahu species. It seems that the more collectors there are the more sightings there are and the more species are named.

The Koolaus epitomize the colonizing habit of *Pritchardia* as the crest of the Koolau range is almost one continuous chain of colonies, each occupying a small valley or depression. Some colonies are arranged in vertical lines several hundred feet long up and down the sheer cliffs although more extensive colonies are located a short distance away on the leeward side of the crest on flatter ground. This colonizing nature of *Pritchardia* in the Koolau range with each colony apparently differing from adjacent colonies has been the source of much of the confusion associated with the genus.

A total of eight species has been named for the rainy Koolau range. One, *P. macrocarpa*, is assumed to be extinct in the wild and only exists as a cultivated specimen in Foster Garden as noted earlier. It was found originally on cliffs at the back of Nuuanu Valley.

Pritchardia martii, the most common species with the largest range in the Koolaus is found in the central and southern portions of the chain although future studies of populations in the north now under other names may indeed be referred to *P. martii*.

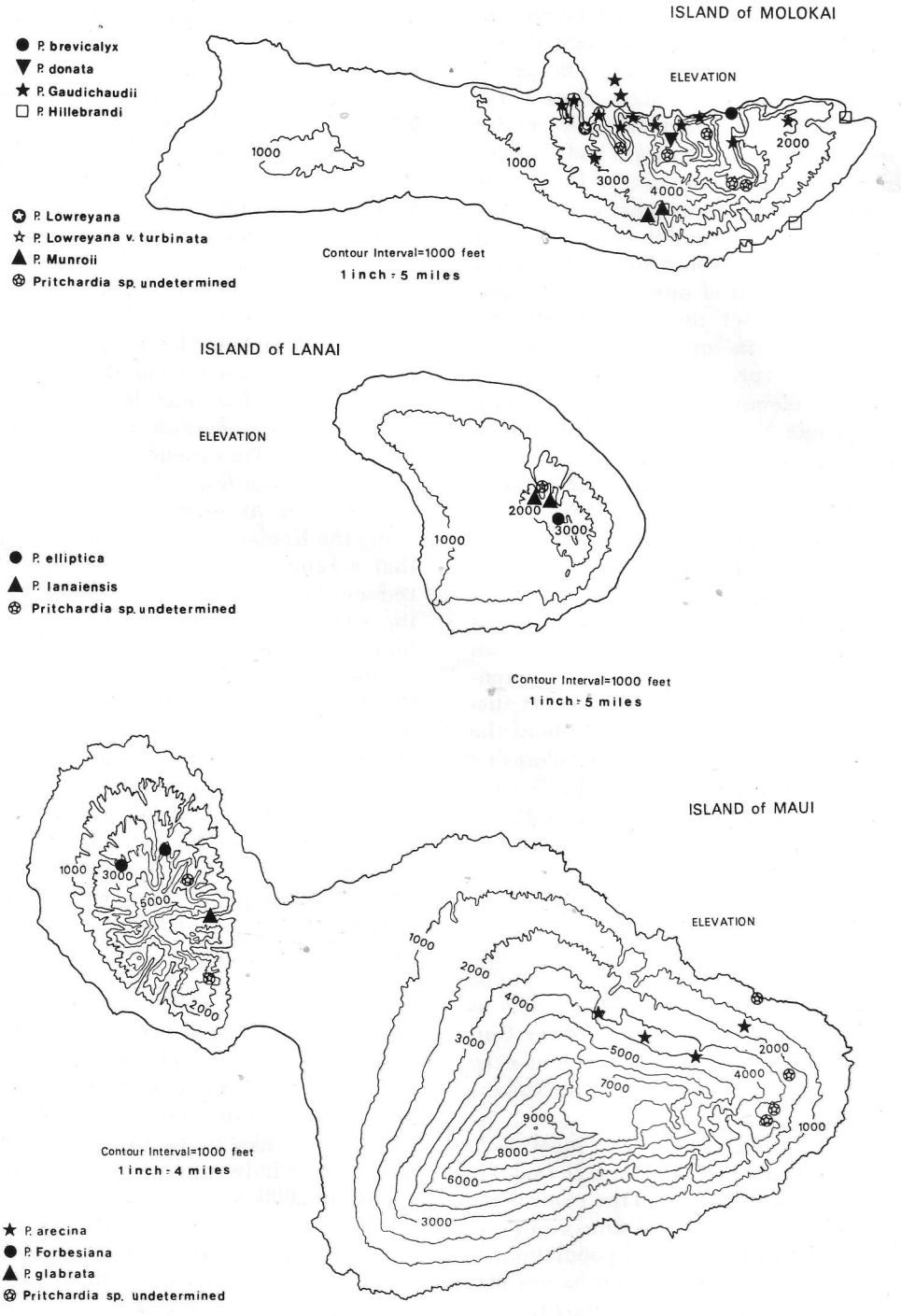
Three localized species are found growing in close proximity to each other and have not been reported from any other areas. *P. rockiana* was reported just above Kaluanui Stream at 2200 feet elevation (Beccari and Rock 1921). Just to the northwest are *P. macdanielsii* and *P. kamapuaana*, both described by Caum (1930). Later, Caum, in a personal communication to Selling (1947), indicated that these latter two species could probably be referred to *P. martii*.

The remaining three species of *Pritchardia* named from the Koolau range are *P. kahanae* located near Kahana Valley, *P. kahukuensis* situated at the northern end of the range, and *P. martioides*. I have observed *Pritchardia* at numerous locations along the Koolau crest. It is my feeling that a future study of the genus will reduce the seven species remaining in the wild in the Koolaus to one or two highly variable species.

One species, *P. kaalae*, is found in the drier Waianae range in west Oahu. This species differs from species in the Koolau range by the nature of its smaller fruit, about one inch in diameter, and long inflorescence which protrudes out beyond the leaves for a considerable distance. A variety, *P. kaalae* var. *minima*, grows west of the species in a dry and exposed situation on Ohikilolo Ridge.

Molokai

Molokai (Fig. 9) is situated 25 miles southeast of Oahu. The western portion of Molokai is low, dry, and barren while the eastern section is mountainous with peaks rising over 4000 feet high. The windward cliffs of the mountains fall 2000–3000 feet into the ocean on the north coast. The north coast is cut by deep canyons as Waihanau, Waikolu, Waialeia, Pelekunu, Wailau, and Halawa. The type specimen of *P. brevicalyx* was reported growing in an



9. Distribution of *Pritchardia* on Molokai, Lanai, and Maui.

old Hawaiian garden at the mouth of Wailau Valley (Beccari and Rock 1921). Beccari and Rock noted that the species was to be found, also, on cliffs and hills surrounding Wailau Valley but this has not been substantiated.

Pritchardia gaudichaudii is common along the vertical cliffs of the north coastal area and is found, also, on the rocky, columnar islets of Mokapu and Huelo off the north coast to exclusion of all other vegetation. Growing above and behind *P. gaudichaudii* on flatter ground near Waialeia is *P. lowreyana* (Beccari and Rock 1921). A variety, *P. lowreyana* var. *turbinata*, was noted by Beccari and Rock (1921) growing with *P. gaudichaudii*.

Two specimens of *P. munroii* are known to exist in dryland forest in two gulches above Kamalo near Puakoolau on the leeward side of Molokai.

As late as 1930, Caum described a new species of *Pritchardia*, *P. donata* from Pelekunu Valley. Caum later reversed himself (Selling 1947) and said that *P. donata* could probably be referred to *P. gaudichaudii*. Rock (personal communication to Paul Weissich) and several others have reported a *Pritchardia* in Pelekunu Valley that appears to be different from the other species known from Molokai. Further study is needed to determine if it is indeed *P. donata*.

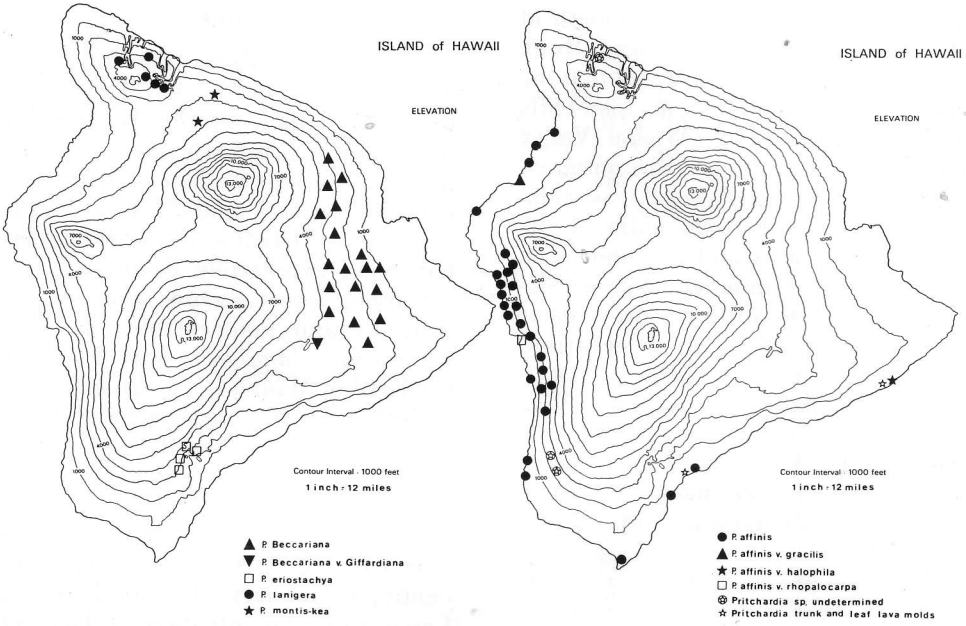
One species from Molokai is known only from cultivated material. *P. hillebrandii* was described from a cultivated specimen found along the dry, leeward coast of Molokai. Beccari and Rock (1921) noted that this species was commonly cultivated along the leeward coast of Molokai by Hawaiians and surmised that Molokai must be the native habitat of *P. hillebrandii*. To the best of my knowledge, *P. hillebrandii* has never been found in a truly wild state on Molokai.

Lanai

The island of Lanai (Fig. 9) is situated just south of Molokai. Lanai is in the rain shadow of the West Maui mountains and is fairly dry except for higher elevations to the east which receive substantial rainfall. As with other Hawaiian Islands, the native forest has been extensively destroyed, the remaining forest occupying higher elevations and inaccessible canyons. *Pritchardia lanaiensis* was found at the head of Mauna Lei gorge and west of Nahuku Valley (Beccari and Rock 1921). Rock suspected that there may have been another species of *Pritchardia* on Lanai and later Caum (1930) described *P. elliptica* growing in Kumoa Valley at 2500 feet elevation. Recently, in January of 1980, I visited Lanai with the intention of locating *P. lanaiensis* and *P. elliptica*. I was able to visit the type localities of each species but was unable to distinguish between specimens found in each area.

Maui

The island of Maui (Fig. 9) is fifty miles southeast of Oahu and was formed by two volcanoes. The older, Puu Kukui on West Maui reaches a height over 5000 feet and is deeply eroded by several gorges. East Maui is dominated by Haleakala, much younger and less eroded than Puu Kukui, but reaching a height over 10,000 feet. *Pritchardia forbesiana* has been reported by Beccari and Rock (1921) growing near Mauna Eeke north of Puu Kukui at about 4000 feet elevation. In 1976, *P. forbesiana* was collected near the beginning of the trail to the summit of Puu Kukui at 3000 feet elevation. *Pritchardia glabrata*, supposedly one of the smallest species of the genus but little known to cultivation, was reported to be found on



10. Distribution of *Pritchardia* on Hawaii.

lateral branches of Iao Valley on steep cliffs at 1800 feet elevation (Beccari and Rock 1921).

The only named species from East Maui is *P. arecina* which inhabits the wet, windward slopes of Haleakala between 2000 and 4000 feet elevation. Although there have been relatively few sightings of *P. arecina* considering the large forested area on Haleakala, it is likely that *P. arecina* is fairly evenly distributed throughout the band of wet forest clothing the northeast slope of Haleakala. There may be another species of *Pritchardia* on Haleakala besides *P. arecina*. In 1972, Derral Herbst collected a *Pritchardia* along Waiohonu Stream in Waihoi Valley during a botanical survey of this pristine area. Derral, one of the most knowledgeable students of the Hawaiian flora, felt that this collection may be distinct from *P. arecina*.

Hawaii

Hawaii (Fig. 10), the youngest island in the Hawaiian group, is larger than all the other Hawaiian Islands combined and is still growing today. The center of Hawaii is dominated by Mauna Kea and Mauna Loa, both rising close to 14,000 feet high and sloping gently to the coast. The Kohala Mountains in the northwest section of Hawaii are older than Mauna Kea and Mauna Loa and deeply eroded by several spectacular valleys over 3000 feet deep. *Pritchardia lanigera*, one of the species with largest leaves in the Hawaiian Islands, is found scattered throughout the rugged rain forests of the Kohala Mountains. It has been reported from the flatter areas behind Waipio Valley although most often it is found clinging stubbornly to the steep valley walls (Beccari and Rock 1921). Owing to the extreme inacces-

sibility of the Kohala Mountains, *P. lanigera* is little known to cultivation.

Pritchardia montis-kea once inhabited the northwest slopes of Mauna Kea facing Kohala between 3000 and 4000 feet elevation but it is now probably extinct. Beccari and Rock (1921) reported that *P. montis-kea* existed as only a few individuals in 1909 and that the area was being severely damaged by grazing cattle. Today, the area is almost completely denuded of native forest and if by some slight chance *P. montis-kea* does still exist, it must be in a steep gulch where cattle have yet to go.

Occupying the broad band of rain forest on the windward sides of Mauna Kea and Mauna Loa from 1000 to 4000 feet elevation is *P. beccariana*, which occurs as individuals or loose colonies from Olaa across Waiakea into Piihonua and perhaps going all the way around the northeast slopes of Mauna Kea until approaching the locality of *P. montis-kea*. This latter area is little explored and it will be interesting to see if future exploration will yield additional sightings of *Pritchardia*. It would seem strange that the distribution of the genus would cease abruptly although the forest continues on. A variety, *P. beccariana* var. *giffardiana*, grows near the active volcano of Kilauea at an elevation of 4000 feet.

On the southeast slopes of Mauna Loa in the Kau Forest behind Naalehu exists *P. eriostachya*, a distinct species separated from *P. beccariana* by the Kau Desert and characterized by the woolly, salmon-colored tomentum which densely covers the bracts. *Pritchardia eriostachya* is not at all common in the dense rain forest of Kau but the area is very rugged and little explored. Perhaps with future exploration there will be more sightings.

Scattered as individuals or colonies throughout the Kona Coast, or west coast of Hawaii, from sea level to 2000 feet elevation is *P. affinis*. Kona is considerably drier than Waikea Forest and Kau Forest where *P. beccariana* and *P. eriostachya* occur. Rainfall amounts along the Kona coast are about 15 inches annually while at 2500 feet elevation, rainfall averages almost 100 inches a year. Beccari and Rock (1921) noted *P. affinis* as growing wild at Kaohe, Opihale, and Kealia although there is doubt whether these were truly wild populations or cultivated plants. The forest has changed much in this area since the 1920's due to cattle ranching and it is doubtful if wild populations exist today. I have spoken with several ranch hands who work this area and they know of no pritchardias. There have been reported sightings to the south in the South Kona Forest Reserve and, perhaps, these may be referred to *P. affinis*. I am doubtful whether the other individuals and colonies scattered throughout Kona are wild populations or simply cultivated plants. The entire Kona area was home to large populations of Hawaiians and the *P. affinis* existing today are perhaps remnant cultivated populations. The entire sea coast of Hawaii from Kau through Kona and up to South Kohala is dotted with colonies of *P. affinis*. Many of these populations are growing around brackish water pools and there is the slight chance that these are wild populations. Several varieties were named from these populations along the sea coast. They are *P. affinis* var. *halophila* near Kalapana in Puna, *P. affinis* var. *rhopalocarpa* at Napoopoo in South Kona, and *P. affinis* var. *gracilis* at Kiholo in North Kona. More study is needed to solve the mystery of *P. affinis* in Kona.

There may be a species of *Pritchar-*

dia yet to be named for Hawaii. In 1969 and 1970, George Schattauer of Honomalino in South Kona sent Paul Weissich fruits of a *Pritchardia* found growing in the adjacent areas of Kapua, Papa, and Honomalino. Although the fruits were much larger than those normally found on *P. affinis*, Paul assumed that they belonged to this species as it is the only species named for Kona. Paul alerted me to be on the lookout for this unusual palm when I was spending time in Kona in 1976 doing botanical work. George Schattauer was kind enough to take me to see the palms. At first sight of the tall and majestic specimens, I could not begin to conceive how these were confused with *P. affinis*. The palms are quite tall, one of the specimens approaches 100 feet in height. Unfortunately, only about twelve specimens exist and although much fruit is produced, there is no regeneration due to the palms being located in a partially cleared forest that is now cattle grazing land. The fruits are globose and about two inches in diameter, making them over twice as large as those of *P. affinis*. Seeds of this palm were sent to the Seed Bank in April of 1976 as *Pritchardia* sp. Hodel #169.

Much of my time over the last five years has been spent pursuing *Pritchardia* throughout the Hawaiian Islands. I am filled with elation and amazement everytime I encounter a *lo'ulu* palm and admire its beauty and wonder how it ever arrived in Hawaii and came to be as it is. Much work is needed to solve the mysteries surrounding the genus in Hawaii. I hope that an extensive taxonomic and ecological study of *Pritchardia* can be undertaken soon so that we may better understand these magnificant, endangered, and possibly diminishing elements of the Hawaiian flora.

Acknowledgments

Many individuals and institutions have assisted me in my quest of *Pritchardia* in Hawaii and they all deserve sincere thanks. Among them are L. W. Bryan, Robert Hobdy, Libert Landgraf, John Obata, Harold St. John, Wes Wong, Winona Char, George Schattauer, Derral Herbst, Keith Woolliams, Erling Hedemann, William Theobald, the Bishop Museum, Pacific Tropical Botanical Garden, Lyon Arboretum, Waimea Arboretum, and Honolulu Botanic Gardens. Special thanks must go to J. Robert Judd, Jr. and J. Robert Judd, III, who have given me extraordinary assistance in my pursuit of *Pritchardia* here on the island of Hawaii, and to Paul Weissich, the source of the grand inspiration behind it all.

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(*Continued from page 64*)

23. *Ravenea hildebrandtii* H. Wendl. ex Bouché
24. *Trachycarpus fortunei* (Hook.) H. Wendl. (Chinese windmill palm)
25. *Veitchia merrillii* (Becc.) H. E. Moore (Christmas palm, Manila palm, or adonidia)
26. *Veitchia montgomeryana* H. E. Moore (Montgomery's palm)

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Joseph F. Rock (1884–1962)

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A young man of 23 arrived in Honolulu, Hawaii, from Austria in 1907 after wandering for five years in Europe and North America, partly searching for a respite from his health problems, but also hoping to see the world. Up to this point in his life he had shown but one intellectual accomplishment, the mastery of a number of languages. However, lacking both money and educational degrees, he took a position as teacher of Latin and natural history at Mills School, later to become the Mid-Pacific Institute. In the next twelve years he accomplished more in botany than most botanists do in a lifetime. He became *the* authority on the flora of Hawaii, just as later he would become *the* authority on the tribes, geography, and natural history of Western China. In fact, Joseph Rock is commonly called the Father of Hawaiian botany.[1]

Rock plunged into botany, after arriving in Hawaii, with no formal training in this discipline. He taught himself by both reading classical botanical works and by spending as much time as he could with the living plants in the field. He tramped over all the inhabited islands of Hawaii, photographing and botanizing with great energy and determination. Hawaii offered an unparalleled opportunity for anyone interested in plants and in Rock were combined all those qualities necessary to produce unsurpassed works. And none too soon, since in the interim the depredations both of man and the plants he has either intentionally or unwittingly introduced to the fragile and defenseless island landscape have swept away much of what Rock found. The results of this effort were several classical works on Hawaiian botany, including the definitive work on the only indigenous Hawaiian palm—*Pritchardia*—which Rock and Beccari jointly produced. Odoardo Beccari of Italy, a world authority on palms, along with many other specialists from several countries, collaborated with Rock in the identification of Hawaiian plants.

Earliest Years

Joseph Rock remembered his boyhood with bitterness. His mother died of an illness at 45, when he was only six years old. He turned to his grandmother for comfort, but she died two weeks later. He was born in 1884 in Vienna as Josef Franz Karl Rock. His father was a stern figure, who decided early that Josef should enter the priesthood and who was supported in this desire by Rock's only sister Lina. But the boy had other interests, and dreamed instead of far off lands. Formal schooling bored him and he did only mediocre work. His interest in foreign languages was awakened at the age of 10 when his father took him on

[1] Dr. William Hillebrand (1821–1886), a physician, is known as the Grandfather. He came from Germany to Hawaii in 1851, like Rock to recover from tuberculosis, served as a government official under King Kamehameha V, and remained in Hawaii until 1871. His policies greatly influenced the future of Hawaii.

a trip to Egypt, resulting in a quick mastery of Arabic, which he later taught. By the age of 13 he was teaching himself Chinese, studying secretly by candlelight in his room after the rest of the family went to bed. This was the beginning of a life-long love for China, because Rock turned out to be a sinophile for the rest of his life.

His father was a steward at an Austrian count's *Winterpalais* in Vienna, where the boy learned by proximity the urbane niceties of continental manners and form, even though he and his father were at the bottom of the social scale. The boy came to resent more and more where fate had placed him.

Promptly upon graduation from secondary school in 1902, young Rock set out wandering in Europe and North Africa, starting a life style that would continue the rest of his days. He paid for his leisurely way by taking on odd jobs and so he learned to improvise. He was in Ostend in 1904 when his father died, but he returned to Austria for the funeral and to see his sister. He then left for England, but the damp climate caused his tuberculosis to get worse, so he headed for Italy, then Tunis, and finally recuperated in Malta where he rented a house with a rooftop garden where he could lie in the sun. When he had recovered sufficiently, he took a job as a crewman on a ship going to Hamburg, where he fell ill again and stayed in charity wards there and later in Belgium. One day, heading for France, he missed the train, so on a hunch instead sailed for New York, working his way as a steward. Landing in New York penniless, he had to take a job as a dishwasher. He frequented graveyards on his free days and soon falling ill again decided to follow the advice of doctors to go to the sunny Southwest, after some more menial jobs in upstate New York.

Leaving New York exactly after one year of his arrival, he took a ship to Vera Cruz, via Havana, and stayed two months in Mexico, since his habit was never to be in much of a hurry on these travels. He passed the winter of 1906–07 in San Antonio, Texas and the summer in Waco, Texas, where he took university courses to further polish his English. But his health turned bad and against his doctor's advice he decided to go to Hawaii. He left via Los Angeles and San Francisco, which was still suffering from the great earthquake.

The Hawaii Years

Rock came to Honolulu on the steamer Manchuria, a young man 5′8″ in height, wearing glasses, with continental charm and manners, and a taste for the things money can buy, but with no money of his own and no educational degrees to help him along the way. Instead he came, as stated, armed only with a knowledge of foreign languages, Hungarian from his mother, added to German from his place of birth, then Latin and Greek from his schooling, to which he added a reading knowledge of Sanskrit, and along the way French and Italian to the Arabic, Chinese, and English already mentioned. But Hawaii, at this time a United States territory of only seven years, unfortunately needed merchants' talents, not linguists. He improvised a class he taught in natural history and to do so spent a lot of time in the field learning about the Hawaiian flora, which was completely different from any he had seen before.

In 1908 he resigned his teaching position with Mills School and took a job with the Division of Forestry. His job of collecting seeds and specimens of rare trees and shrubs for a herbarium (which he decided the Division needed) and exchange purposes suited both

his need to be outdoors and to work off his restless energy. Spending extended periods on all the islands for collecting purposes, he soon became thoroughly familiar with all of the native plants. And thus he became a botanist, much to Hawaii's gain and the world's. Delighted by his wit and continental charm, the local ranchers' wives would invite him to their homes when he was in their area. And since the Division could not provide him with the necessary funds to hire horses and provide assistants, Rock, made quite resourceful by several years of knocking around the world penniless, would make the local ranchers feel honored by wanting to study the plants on their land and they would volunteer ranch hands as assistants and also provide the horses. However, Rock was really a loner at heart and he held all friends and acquaintances at arm's length. All friends were addressed by their surnames; in letters, for example, even later after he had known them for 30 or 40 years. Formality of one degree or another was always maintained.

Rock stayed in his position as collector for the Division of Forestry for almost three years, during which time he established a first-rate herbarium. Upon his leaving, it was transferred on indefinite loan to the College of Hawaii, which had been established in 1907 and where Rock now took a position as botanist on the faculty of about twelve men. He had only a few students so he did his teaching in the herbarium or in the field, lecturing in either Latin or English. He was placed in charge of the 20-acre botanical garden area on campus and eventually planted some 500 different species on the grounds. In 1913 he became a naturalized American citizen, using the Americanized version of his name, and stayed on at the College of Hawaii until 1920, having been promoted to the rank of Professor of Systematic Botany. This period was the high point in his career for the production of works on botany and forestry, since, as has been mentioned, his long subsequent sojourn in China, which he eventually came to regard as his home more than anywhere else, concentrated exclusively on the tribes of Western China and the geography of that general area.

Rock, however, always thinking of excuses to travel, took a leave of absence in 1913–14 to make a trip around the world, but not entirely for selfish reasons, since he also collected seeds and plants for reforestation purposes in Hawaii; collected bamboos for the Panama Canal Zone; and visited herbaria in Europe and the United States for the College. It was during this trip that he first saw China and it simply captured him. His earliest extant diary shows long entries for his stops there, but only passing remarks about Singapore, India, Ceylon. Rock's boyhood enthusiasm for China was real and his interest—call it fascination—remained all his life.

But whenever funds permitted, he was off on other journeys: the Philippines and Singapore again, Java in 1916, revisiting California in 1917, and revisiting Siam, Malaya, and Java in 1919.

He was miffed that an agreement had been reached over his objections to transfer the herbarium of some 28,000 specimens to the Bishop Museum from the College, which was now in the process of taking on University status. Although not his private property, he harbored very strong feelings about it. As a result, he resigned in 1920 and in May of that same year packed his bags and left for the continental United States to seek employment there.

Beginnings of a Far East Explorer

Rock took a job as Agricultural Explorer for the Office of Foreign Seed and Plant Introduction of the U.S. Department of Agriculture, after experiencing some negative results at Harvard University and the New York Botanical Garden, and left in the Fall of 1920 for the Orient. No better assignment could have been found for him, since it fitted his needs and talents exactly, in addition to satisfying his deep desire to experience the Orient. He was to locate a tree (*Hydnocarpus kurzii*), which produces an oil useful in the treatment of leprosy, and ship the seeds back to the United States. He of course found the tree and did a meticulous job of sending back batches of seed from different localities where the tree grew. With the money from this successful trip and an article he wrote for the *National Geographic Magazine*, he returned for a recuperative trip to Vienna, back there for the first time in almost twenty years. However, he soon returned to the Far East, this time searching for ornamental species of plants, especially a blight-resistant chestnut, this trip also under the sponsorship of the USDA.

Thus began three decades of active exploration and research in Asia, which resulted in the introduction of thousands of Asiatic plants to the United States; the collection of some 60,000 botanical, ornithological and zoological specimens; the mapping and photographing of practically unknown regions; the translation of volumes of native literature; and the most exacting research into the linguistics, culture, folklore, and religion of Western China and Eastern Tibet. Whereas at 35 Rock had become *the* authority on Hawaiian flora, at the age of 55 he had become *the* authority on the Nakhi tribe of Western Yunnan and *an* authority on that part of China bordering Tibet.

The China Years

The ensuing years in Rock's life were of such an adventurous nature that his exploits were the subject of newspaper articles, with reports several times that his party was lost somewhere in the wilds. The National Geographic Society took over the sponsorship of several of his expeditions and Rock sent back a whole series of articles which the *National Geographic Magazine* published (although greatly irritating him by editing his precise language into "National Geographese"). And recently a most interesting book[2] about his life has been published. It is highly entertaining reading for armchair adventurers and, although covering Rock's entire life, it dwells on his turbulent years in China.

Rock liked to travel in style in the Orient. He taught a tribesman the elements of continental cuisine, so his entourage always included a cook, porters for items like his folding bath tub, which he used daily, linen napkins and tablecloth, since a table was set up in the wilds for the evening meal except in the most extreme circumstances, porters for all the food necessary for the journey and for the plants collected along the way. And very often at the front and rear of the party, soldiers to guard against brigands or robbers, soldiers at one time numbering as high as 150 to provide safe passage through the local magistrate's territory, which official would be responsible for the party's safe con-

[2] *In China's Border Provinces; The Turbulent Career of Joseph Rock, Botanist-Explorer*, S. B. Sutton, 1974, 344 pp., Hastings House, N.Y.

duct on its way. Another consideration was that Rock felt he had to present the right image as a man of some importance so that he could control the situation. This required a certain aloofness and formality, which suited Rock's style, but which also made his life extremely lonely. And to combat this he turned to his diary (where he had left off in 1913) to express his feelings. The only other white persons, even in the towns, might be a missionary or two, who were often too narrowly religious to suit Rock, and occasionally some government official. In a desperate attempt to alleviate this loneliness and obtain a surrogate son, Rock had his nephew come as far as Hong Kong, with the idea that the youth could serve as his assistant, but sent him back. During his whole lifetime, Rock is not known to have been intimately involved with anyone. He complained bitterly in his diary of his loneliness and lack of roots. Although he carried medicines, he stayed on in China even though in indifferent health and days from a doctor or a hospital. Very often he was in pain from one ailment or another, from a malfunctioning digestive system, including a blocked intestine, to facial neuralgia, dental problems, and amoebic dysentery. Nevertheless, he continued to eat rich foods and only rarely would he let any ailment keep him in bed.

Rock was not the first plant collector ever to visit these Western provinces of China, although he was surely the very first white man to set foot in some out-of-the-way regions. There had been notably Ernest Wilson at the turn of the century and later George Forrest, Reginald Farrar, and Frank Ward. In fact, Rock would eventually run into both Forrest and Ward, only to have professional conflicts arise, so he kept his distance.

China, at the time of Rock's entry, was still not a completely unified country. Central government control over certain provinces, particularly those in which Rock worked, was only under the nominal control of the Chinese. A degree of local automony was politically expedient. Local chiefs and kings ruled but were beholden to some extent to the Chinese capital, especially in the payment of taxes, that being their paramount obligation. And very often the amount of tax to be paid, along with the graft involved, obliged the peasants to raise poppies to make opium, as the best paying cash crop, rather than rice. The perniciousness of opium on man touched greatly on Rock's life in China. He forbade all those around him to use it. In addition to the addiction of many people there to opium, other factors which greatly distressed Rock was the "filth," as he called it, since his own habit was to bathe daily, even when out on a journey. Generally, the political situation was unstable, with brigands infecting large areas along major trading routes, feuding chiefs fighting one another with private armies, unpaid, or underpaid, soldiers foraging off the land at the expense of the peasants, and, much to Rock's surprise, since he never expected the indifferent masses to revolt, the eventual takeover of the Communists, which ultimately drove him out of China forever.

As he grew older, Rock gradually gave up the rigorous type of botanizing and would just collect plants along the roadside, but he continued to send his helpers inland for specimens. He sent over 60,000 plants to various institutions in the West and introduced over 493 species of rhododendrons, more than had been known heretofore.

Although Rock was in the distant Orient, he still made numerous trips to Europe and/or the United States between 1920 and 1944: to seek spon-

1. The Prince of Choni and Rock. Courtesy *National Geographic Society.*

sors, to see about getting his works published, to visit old acquaintances, to seek medical attention, and for a change of scene. He would be invited to speak before various groups, which he relished, to meet with influential people, and was accepted in intellectual circles. Questions were put to him as if he were the authority on all things Chinese.

But when he returned to China from one trip abroad in 1935 he returned to find the Nationalists and Communists fighting. They later reached a truce long enough to fight the invading Japanese. By 1937 real warfare broke out, but Rock decided to stay on since he felt comparatively safe deep in the interior. However, eventually the war reached Western China and some bombs were even dropped on Junnanfu, the town where Rock was staying. He had considered many times living in Peking, where he could be near libraries and book stores and participate in the intellectual life, and even went house hunting there, but always returned to some provincial town in Western China, eschewing what he considered to be the many unpleasant things encountered in any large city.

He evacuated to Indochina, made a trip to Hawaii, and then returned to China to the remote town, Likiang, in the western provinces where he had stayed for so many years before. He feared more for his health than about the war.

At this time Americans were losing many planes flying materials over the "Hump" air route. Since Rock knew more about the Chinese side of the Hump, as it was called, than anyone else, he was sent for by special plane, brought out, and put to work by the Army Map Service for a year to draw maps of the area. Since the war in the Pacific ended in 1945, Rock was back in the Orient by 1946, where he wanted to replace the loss of 12 years of scholarly productivity. A Japanese torpedo had sunk the ship carrying his research manuscripts to the United States for safekeeping during the war. Rock returned to Likiang, but the civil strife was making it unbearable for him, the Communists let him know he was unwelcome there, and in 1949 he left China for the last time.

The Final Years

After a trip to Europe, he waited in the Himalayas of India for two years poised to return to China, but finally gave up and spent the final eleven years of his life, first in Europe, next the State of Washington, and finally Hawaii. He returned to Hawaii for health reasons once more and an increased interest in establishing a bo-

tanical garden there. In Hawaii he divided his time between finishing a dictionary of the language of a Western China tribe (the Nakhi) and Hawaiian botany. He again worked on the lobelioids, called one of the most complicated tribes of plants.

Unfortunately, money was a problem even during his later years. He sold his library to the University of Washington (the Far East and Russian Institute) for $25,000 and lived as a guest in the home of friends in Honolulu for the last five years of his life. This left him free for his travels and scholarly pursuits, for which he still had the old energy and enthusiasm. However, he died of a heart attack on December 5, 1962, at the age of 78, and was buried on the island of Oahu.

The Monograph of Pritchardia

A Monographic Study of the Genus Pritchardia, by Beccari and Rock, first appeared in 1921 in the *Memoirs of the Bernice Pauahi Bishop Museum* as article Number 1, in Volume VIII, published in Honolulu. The article is encompassed in 77 pages, followed by 24 pages of plates (photographs).

The title page, giving credit to Beccari and Rock, as coauthors, is followed by a table of contents listing 33 treated species and five varieties of *Pritchardia*.

Next follows Rock's one-page introduction, which elaborates on the circumstances surrounding the publication of the work and who wrote what. Since it gives some interesting details, it is reproduced in part as follows:

> The present study of the genus *Pritchardia* is mainly the work of Dr. O. Beccari of Florence, Italy, and forms part of a monograph on the tribe *Coripheae* [sic] to which the genus *Pritchardia* belongs. The manuscript was prepared in Latin for publication in the *Annals of the Calcutta Botanical Garden*, but Dr. Beccari has consented to have that part of his monograph dealing with the genus *Pritchardia* published in English in Honolulu. Of the thirty-three species described in this paper twenty-one including five varieties were discovered by me, and several old species were rediscovered and their status cleared. My recent explorations on the islands of Kauai, Molokai, and Hawaii resulted in the discovery of several new species and one new variety. Specimens of these and of other new species were forwarded to Dr. Beccari, but I am responsible for the description of the following: *Pr. kaalae*, *Pr. Forbesiana*, *Pr. Hardyi*, *Pr. Munroi*, *Pr. montis-kea*, *Pr. viscosa*, *Pr. Lowreyana*, var. *turbinata*, *Pr. Martiodes*, and *Pr. Kahanae*. Plates illustrating this monograph are from photographs taken by me; the drawing of the flowers was made by Dr. Beccari. It is hoped that the present paper will be a stimulus to further exploration by future botanical workers, for it is probable that the Hawaiian Islands harbor a number of other new species of *Pritchardia*. Special attention should be given to the western part of Oahu, the windward side of Molokai, especially the valleys of Waikolu, Pelekunu, and Wailau, and to the windward slope of Haleokala on Maui. On the island of Hawaii, Waipio, Waimanu, and other valleys of Kohala have not been searched for palms, and the island of Kauai may reward the assiduous explorer with additional new species.

He closes the introduction with the names of those to whom thanks were due for financial support and a footnote citing the great loss to the scientific world in the death of Dr. Beccari, which occurred at Florence, Italy, October 25, 1920.

The main body of the work is divided into two parts: Part I, entitled Distribution and Characteristics, and Part II, Systematic Treatment.

Part I is introduced with a General Discussion section written by Beccari, in which he elaborates on three subjects: distribution, fertilization, and finally structural peculiarities, which stresses the appearance of the leaves of the various species, since as Beccari states ". . . the diagnostic characteristics of the species of *Pritchardia* are found chiefly in the fruit, and in the indumentum which covers the

leaves and the spadices. Characters which might serve to distinguish one species from another are hard to find in the flowers, as these conform to one type, with slight differences in size and in the venation of the calyx and of the corolla." In fact, the section includes a prospectus on the appearance of the lower surface of the leaves.

In the section under distribution he mentions that the first *Pritchardia* species described were *P. martii* and *P. gaudichaudii*, both from Hawaii and thought to belong to the genus *Livistona*. Besides Hawaii, two species were indigenous to Fiji and an additional two species were found in the distant Dangerous Archipelago. He further states that the one species (*P. wrightii*) found in the New World (in Cuba), is "one of the most extraordinary facts known of geographical distribution of palms . . . ." Its general acceptance today as a species of the distinct genus *Colpothrinax* makes its distribution less dramatic. He also comments on the great precinctiveness of the species of *Pritchardia* in Hawaii in that no species is found on more than one island.

Next follow two sections authored by Rock: Distribution of *Pritchardia* in the Hawaiian Islands, introduced by a table showing on which island each species is found, giving credit for nine to Hawaii, six each to Molokai and Oahu, four to Kauai, three to Maui, but none to either Nihoa or Lanai. This is followed by an island-by-island detailed description of the locales where each species is found. Part I is closed by Rock's second section on the uses of *Pritchardia*, in which he briefly discusses the possible uses of the leaves and the use of seeds for food.

Part II, authored by both men, after referencing prior botanical literature on the genus, first describes the genus *Pritchardia*, then includes a five-page conspectus of the species, followed by a listing of synonyms, doubtful and excluded species, and concludes with a 48-page detailed description of all the species, one by one. The description of each species again, of course, cites prior botanical literature, which is then followed by a description, covering general appearance of stem and crown, then leaves, spadices, flowers, fruit, seed, and fruiting perianth, in that order. This is in turn followed by two closing sections on habitat and observations.

As already noted, the work concludes with 24 pages of photographs, including five pages on the fruits in life size.

Another Pritchardia

At the end of his life, Rock returned to Hawaii and on Kauai found another *Pritchardia*. The paper[3] was published in 1962 and the Introduction reads as follows:

> On a recent trip to Kauai to collect young plants and seeds of *Pritchardia hardyii* and *P. viscosa*, Mr. Paul Weissich and I discovered a distinct new species, immediately discernable as such from a distance. It has the longest spadix of any *Pritchardia* known.
>
> It seems that all species of plants, including *Pritchardia*, found on Kauai are less prone to variation than those found on the other Hawaiian Islands, but are more fixed or stabilized. Kauai is the oldest of the islands. The pritchardias found in the central Koolau Range of Oahu display the greatest variation. In fact, they are so variable that one could describe and name each individual plant. The most distinct species, *P. kahukuensis* Caum, grows on the extreme northwestern end of the Koolau Range, whereas on the central part from Hauula to Waiahole (all on the windward side) is found polymorphic species with fruits of all sizes and shapes, ranging from obovate to ovate elliptical, and globose; but all seem to have

[3] A New Hawaiian *Pritchardia*, Occasional Papers of Bernice P. Bishop Museum 38: 61–63.

the staminal cup included in the hypanthium. In order to designate these plants by a common name, I suggest the specific name polymorpha which has been used before to designate a highly variable species (*Metrosideros polymorpha*).

Pritchardias found in the wettest areas of the islands, Kauai excluded, have the largest fruits. When these are transplanted to the drier areas near sea level on Oahu, their fruits greatly diminish in size and shape, so that it becomes impossible to rediagnose them. A case in point is *Pritchardia lowreyana* Rock, from the windward side of Molokai, which I grew from the type tree. I planted a specimen at the eastern corner of Hawaii Hall at the University of Hawaii at Honolulu, and after 44 years it had produced fruits not, or only slightly, larger than those of *P. affinis*, though in other respects it is quite different from that species. It would be interesting to plant specimens grown from the seeds of the Honolulu *P. lowreyana* in a wet area and see whether it will produce as large fruits as the type. At any rate, the size and shape of the fruits of *Pritchardia* do not appear to be good specific characters. *P. weissichiana* is one of the most distinct of the genus.

After the botanical description, Rock states further "This new *Pritchardia* increases the number found on the island of Kauai to five, four of which are small fruited. *P. viscosa* has the largest fruits of any *Pritchardia* known from Kauai."

Rock named this new *Pritchardia* for Paul R. Weissich, Director of the Foster Botanical Garden of Honolulu, who was interested in procuring all the Hawaiian pritchardias for planting in the Foster Botanical Garden.

Other Botanical Works

More than 45 other works on botany and forestry were produced by Rock, of which three are full-scale books: *The Indigenous Trees of the Hawaiian Islands* (1913), which established his credentials in the world scientific community; *The Ornamental Trees of Hawaii* (1917); and *A Monographic Study of the Hawaiian Species of the Tribe Lobelioideae, Family Campanulaceae* (1919). Rock's works are almost always profusely illustrated with his own excellent photographs.

It is interesting to note that although Rock spent 30 years in the Far East after leaving Hawaii, and although he collected tens of thousands of botanical and ornithological specimens there and sent them back to the West, this long period of his life produced no botanical works. It seems he became so interested in the cultures of the aboriginal tribes of Western China that he decided to capture what he could for posterity before it was too late, since an overwhelming Chinese influence was quickly wiping away the last vestiges of these cultures. We assume that in his mind he decided that the botanical collections could wait for other men in later years who would have time to work on the thousands of specimen plants he collected there and other places in the Far East.

Even if Rock had made no other contribution except his plant collection efforts, he would have his niche in the world of botany. However, this legendary scholar, first recognized as a botanist, plant collector, naturalist, and explorer, went on to become an orientalist, philologist, geographer, anthropologist and cartographer. And he was an unexcelled photographer, which talent added so much to his works. Rock was a member of many organizations, was listed in *Who's Who* for thirty years, and was honored with awards, medals, and honorary degrees by many scholarly and scientific organizations.

NOMENCLATURAL NOTES

Brahea aculeata

Species of *Erythea* known in cultivation but lacking names in the genus *Brahea* were transferred to that genus (Moore 1975) in preparation for the publication of *Hortus Third* by the staff of the L. H. Bailey Hortorium at Cornell University. The union of *Erythea* with *Brahea* had previously been suggested in a list of recognized palm genera (Moore 1973). *Erythea aculeata* was not then listed in files of cultivated palms, but it is now grown in Hawaii and a name under *Brahea* is needed for it in Baker's list published elsewhere in this issue. The following combination is therefore proposed:

Brahea aculeata (Brandegee) H. E. Moore, **comb. nov.**

Erythea aculeata Brandegee, Zoe 5: 196. 1905.

LITERATURE CITED

MOORE, H. E., JR. 1973. The major groups of palms and their distribution. Gentes Herb. 11: 27–141.

———. 1975. Nomenclatural notes for Hortus Third: Palmae. Baileya 19: 168.

H. E. MOORE, JR.
L. H. Bailey Hortorium
Cornell University
Ithaca, N.Y. 14853

NOTES ON CULTURE

A Note on Mulching in South Florida

One of our members, Mr. Frederick W. Shick, of Naples, Florida, has lovely palms in a lovely setting along the edge of a body of salt water. He was asked to tell about the method he uses to mulch his garden, which was a delightful place. The mulch made for a soft, attractive feeling and appearance underfoot. Here is his report:

"Approximately ten years ago I found that I was spending a considerable amount of time weeding the beds under and around a pepper hedge that was about 450 ft long. In order to cut down on this weeding, I decided to mulch the entire bed heavily, using the chipped material that a local tree trimmer was disposing of from his trimming operations. (In many Florida cities a coarse shredding machine reduces the size of the cut material so a truck holds far more than it could if branches were just loaded.) The first couple of truck loads I received from him I put on as received to a depth of about six inches.

"It wasn't long until I discovered that the consistency of the material varied considerably, at which time I decided to invest in a good shredder. Although this proved to double the amount of work, since the mulch had to first be put through the shredder and then spread on the beds, it not only improved the looks of the beds mulched, but also made the mulch deteriorate much faster and hence a better compost.

"All this proved so satisfactory as a weed deterent under the pepper hedge that I next eliminated the wedelia ground cover around all my palms and mulched everything heavily—up to 12"—with the exception of the lawn area. Two benefits have been derived from this mulching:

1) It has practically eliminated the need for fertilizing and

2) it has proved to be an ideal germinating medium for the seeds that drop.

"I would advise anyone thinking of doing this NOT to accept any trimmings that include palm material since it does not chip well, and is hard to handle because of its being stringy.

(Many shredders cannot handle this stringy, fibrous material.)

"Although there is considerable work involved in shredding the material I have found it to be very worthwhile, to the extent that I now use about 12 to 14 truck loads a year."

FRED S. SHICK

Not only does the mulch cut down on fertilizing and weeding, but it also helps conserve moisture. As a result Mr. Shick's palms looked very beautiful, they obviously relished the mulch. There is one thing though, that should be watched—do not let the mulch pile up too heavily around palm trunks as it could be a breeding place for fungus and molds which would affect the palm trunk, especially during a season of heavy rain.

TEDDIE BUHLER

Ceroxylons in Northern California

Coastal Northern California and the Andean mountain ranges of tropical South America have a remarkably similar climate. It is cool all year but mild, with little or no freezing in many areas. In these areas moisture is abundant; although the California climate has a long dry season, the coastal areas receive an almost daily fog at that time—the air is very humid and even the ground is watered in some areas of fog condensation. To palm enthusiasts this climate type in the Andes brings to mind the beautiful palms of the genus *Ceroxylon*. Except for a few species, the genus *Ceroxylon* is not well described. But even from the few described species—*C. alpinum*, *C. klopstockia*, *C. hexandrum*, *C. quindiuense*, and *C. utile*—one can choose from a relatively small *C. utile* to the tall giant of all palms, *C. quindiuense*. These species range in altitude of habitat from a few thousand feet to well over 10,000 feet. Shouldn't some of these adapt to Northern California?

Trials over the years in Southern California have been disappointing. Successes are few and often temporary. Dry heat is a deadly enemy of *Ceroxylon*. Member Mardy Darian had in Vista one of the largest, a *C. quindiuense*, which was killed a few years ago by late summer's heat. Member Ed Moore has a beautiful *C. alpinum* shade grown in a cool area in the ocean influence near the beach area of San Diego. And Pauleen Sullivan has a *Ceroxylon* in Ventura which is growing well in a cool moist spot. It appears to me to be *C. hexandrum*. In Northern California these palms unfortunately had not been tried so far as we know until very recently. Perhaps the first was a *C. alpinum* planted by Warren Dolby at his beautiful hillside garden in Oakland. It was a few years old and thriving in 1972 when it perished following a transplant.

Northern California members finally got our first real chance to try ceroxylons after the Palm Society Colombia trip following the Biennial Meeting in 1974. A few seeds and seedlings of *C. quindiuense* were obtained and shortly thereafter seeds of *C. hexandrum* came through the seed bank. The resulting plants, although few in number, seemed to thrive in our climate. It had been suggested in the past that these palms might require a mycorrhizal fungus association with the roots. Wanting to take no chances with my plants, I contacted Mardy Darian who kindly provided soil and root fragments from his *C. quindiuense* and also suggested that any good woods soil might contain an appropriate fungus. Some of my seedlings were grown in sterilized potting mix, some in forest soil, and some in sterilized mix inoculated with Dr. Darian's soil. All of

them thrived. Our consistently cool nights in Northern California might be the secret of success with these palms. Our hot spells do not seem to bother the plants, but even when we have 105° F days, the nights between will usually be in the 50's. The days in my area normally are about 80° F in summer, and even during the warmest months the nightly average is about 54° F. Last winter was one of the coldest in years here. In the coldest area of my property it reached 26° F on January 29, and I cold tested a small *C. quindiuense* in a one-gallon container by placing it in the open on the ground in this spot. It was uninjured at 26° F even though the leaves were white with frost.

With this background experience I decided it would be interesting to test a few *C. quindiuense* plants in the wild. In 1976 I was in Colombia and visited the area where the Palm Society members collected *C. quindiuense* near the mountain village of Tenerife outside of Cali. After collecting several hundred fresh seeds and having thoroughly cleaned them, they were confiscated by an overzealous USDA agent in Miami in spite of my having a proper permit and being a USDA scientist myself. But one of our members (Dick Douglas) who was visiting in Miami at the time picked them up the next day, received an apology from another USDA agent who knew that clean seeds should enter with permit, and carried the seeds back to me in California by the third day. I had about 95% germination from this lot of seeds. I kept about a hundred and distributed the rest to other Palm Society members in Northern California. So with enough plants for some experimentation I carried several about 100 miles north of San Francisco along the coast and planted them among the redwoods in a moist valley opening to the ocean. Here the soil was full of humus and still moist in late summer. Previous scouting of the area had indicated that the location was fairly mild in winter and undisturbed by the public. A major stream and several tributaries flow all year through the small valley and these seem not to flood much in times of heavy winter rains. The banks and steep hillsides support tall redwood trees and a magnificent undergrowth of ferns. Here and there near the streams are sites with spaces open to the sky surrounded by 100-foot redwood trees. In these places I planted the small *Ceroxylon* seedlings, where they have the protection of the surrounding trees but growing space overhead.

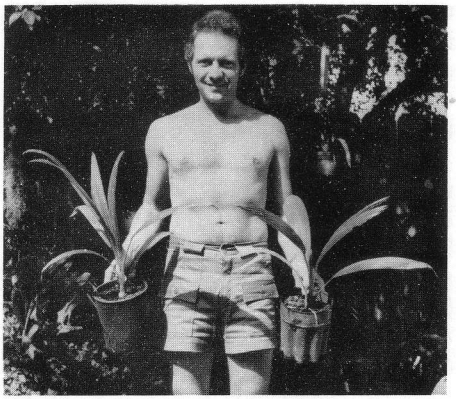
1. *Ceroxylon quindiuense* potted in a five-gallon can.

I can now report that after two years of no care except Mother Nature's, the plants have not only survived but are thriving! They passed through one of our coldest winters unscathed. They

have been through the rainless summers with no problem. When planted they were carrying only their first leaf. At least one is now getting its first divided leaf. Two are growing where the soil gets quite dry by summer's end but have not even turned brown at the leaf tips; they just slowed their growth while dry. The cool, moist ocean air seems to minimize the effect of the dry soil. One of the dry plants was undermined by a gopher and had nothing but air under it—it still showed no sign of distress except that it temporarily stopped growing.

I am convinced now that *Ceroxylon quindiuense*, at least, will grow in Northern California, even with no human care in the right location. They prefer shade when young, at least away from the immediate coast. Cool nights are a must. With cool nights heat during the day is tolerated. Moisture in the air as well as the soil is appreciated. The palm prefers an acid, well aerated soil. My young plants respond well to rhododendron-azalea fertilizer. Northern Californians have often been considered to be at a climatic disadvantage for growing palms, but it appears that there might be some species that only we can grow! Of the *Ceroxylon* species, *C. quindiuense* is beginning to prove itself here, *C. hexandrum* seedlings are doing well but seem to be somewhat slower, *C. alpinum* grows well but might not be as frost tolerant since it comes from lower altitude.

My great hope at this time is to obtain *Ceroxylon utile*. It is probably the most cold tolerant of the genus since it grows at the highest altitude—with morning snow and ice I have been told! My observations in Quito, Ecuador, indicate that it might be more heat or drought tolerant than *C. quindiuense* also. In Quito the few specimens I saw of *C. quindiuense* looked



2. The author holds two small seedlings of *Ceroxylon quindiuense*.

a bit stressed but *C. utile* looks superb and would also be in better scale to most gardens with its slender 4–6 inch trunk. Any help from our members in getting seeds of this palm would be greatly appreciated.

J. GARRIN FULLINGTON
3017 May Road
Richmond, CA 94803

LETTERS

In the April 1979 issue of PRINCIPES, there was an article by Dennis Johnson on palms in the National Register of Big Trees. This list included a *Cocos nucifera* measured in 1968 in Hilo, Hawaii that was 94′ in height and was 4′8″ in circumference at 4½′ and had a spread of 28′.

As I live in Hilo, my interest was aroused and I asked Donn Carlsmith, who is president of The Palm Society and also lives in Hilo, where the tree was located. He said that specific tree is now dead but he told me where it had been located. There are still trees in that area which I presume are of the same age. They are on public land and within a block of the ocean, and they have withstood tsunami. My husband and I went down and measured several trees carefully but unscientifically. We

measured the distance on the ground, took the angle to the top of the tree, and then calculated the height of the trees.

The tallest tree we found was 91′ high with a circumference of 5′ as measured at 4½′. We had no way to measure the spread. Obviously, there is room for error here and I am not nominating this palm to be placed on the register.

I knew these trees were old and tall but I never realized that they were that tall. They are still fruiting and look relatively healthy though the trunks have the weathered look.

Several varieties of coconuts are grown on this island, and so we are accustomed to seeing coconut trees of various heights. What James McCurrach calls the 'Dwarf Malayan' variety, and what is called in Hilo the 'Samoan' coconut, is very popular here. There is a row of them planted very close together that is several blocks in length—and this row of dwarf trees is within sight of the tallest trees.

So come to Hilo next June for the biennial meeting of The Palm Society and see the Mutt and Jeff coconut trees.

Aloha,
JANE ROBINSON
28 Makakai Place
Hilo, Hawaii 96720

Dear Fellow-Members of
The Palm Society,

After serving as your Executive Secretary for eight years I find it necessary to resign, for personal reasons.

The membership has nearly tripled in these eight years; it has become apparent that more than one person should be involved in attending to the daily office affairs. These affairs have now been assigned to a hightly qualified organization. The new address for the society is:

The Palm Society, Inc.
P.O. Box 368
Lawrence, KS 66044, USA

I have thoroughly enjoyed working as your Executive Secretary and I value highly and hope to keep the many friendships I have made. It is with sadness and regret that I give up this responsibility but I trust I shall be able to continue contributing to the society in some way. I know many of you will wonder what is to become of my garden. I shall take with us many of my beloved palms when my husband and I move to East Ridge Retirement Village, which is in the Greater Miami Area.

We hope to attend the Biennial Meeting in Hawaii and look forward to seeing many of you there.

TEDDIE BUHLER

Seed Bank News

The seed bank list was sent to all members in mid-January. If your copy has not been received, please inquire of The Palm Society office.

CLASSIFIED

SUBZERO PALMS. Includes seeds, seedlings, plants of *Rhapidophyllum hystrix*, *Sabal minor*, *Sabal louisiana*. Send for list. Dr. David Griggs, 3365 Timberridge Trail, Duluth, GA 30136.

BOOKSTORE

INDEX TO PRINCIPES (Vols. 1–20, 1965–1976, H. E. Moore, Jr., 68 pp.)	$ 3.00
CULTIVATED PALMS OF VENEZUELA (A. Braun, 1970, 94 pp. and 95 photographs.)	4.50
THE INDIGENOUS PALMS OF SURINAME (J. G. W. Boer, 1965, Part of Flora, 172 pp.)	21.00
PALMS (D. Muirhead, 1961, 140 pp.)	2.50
PALMS OF SOUTH FLORIDA (G. B. Stevenson, 1974, 251 pp.)	6.00
PALMS OF THE WORLD (J. C. McCurrach, 1960, 290 pp.)	19.00
SUPPLEMENT TO PALMS OF THE WORLD (A. C. Langlois, 1976, 252 pp.)	25.00
THE GENUS PRITCHARDIA (O. Beccari and J. F. Rock, 1921, 74 pp.)	12.00
THE MAJOR GROUPS OF PALMS AND THEIR DISTRIBUTION (H. E. Moore, Jr., 1973, 115 pp.)	4.50
THE GENUS PTYCHOSPERMA LABILL. (F. B. Essig, 1978, 61 pp.)	5.50
THE PALM FLORA OF NEW GUINEA (F. B. Essig, 1977, 46 pp.)	5.50
PALM SAGO (K. Ruddle, D. Johnson, P. K. Townsend, J. D. Rees, 1978, 190 pp.)	7.50
HARVEST OF THE PALM (J. J. Fox, 1977, 244 pp.)	15.00
THE DATE PALM (H. Simon, 1978, 155 pp.)	8.95

Palm Papers (Postage Included)

THE HARDIEST PALMS (J. Popenoe, 1973, 4 pp.)	1.00
FURTHER INFORMATION ON HARDY PALMS (J. Popenoe, 1973, 4 pp.)	1.00
FRUITS OF THE PTYCHOSPERMA ALLIANCE (F. B. Essig, 1977, 16 pp.)	1.00
PALMS—ANCESTRY AND RELATIONS (B. Ciesla, 1979, a chart)	4.00

Prepaid mail orders now are invited for the palm books listed above and should include the indicated price plus $1.00 extra per book to cover packaging and postage to any address in the world. (California residents please add 6% sales tax.) Send check in US currency payable to The Palm Society, together with specific indication of book (or books) desired, and with clearly legible return address, to Pauleen Sullivan, 3616 Mound Avenue, Ventura, California 93003, USA. We also buy and resell old palm books.

Nurseries Offering Palms

Five years ago (*Principes* 18: 157), an invitation to nurserymen and buyers of palms to address letters or catalogs to the editor met with a response that was less than overwhelming. The following list is now published in the hope that it will be useful to readers and that it will stimulate additions. The following are current suppliers of seeds or plants.

USA

Hana Gardenland, P.O. Box 248, Hana, HI 96713

Hurov's Tropical Seeds, P.O. Box 10387, Honolulu, HI 96816

Pinehurst Farms, P.O. Box 207, Estero, FL 33928

Smith Hammock Nursery, 28595 SW 170th Ave., Homestead, FL 33030

New Zealand

Peter B. Dow & Co., P.O. Box 696, Gisborne, New Zealand, with a subsidiary company, Dow Seeds Hawaii Ltd., P.O. Box 30144, Honolulu, HI 96820

H. E. MOORE, JR.

Notice

Remember the biennial meeting of The Palm Society in Hawaii, June 14–22, 1980.