pernicia, Roystonea, Corypha, Pritchardia, Borassus, Caryota, Chrysalidocarpus, Latania, Bismarckia, Livistona, Phoenix, Ptychosperma. And many other species are becoming established in the lowland which, in another decade, will make this newly developed area one of the most striking sections of the Garden.

We frequently walk a mile through the Garden, often leaving the paved surface to "explore" some area that has undergone changes since we saw it last. And we feel fortunate to live so close to this botanical garden where it is possible to go at any time we feel the urge for a walk and be assured that we will always find something new and interesting.

Germination Experiments

The Effect of Scarification on the Germination of Seed of Acrocomia Crispa and Arenga Engleri

JUAN DE DIOS HOLMQUIST* AND JOHN POPENOE
FAIRCHILD TROPICAL GARDEN, MIAMI, FLORIDA

Most research on the germination of palm seeds has been on African Oil palm, coconut, or other palms grown as plantation crops. Some work has been done on ornamentals, however, and most of it is reported in the journal PRINCIPES.

From the various studies made on the germination of palm seeds it is found that most species germinate readily and no special treatment is needed to accelerate germination (1, 3).

The methods described for accelerating germination of palm seeds vary from simply removing the exocarp or husk (fleshy part of many fruits) and cleaning the seed to complicated chemical or mechanical treatments such as breaking the seed coat with a hammer and treating the hard seeds with concentrated sulphuric acid. Kitzke (2) working with *Copernicia* got the best germination by scarifying the seeds with 10 per cent sulphuric acid for ten minutes.

High temperatures have also been useful in promoting germination. De Leon (1) had good results in germinating seeds of two difficult species using a hotbed with electric cables which maintained a temperature of 83° F. This same treatment was later recommended by Loomis (3), Lothian (4), and Yocum (5) for different species of palms.

From among the various species of palm that are difficult to germinate two were selected for this study. *Acrocomia crispa* was selected because it is one of the most desirable of its genus for ornamental purposes and most of the other species of this genus are also very slow in germination. *Arenga Engleri* is one of our most desirable ornamentals because of its attractiveness and hardiness in Central Florida and California. *Arenga Engleri* is notoriously difficult to germinate.

Experiments with ACROCOMIA CRISPA

Fruits were obtained from two palms. The first batch was fully mature and beginning to drop. One hundred of these first fruits were cracked open and the kernels given a visual examination.

*Present address: Facultad de Agronomía, Maracay, Venezuela.

Ninety-three percent of the seeds appeared to have good embryos, while seven per cent were blanks with no kernel. The second lot of fruits were not as mature as the first and were still a greenish-yellow color. Two hundred of these seeds were cracked to examine the kernels. Twenty-three percent of these seeds were blanks and had no kernel. Approximately 50 per cent had not completed maturation, that is they were still soft. Seeds from both groups were used for the experiments but were kept separate to determine whether or not less mature fruits would germinate satisfactorily.

The husk or fleshy exocarp was removed from all but one lot of the seeds which was used as a control. Then the following treatments were made with 25 seeds from each lot receiving each treatment:

a. Control — no additional treatment after removal of the exocarp.

b. Removal of the mesocarp after cracking with a hammer and only kernel planted.

c. Removal of the mesocarp with a hammer and the pellicle or membrane around the kernel with a knife.

d. Removal of the mesocarp with a hammer and soaking the kernel in tap water for 12 hours at room temperature.

e. Same as *d.* but soaking the kernel for 24 hours.

f. Filing the mesocarp with a file on the side next to the hylum (scar or point of attachment of a seed) until the kernel could be seen.

g. Cleaning out the hylum with a knife, taking care not to damage the kernel.

h. Burning the seed wrapped in newspaper for one minute.

i. Soaking the seeds in concentrated sulphuric acid for 10 minutes.

j. Same as *i.* but for 20 minutes.

k. Same as *i.* but for 30 minutes.

l. Control — seeds planted without removal of husk or exocarp.

After the treatments were made the seeds were planted in ten-inch pots in a mixture of 50 per cent peat moss and 50 per cent vermiculite. Each treatment of 25 seeds was planted in a separate pot. The pots were placed in the greenhouse for germination. The treatments were made on June 4, 1965.

The germination of the *Acrocomia* seeds was recorded on August 26, or a total of 83 days after the treatments were started. At this time the only treatments that showed much germination were where the exocarp and mesocarp or hard shell surrounding the seed had been removed. In treatment *d.* on the mature seeds of the first lot, 15 seeds had germinated. In treatment *e.* of this lot 10 seeds had germinated. Where the kernel was not soaked at all but planted directly, six seeds germinated from the first lot.

In the control where only the exocarp was removed, four seeds germinated from the first lot of seeds. One seed germinated where the channel of the hylum had been cleaned out with a knife. Also in the mature lot of seed one seed germinated in treatment *f.* where the mesocarp was filed down.

In the group of seeds from immature fruits, only two germinated and these were both from treatment *b.* where the exocarp and mesocarp were removed but no further treatment was made.

No statistical treatment was applied to the results because of the lack of replications. Nevertheless, it can be concluded that there is probably a beneficial effect on germination from removing the exocarp, then cracking the

shell or mesocarp with a hammer before planting the seeds. Perhaps soaking the kernel in water is also beneficial and further study should be made on this matter. None of the other treatments seem to have any particular value. The effect of temperature on germination of seeds of this species should be examined also but there is always the difficulty of finding a sufficiently large quantity of seeds of uniform maturity and quality to run valid experiments. If the mesocarp is cracked before planting it is easy to eliminate the blanks and thus eliminate one of the variables in these germination experiments.

Experiments with ARENGA ENGLERI

Mature fruits were separated into two groups. The first group was cleaned and then soaked in water for two weeks. The second group was cleaned and then planted immediately after treatment. (Note — There is a substance in the fleshy exocarp of these fruits which burns the skin of a person cleaning the seeds. It is best to wear rubber gloves and take all precautions necessary to protect the skin.)

The following treatments were made on June 9, 1965:

a. Sanding down the mesocarp with emery paper at the point of the hylum.
b. Control — no additional treatment.
c. Filing the seed in a location other than the hylum.
d. Burning the seed coat with ignited newspaper for 30 seconds.
e. Soaking the seeds in sulphuric acid for 5 minutes.
f. Soaking the seeds in concentrated sulphuric acid for 10 minutes.
g. Soaking the seeds in concentrated sulphuric acid for 20 minutes.

Twenty-five seeds were used for each treatment and each treatment was planted in separate pots and handled the same as the *Acrocomia* seed.

After 80 days the germination was recorded. The most successful treatment was where the seeds had been sanded down at the point of the hylum until the embryo was just visible. In this treatment 15 seeds germinated. With the same treatment but the seeds soaked in water first, eight germinated. With the sulphuric acid treatment for 10 minutes two seeds germinated, and when the seeds had been soaked in water for 15 days first and then treated for 10 minutes with the sulphuric acid only one seed germinated. None of the other seeds had germinated during the 80 days.

Although no statistical treatment of the results was possible it is safe to conclude that sanding or filing down the seed at the point of the hylum until the embryo is just visible is the most effective method of treating the seed and can be recommended for further trial and use.

LITERATURE CITED

1. DeLeon, N. J. 1956. Palm Society Bulletin No. 5.
2. Kitzke, Eugene D. 1958. A method of germinating Copernicia palm seed. PRINCIPES 2 (1): 5-8.
3. Loomis, H. F. 1958. The preparation and germination of palm seeds. PRINCIPES 2 (3): 98-102.
4. Lothian, T. R. N. 1959. Further notes concerning the Central Australian cabbage palm (Livistona Mariae). PRINCIPES 3 (2): 53-63.
5. Yocum, H. G. 1964. Factors affecting the germination of palm seeds. American Horticulture Magazine 43: 104-106.