the several days required to reach the locality where it had been collected originally. It's always well to have a focus for a return to exciting palm areas, thus I left Nadi that night ready to rest after more than seven months on the go but already thinking about returning to Fiji, to New Caledonia, to New Guinea and its neighbor islands and to Madagascar.

It would not be fitting to close this account without reiterating my thanks to all those who made it by far the most rewarding experience since I first began field work in 1940. Travel was made possible by National Science Foundation Grant GB-1354 as part of a broader program of palm study and though I should like to single out everyone who aided me, I shall have to be content with those already noted who made so many arrangements in Madagascar, and Mr. Don Jayaweera in Ceylon, Mr. Humphrey Burkhill in Malaya, Mr. B. Smythies, Dr. J. A. R. Anderson, Dr. Peter Ashton, Dr. W. Meijer in Borneo, Mr. John Hauser, Mr. Reginald Spence, Mr. Selwyn Everist in Australia, Mr. John Womersley and Mrs. Andrée Millar in New Guinea, Dr. T. Whitmore, Mr. G. Dennis and Mr. K. Treneman in the Solomon Islands, M. Lavoix in New Caledonia and Mr. John Parham in Fiji. To them I shall ever be grateful.

Salt Tolerance in Young Palms

A Personal Experience With the Effects of a Hurricane Tide on Several Hundred Small Palms in a Nursery

Jack Koebernik

There is little to be found in the literature about the effect of ocean water on seedling palms — at least it has been difficult for me to find much published on this subject. Therefore, I thought that it might be of some interest to members of The Palm Society to know what happened to several hundred young palms after being submerged in salt water of varying depths and for varying lengths of time.

On September 7th, 1965, hurricane "Betsy," the second hurricane of the 1965 season (the U. S. weather bureau names the storms alphabetically), bore down on Key West, Florida, with winds to 90 miles an hour and very high tides. My small nursery is situated on Stock Island, on rather low ground, and the hurricane tide inundated it quite thoroughly. In the subsequent weeks I have noted carefully what effects the salt water had on a number of genera and species, and have compiled the following chart showing the results. Some of them surprised me not a little.

Palm	Size, How Planted	Approx. Depth Water and Time Submerged	Effect
Acoelorrhaphe Wrightii (*Paurotis Wrightii*)	3 ft., container grown	6 in., 3 hrs.	Unaffected
Aiphanes acanthophylla	Seedling in flats	6 in., 3 hrs.	Slight burn
Arecastrum Romanzoffianum	Gal. cans, 18 in. tall	6 in., 3 hrs.	Unaffected
Arenga Engleri	Large plants, 5 ft. tall	12 in., 6 hrs.	Unaffected
A. pinnata	Gallon cans	6 in., 3 hrs.	Unaffected

Arenga species	Gallon containers	6 in., 3 hrs.	Unaffected
Arikuryroba schizophylla	Large plants, 3 ft.	12 in., 6 hrs.	Unaffected
Arikuryroba schizophylla	Seedlings, 4-inch pots	12 in., 6 hrs.	Unaffected
Bactris species	Gallon containers	6 in., 3 hrs.	Unaffected
Basselinia eriostachys	Gallon containers	6 in., 3 hrs.	Unaffected
Calyptronoma dulcis	Gallon containers	6 in., 3 hrs.	Unaffected
Caryota mitis	12-ft., container grown	30 in., many hrs.	Much burn right away. Fungus set in. All but one plant had to be destroyed.
Chamaedorea elatior	Seedlings in flats	6 in., 3 hrs.	A little burn
Chamaedorea erumpens	7-ft., container grown	30 in., many hrs.	Unaffected
Chamaedorea erumpens	Seedlings in 4-in. pots	24+ in., m. hrs.	Unaffected
Chamaedorea erumpens	Seedlings in flats	6 in., 3 hrs.	Unaffected
Chamaedorea Seifrizii	4-ft., container grown	30 in., many hrs.	Unaffected
Chamaedorea Seifrizii	Seedlings in 3-in. pots	24+ in., m. hrs.	Unaffected
Chamaedorea Seifrizii	Seedlings in flats	6 in., 3 hrs.	Unaffected
Chamaedorea Tepejilote	Seedlings in flats	6 in., 3 hrs.	A little burn
Chamaerops humilis	4-inch pots	24+ in., m. hrs.	Little tip burn
Chrysalidocarpus lucubensis	2½ ft., container grown	6 in., 3 hrs.	Unaffected
C. lutescens	4-ft., container grown	30 in., many hrs.	Much burn right away. All died.
Dictyosperma album	4-ft., container grown	6 in., 3 hrs.	Unaffected
Dictyosperma album var. rubrum	10-ft., container grown	30 in., many hrs.	(seemed to thrive)
Dictyosperma aureum	Seedlings in flats	6 in., 3 hrs.	Unaffected
Drymophloeus Beguinii	Gallon containers	6 in., 3 hrs.	Unaffected
Elaeis guineensis	5-ft., container grown	12 in., 3 hrs.	Unaffected
Euterpe globosa see *Prestoea montana*			
Geonoma membranacea	Seedlings in flats	6 in., 3 hrs.	Little tip burn
Heterospathe elata	Seedlings in flats	6 in., 3 hrs.	Unaffected
Jubaea chilensis	4-inch pots	6 in., 3 hrs.	Unaffected
Latania Loddigesii	3-ft., container grown	6 in., 3 hrs.	Unaffected
Licuala spinosa	Gallon containers	6 in., 3 hrs.	Unaffected
Livistona chinensis	4-inch pots	6 in., 3 hrs.	Much burn right away. All died in short while
Livistona chinensis	Seedlings in flats	6 in., 3 hrs.	Unaffected
Mascarena Verschaffeltii	Seedlings in flats	6 in., 3 hrs.	Unaffected
Neodypsis Decaryi	Gallon containers	6 in., 3 hrs.	Unaffected
Oncosperma tigillarium	Gallon containers	6 in., 3 hrs.	Unaffected

Opsiandra Maya	Seedlings in flats	6 in., 3 hrs.	Unaffected
Orbignya Guacuyule	Gallon containers	6 in., 3 hrs.	Unaffected
Paurotis Wrightii see *Acoelorraphe Wrightii*			
Phoenix canariensis	Seedlings in 3-in. pots	6 in., 3 hrs.	Unaffected
Phoenix species	Seedlings in 4-in. pots	6 in., 3 hrs.	Some tip burn, fungus later
Phoenix species	Gallon containers	6 in., 3 hrs.	Unaffected
Phoenix Roebelenii	1-quart cans	12 in., 3 hrs.	Unaffected
Pinanga patula	Gallon containers	6 in., 3 hrs.	Unaffected
Prestoea montana (*Euterpe globosa*)	Gallon containers	6 in., 3 hrs.	Unaffected
Pritchardia species	Seedlings in a flat	6 in., 3 hrs.	Unaffected
Pseudophoenix Sargentii	Gallon containers	6 in., 3 hrs.	Unaffected
Ptychosperma elegans	12-ft., in containers	6 in., 3 hrs.	Some burn
Ptychosperma Macarthurii	9-ft., in containers	12 in., 3 hrs.	Unaffected
Ptychosperma Macarthurii	In 3-inch pots	6 in., 3 hrs.	Much burn, nearly all died
Rhapis species	3-ft., container grown	6 in., 3 hrs.	Unaffected
Roystonea species	10-ft., container grown	6 in., 3 hrs.	Some burn
Scheelea amylacea	Gallon containers	30 in., many hrs.	Unaffected
Syagrus sancona	Seedlings in a flat	6 in., 3 hrs.	Unaffected
Synechanthus fibrosus	Gallon containers	6 in., 3 hrs.	Unaffected
Tessmanniodoxa Chuco	2½-ft., container grown	6 in., 3 hrs.	Unaffected
Veitchia Merrillii	6-ft., container grown	30 in., many hrs.	Unaffected and seemed to thrive
Veitchia Merrillii	4-ft., 3-gallon cans	30 in., many hrs.	Much burn
Veitchia Merrillii	2-ft., 1-gallon cans	30 in. many hrs.	Much burn
Veitchia Merrillii	Seedlings in a flat	12 in., 6 hrs.	Unaffected
Washingtonia, species	3-ft., container grown	30 in., many hrs.	Unaffected and seemed to thrive

All the palms were thoroughly watered before the tide came in and as soon as posible after it drained away. The foliage was well washed off.

It is notable that plants grown in muck with no sand added showed no burn or other injury. Plants grown in muck and sand mixture showed some burn to much burn. For example, *Livistona chinensis* seedlings in 4-inch pots were in muck and sand mixture and all were lost. *Livistona chinensis* seedlings in flats were grown in muck with no sand and all survived undamaged.

An *Arenga Engleri* planted in the ground and about eight feet tall, growing about twenty miles from Key West was completely covered with salt water and was unaffected. Several *Veitchia Merrillii* and *Washingtonia* species in the same area were standing in several feet of salt water during the storm and showed no effects whatsoever from it. Several years ago some washingtonias were planted in Key West. One plant grew much more rapidly than the rest. Its roots were found to be in salt water. Later, the salt water was cut off from it and the rate of growth was much affected for over a year.