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Contents for January

Cover Picture

The head of the Ecuadorian liberator, Sucre, carved from a single seed of the *tagua* palm, source of "vegetable ivory." The head stands about two inches high and the palm may be either *Palandra aequatorialis* or *Phytelephas macrocarpa*. Photograph by W. H. Hodge.

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Cicada Populations on Palms in Tropical Rain Forest

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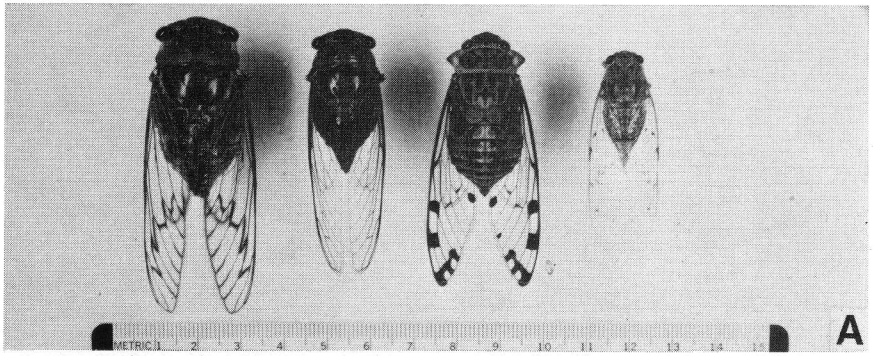
The purpose of this note is to call attention to some apparent interactions between several species of cicadas (Homoptera: Cicadidae) and palms (Palmae) in Costa Rican lowland tropical rain forest. Despite the fact that palms collectively comprise a major component of the understory of primary growth tropical wet forests (Standley, 1937; Allen, 1956; Holdridge *et al.*, 1971), little has been done regarding their ecological interactions with insects, with the notable exceptions of pollination systems (e.g., Corner, 1966; Essig, 1971; Schmid, 1970), and seed predation (Janzen, 1971).

Since very little is known about the biology of neotropical cicadas and since ecological studies of these insects have only begun (Young, 1972), this paper concerns primarily the use of various palm species as emergence sites for several cicada species inhabiting the same forest. As more information is gathered on the biology of these insects in the tropics, attention may turn to more detailed study of plant-cicada relationships, particularly with respect to the host plant specificity of the subterraneous nymphs in selected species.

Cicadas are hemimetabolic insects, possessing a nymphal period (of several instars) that is subterraneous, and which is terminated by the mature nymph digging its way out of the soil for eclosion of the winged adult. The nymphs, while subterraneous, feed on plant juices through roots and rhizoids. This paper emphasizes the importance of palm species as sites for the final molt of adult cicadas in the understory of tropical wet forests, and related ecdysis aspects of cicada natural history as influenced by palms.

Habitat and Procedures

The observations discussed in this paper were made during a sampling study of the temporal and spatial emergence patterns in several sympatric species of cicadas in plots of lowland tropical wet forest at a single locality in northeastern Costa Rica (Young, 1972). This locality is Finca la Selva ("La Selva"), a research field station of the Organization for Tropical Studies, Inc., and situated near the confluence of the Río Sarapiquí and the Río Puerto Viejo, near Puerto Viejo (Herédia Province) in the Caribbean lowlands (90–100 m. elev.) of Costa Rica. A full account of the ecological properties of the cicada populations studied is summarized elsewhere (Young, 1972), in addition to sampling techniques, location of study plots, etc. It suffices to say here that one major study plot was located in primary-growth forest understory. Nymphal skins of any cicada species were then collected from all understory plants within the plots, with records kept for each species of dicot and monocot from which skins were taken. The sampling period extended over a two-year period (1968–1970) with samples made several times (days) each month. Notes were made on the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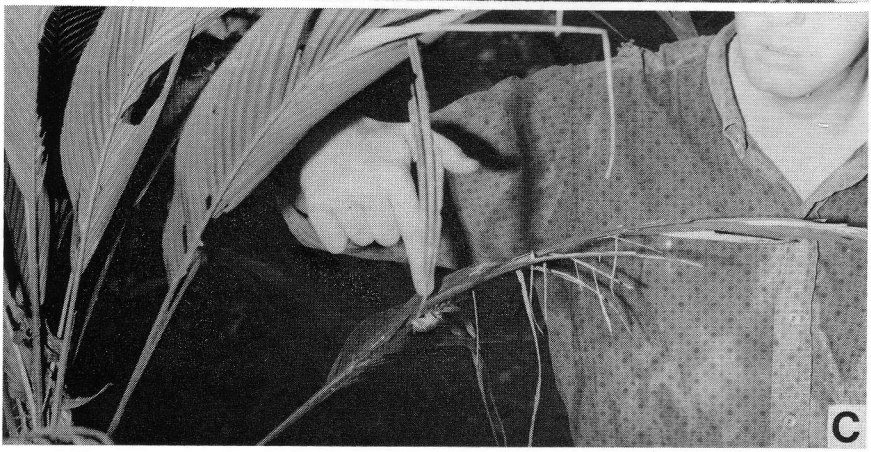
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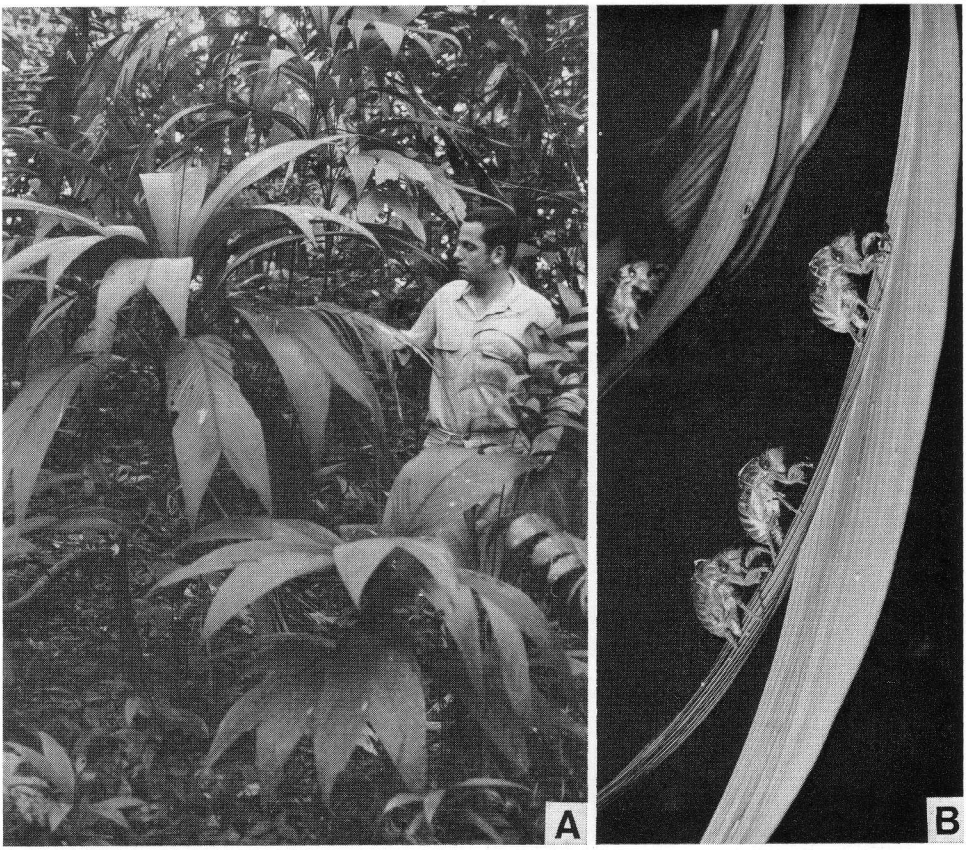

2. (A) *Asterogyne martiana* (foreground) and *Geonoma* sp. (background) in the La Selva understory. (B) several nymphal skins of *F. sericans* on the undersides of *Asterogyne martiana* leaves.

density and distribution of nymphal skins on each individual understory plant.

Results of Survey

This study revealed that four species of cicadas were regularly found on various species of palms: *Fidicina mannifera*, *F. sericans*, *Zammara smaragdula*, and *Proarna sallei* (Fig. 1-A). Nymphal skins of these species were found on palms and various dicots in the lower understory (Fig. 1-B) of the forest, and in most instances, individual nymphs were seen clinging to the ventral surfaces of leaves (Fig. 1-C).

By far the most abundant species of cicada emerging in the understory was *F. sericans*, and local populations of this cicada were most evident on the palms

←

1. (A) four species of cicadas which undergo adult eclosion on palms in the La Selva forest, from left to right: *Fidicina mannifera*, *F. sericans*, *Zammara smaragdula*, and *Proarna sallei*. (B) the understory structure of the La Selva forest, illustrating the abundance of palms (*Asterogyne martiana*—foreground; *Bactris* sp.—upper right background). (C) living nymph of *F. sericans* climbing along the underside of a leaf of *Asterogyne martiana*.

3. Palms in the understory of the La Selva forest. (A) *Geonoma* sp. and *Asterogyne martiana* growing side by side (B) *Geonoma* sp., *Socratea durissima*, and *Asterogyne martiana* in the understory.

Table 1. Relative numerical abundance of cicada species eclosing on various palms in the forest understory at Finca la Selva in Costa Rica.

Palm	Number of cicada nymphal skins				
	Fidicina mannifera	*Fidicina sericans*	*Zammara smaragdula*	*Proarna sallei*	Total
Geonoma spp.	642	1,252	218	57	2,169
Asterogyne martiana	315	842	105	32	1,294
Bactris sp.	261	103	16	52	432
Iriartea gigantea	47	83	34	10	174
Socratea durissima	163	100	12	0	275

Geonoma spp. and *Asterogyne martiana* (Fig. 2-A). It was not uncommon to find several nymphal skins on each leaf of these palms (Fig. 2-B) suggesting high local population density of the cicada associated with the palms. Other species of palms bearing nymphal skins of cicadas were predominantly *Geonoma* spp., *Iriartea gigantea*, and *Socratea durissima* (Fig. 3).

Table 1 gives the relative abundance of cicada species on the palms. The most striking result of this survey is that all cicadas appear to be associated with all the palms, but that *F. sericans* shows the greatest numbers on palms. For the entire sample of nymphal skins of this cicada, more than 70% of the skins were found on palms, with about 25% on dicots and 5% on the ground. In the same habitat, the majority (55–95%) of nymphal skins in the other species were found on dicots. And with the exception of *Geonoma* sp. which is cespitose, dicots were well interspersed with the palm species in the understory; however, all palm species made up about 64% of all understory plants less than 4 meters tall in the plot of understory sampled.

Discussion

Since palms comprise a major component of the understory flora at La Selva (Fig. 1–3), and since several species of cicadas (Fig. 1) undergo ecdysis on them (Table 1), it is interesting to discuss these observations in terms of how palms may function in the biology of cicadas.

There are four major ways in which palms may affect the biology of neotropical cicadas: (1) provision of suitable oviposition sites, (2) provision of suitable sites for ecdysis, away from the ground and litter, (3) provision of host plants for nymphs, and (4) perhaps providing sites of concentration of resting spores of various fungi pathogenic to cicada nymphs and adults.

Young (1972) found that female *F. sericans* lays eggs in the stems of dead palm leaves (mostly *Geonoma* sp.) still attached to the plants. No other egg-laying sites for this cicada have been found in the understory at La Selva. It is not determined if other cicadas lay eggs in palms.

In northern forests, cicadas commonly undergo the final molt on the ground and on the trunks of very large (canopy-

size) trees (Marlatt, 1907; Lloyd and Dybas, 1966). At La Selva and other localities in Costa Rica, nymphal skins are seldom found on the ground or on tree trunks. Predation rates on nymphs after leaving their subterraneous burrows might be high on the ground and tree trunks in tropical forests. The litter of tropical forests can support a high diversity of amphibians and reptiles (Lloyd, Inger, and King, 1968), many of which may be predators on insects such as cicadas. Under such conditions, palms and other understory plants might provide sites for the final molt in which the likelihood for predatory attack is diminished. By undergoing ecdysis on palms and other understory plants, cicadas may "escape" from predation on the ground and on large tree trunks in tropical forests. Thus the forest understory as a whole provides a micro-environment where cicada nymphs face less chance of being found and eaten. Depending on the forest in question, palms might provide the largest portion of this micro-environment (such as at La Selva, Table 1).

By far the most interesting question resulting from these observations concerns the possibility that the root or rhizome systems of palms provide suitable feeding sites for nymphs before their final molt. While no data are available yet on this question, the observed abundance of nymphal skins of *F. sericans* on *Geonoma* sp. is suggestive of such a feeding relationship. Until digging studies are conducted and directed towards this question, nothing conclusive can be stated, especially since many canopy-size tropical tree species have extensive horizontal root systems. But the possibility of such an interaction between cicadas and palms is an intriguing one, and studies are now being planned to examine host plant specificity in situ for selected cicada species in various regions of Costa Rica.

Young, Tyrrell, and MacLeod (1972) have noted high incidence of pathogenic attack on the cicada *Procollinia biolleyi* by the fungus *Entomophthora echinospora* in a montane tropical forest locality in which palms are very abundant. It is known that various fungal species of *Massospora* (which also attacks cicadas) and *Entomophthora* have resting spores which lay on plant surfaces (D. M. MacLeod, pers. comm.). The possibility that palms provide a site for the transmission of pathogenic attack, either in the soil via the roots to nymphs or on aerial portions for contact with nymphs undergoing ecdysis, also merits investigation.

Summary

Several sympatric species of neotropical cicadas undergo the final molt on various palm species in the understory of lowland tropical wet forest in northeastern Costa Rica. Of the various cicadas observed, *Fidicina sericans* is the most common cicada on the most abundant palm, *Geonoma* sp. This cicada also lays its eggs in the dead leaves of *Geonoma* sp. The possible interactions between cicadas and palms in tropical forests are best seen by considering palms as a micro-environment for cicadas, providing these insects with (1) oviposition sites, (2) predator-free sites for the final molt, (3) possible host plants for feeding nymphs, and (4) possible sites for the mobilization of resting spores of fungi pathogenic to cicadas. The extent of species-specificity in such interactions is undetermined.

Acknowledgements

This is a contribution from N.S.F. Grant GB-7805, Dr. Daniel H. Janzen, principal investigator, and the Organization for Tropical Studies, Inc., in Costa

Rica. Dr. L. R. Holdridge (Tropical Science Center—San Jose, Costa Rica) acquainted the author with La Selva palms during a course, "Tropical Dendrology," in October 1968. Dr. Thomas E. Moore (University of Michigan) identified the cicadas.

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REPRINTED FROM HERE AND THERE

How many people have been clobbered by falling coconuts? Is it rare, or do people get bopped on the noggin by nuts all the time?—C. M.

It's so rare it's almost unrecorded. Dick Reeves of the Miami Beach Parks Department says the last case he recalls happened in 1968 when a local citizen got clonked by a privately owned tree. City of Miami officials told us they couldn't remember anyone complaining of direct hits recently and Art Peavy, Jr. of the Dade County Parks Department told us trees in heavy use areas are kept well trimmed to avoid unpleasant incidents. Local legend says coconuts fall only on tourists, but that's not completely true. We discovered a total of four Dade Countians throughout the years who'd been underneath a coconut when the nut decided to drop. One sported a beautiful shiner for days.

Reprinted with permission from *Action Line*, *The Miami Herald*, 20 December 1972

Over 1,200 South Florida coconut palms have died since the lethal yellow blight made its first appearance in Miami in October. This same disease destroyed over 15,000 coconut palms in Key West and turned many lush Jamaican coconut plantations into graveyards. The disease has been around for 50 years and still baffles plant scientists. Picture Miami or Key Biscayne with nothing but hundreds of thousands of dead trees. The cure for lethal yellow blight can't be too elusive. All we need is the money for immediate research and action.—PAUL A. DRUMMOND, The Palm Society.

Reprinted with permission from *Action Line*, *The Miami Herald*, 20 August 1972

Branch and Inflorescence Production in Saw Palmetto (Serenoa repens)*

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The saw palmetto, *Serenoa repens* (Bartr.) Small (subfamily Coryphoideae) is widely distributed throughout the southeastern United States. It is common in pinelands, prairies and coastal sand dunes, typically with a low-growing habit. Most plants have extended underground or surface-creeping stems (Fig. 11) but sometimes it forms dense clumps. Occasional plants in sheltered or otherwise favored habitats are found with more upright, obliquely-rising or even erect stems with basal branches. Saw palmetto then approaches the habit of a typical multiple-stemmed palm.

Both saw palmetto and its associated pines are adapted to fires that are common during the dry season of winter and early spring. In an area that has been burned early in the year, *Serenoa* subsequently shows a conspicuous greening when the charred stems send up their first new leaves. Regrowth is rapid, the green of the new leaves being evident within a few days of the fire and by mid-summer, recovery of the foliage is complete. In some areas of the Everglades fires destroy hardwood hammocks, leaving only the saw palmettos at the perimeters; these form saw palmetto "rings" up to several hundred feet in diameter (Craighead, 1971: 130).

Although *Serenoa* is so widespread and so abundant in pastures that it has been considered a weed, there is lack of information about its growth habit and especially of the vegetative branching whereby it seems to spread. Even a casual examination suggests that *Serenoa* represents an exception to the general method of branching in clustering palms, in which branches arise as suckers from buds at the base of the main axis, at or below ground level. Good examples of this typical habit are provided by the native paurotis palm (*Acoelorraphe wrightii*). Many species in the genera *Bactris*, *Phoenix* and *Chamaedorea* further represent this clustering habit (Tomlinson, 1961). In all of these palms the upright seedling stem at first produces vegetative branches as suckers which originate from buds in the axils of the lower leaves. As the seedling axis develops further there is a switch from vegetative to reproductive branching. Axillary buds may at first abort, but later ones in the axils of more distal leaves grow out as inflorescences. Consequently suckering is restricted to the basal part of a stem and by repetition of this process on daughter axes, a cluster of stems is built up. Abnormal individuals in a few species produce vegetative branches at higher levels as "aerial suckers" (Davis, 1969). In *Chrysalidocarpus* species some branching normally occurs above ground level by initiation of vegetative buds in extra-axillary positions (Fisher, 1973). The normal situation in multiple-stemmed palms, however, is a clear distinction between a vegetative phase (with suckers) and a reproductive phase (with inflorescences). The two phases are sharply circumscribed.

* Supported by N.S.F. grants GB-5762-X and GB-31844-X.

In contrast to this, *Serenoa* clearly produces a sequence of inflorescences and vegetative branches (suckers) along its horizontal axis, without a clear morphological distinction between vegetative and flowering phases. In the following study we have examined some details of the relative frequency of vegetative and inflorescence buds in order to provide quantitative data.

Material and Methods

Our observations are based on dissections of mature stems and seedlings of *Serenoa* collected from pinelands in several localities between Homestead and South Miami, Florida, and of four-year-old seedlings of *S. repens* growing in one-gallon cans in a nursery at Fairchild Tropical Garden. Shoot apices used for microscopic examination were fixed in FAA (formalin-acetic-alcohol), embedded in paraplast, serially sectioned at 10 μm and stained with safranin and Delafield's haematoxylin.

Regrowth of *Serenoa* was followed in an area of pineland near Fairchild Tropical Garden which was burned over in late March 1971, during a severe winter drought. The fire was sufficiently intense to kill many full-grown pines.

Seedling Development

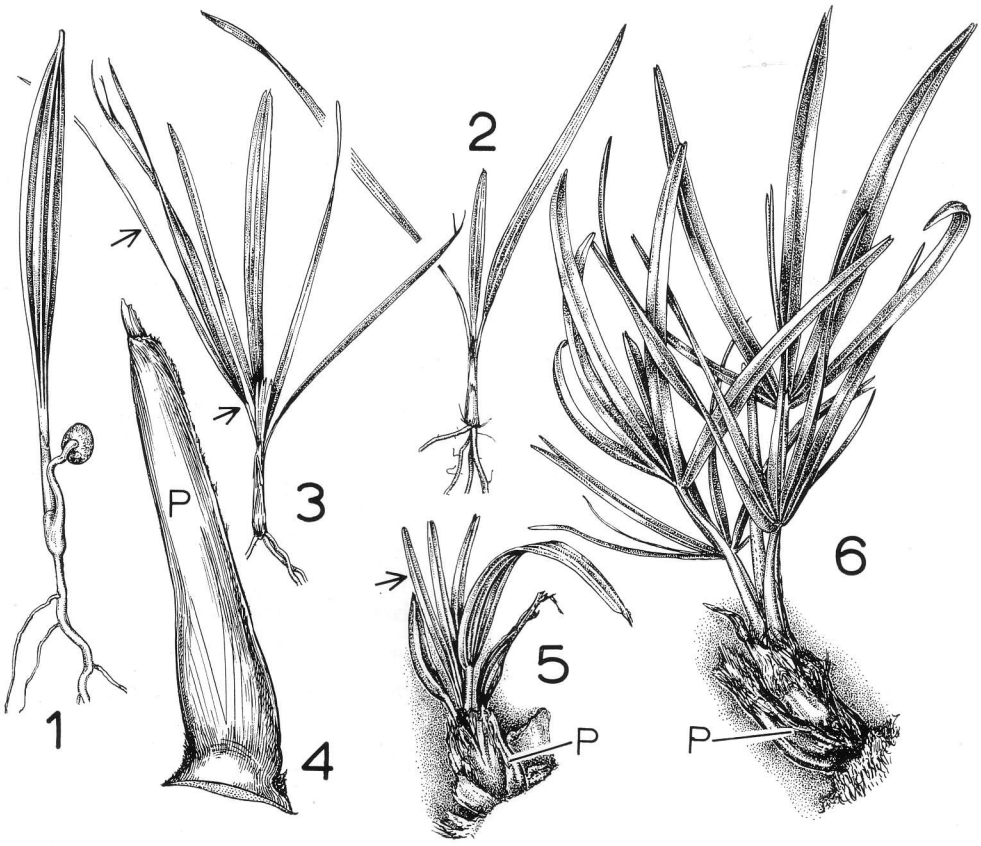
Information about early growth of *Serenoa* seedlings is provided mainly by Hilmon (1968). In a study of germination and early seedling growth he reported that 50–60% of seeds planted in greenhouse flats germinated, the first within six to eight weeks of planting. Only 19% of seeds planted in the field germinated. Removal of the endocarp increased the percentage of germination and induced earlier germination under both conditions. The first eophyll of the seedling emerged above the soil one to two months after germination (Fig. 1).

The first foliage leaves of a seedling are simple and linear (Fig. 2). Up to five of these juvenile leaves, successively wider and longer, are produced, followed by the first palmately dissected leaf (Fig. 3, arrow). Later leaves show increasing dissection. Rate of growth is slow and in field-germinated seedlings Hilmon found that seedlings 18 months after planting had an average of only 2.7 juvenile leaves and the first palmate leaf did not appear until the third year. After five and one-half years, of 30 surviving seedlings, 18 had at least one palmate leaf, 9 of these had entirely palmate leaves (with an average of 4.2 leaves per plant), and 11 still retained entirely juvenile (simple) leaves (with an average of 3.0 leaves per plant).

Branch Morphology and Development

Suckers on seedlings. In our experience, nursery-grown seedlings (Fig. 7) were more vigorous than those grown by Hilmon and within 3 years produced many suckers from axillary buds subtended by typical palmate leaves. In several seedlings the growth of the suckers equalled that of the original axis, making it difficult to distinguish parent axis from daughter sucker. We have no information as to when suckers appear in field-grown seedlings, but it is presumed to be much later than in nursery-grown seedlings.

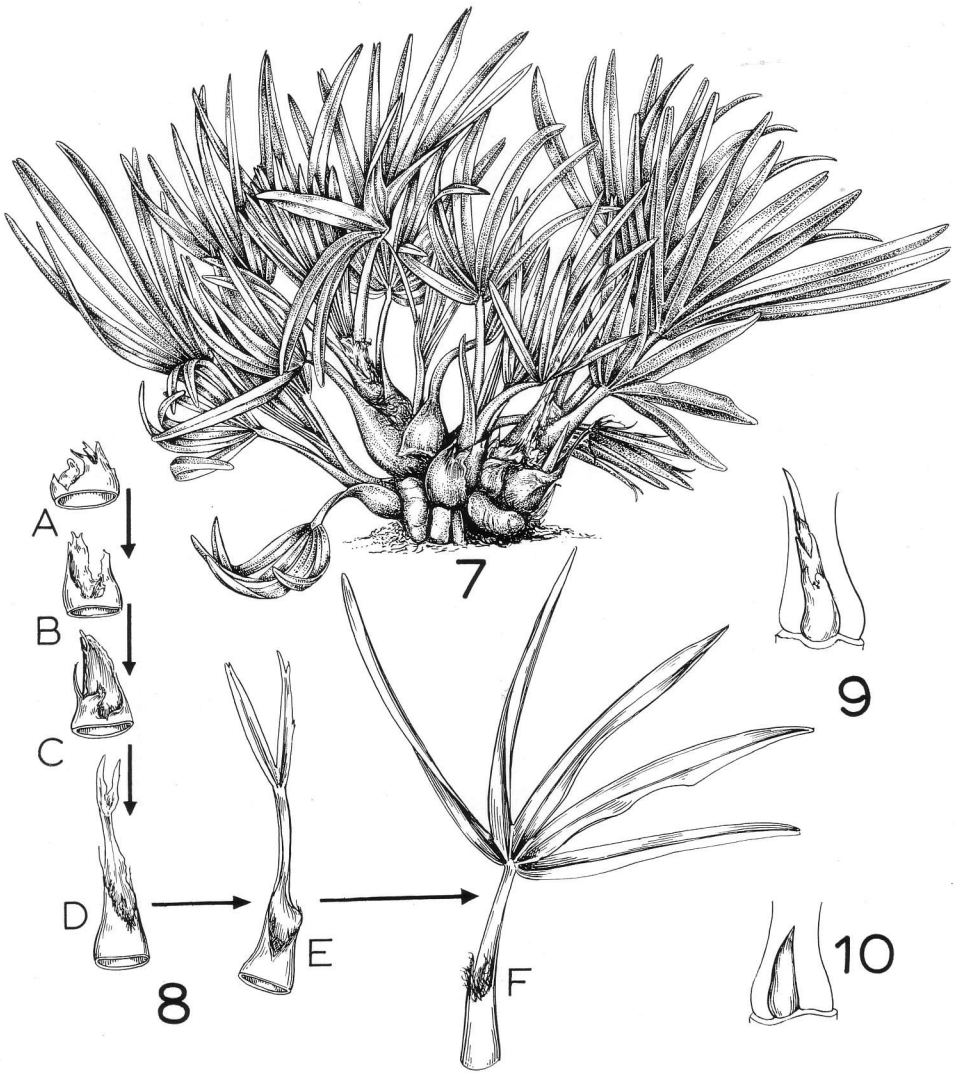
The vegetative sucker bud is covered initially by its first leaf, a scalelike prophyll (Fig. 10) but this is ruptured by growth of subsequent leaves (Fig. 9). These successive leaves (e.g. Fig. 8) are larger but still scalelike (Fig. 8,B–C) followed by leaves with reduced blades (Fig. 8,D–E) until the adult leaf, still with few segments, is formed (Fig. 8,F). This is usually the sixth leaf on the axis of the sucker.



1–6. *Serenoa repens*. Seedlings from the field and vegetative buds and suckers from older plants. 1. Seedling with first eophyll, 12 months after sowing in nursery (× ½). 2. Seedling with only entire leaves (× ¼). 3. Seedling, several simple leaves and first segmented leaf indicated by arrows (× ¼). 4. Vegetative bud with second leaf just exserted beyond prophyll (× ½). 5. Sucker with subtending leaf removed with first segmented leaf indicated by arrow, prophyll is rotted (× ½). 6. Sucker with subtending leaf removed with all recent leaves segmented, prophyll is partially rotted (× ½). P = prophyll in Figs. 4, 5 and 6.

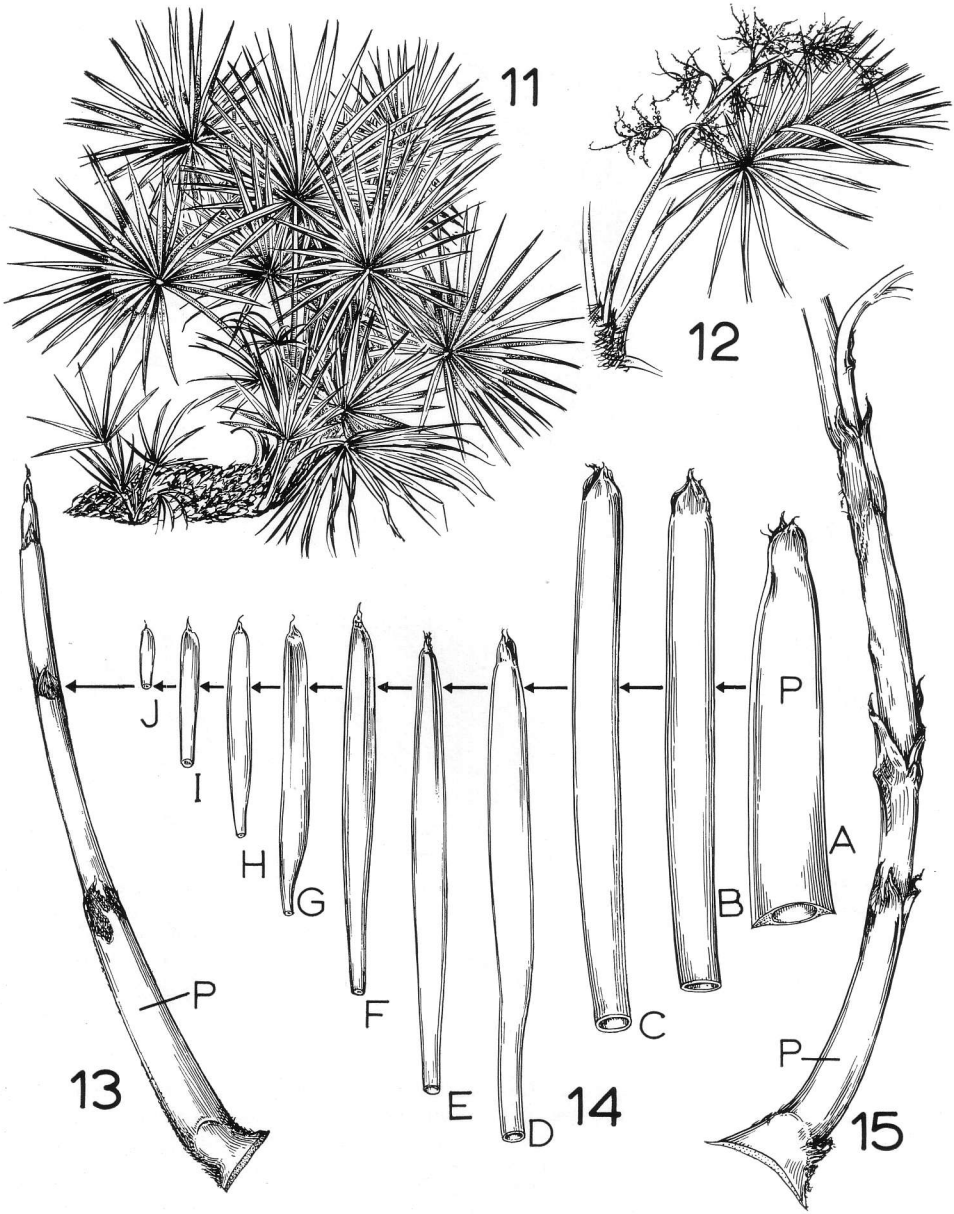
Axillary buds of the seedling always become suckers and never inflorescences.

Microscopic examination of serial sections of seedling apices show that in the axil of every leaf primordium except the three youngest there is a single bud (Figs. 19 and 20). Interpretation of serial sections is made difficult because the crown is not conical but bowl-shaped, with the apical meristem at the base of a shallow depression. Consequently older leaves are attached to the stem in a higher plane than younger leaves. We can indicate the relative positions of leaf primordia by referring to the youngest as P_1 (Figs. 21 and 24) and successively older ones as P_2 . . . etc. The first visible evidence of an axillary bud is in the axil of the fourth youngest primordium (P_4) as a small mound of tissue enclosed by the tubular leaf base (Figs. 23 and 26). The bud in the axil of a

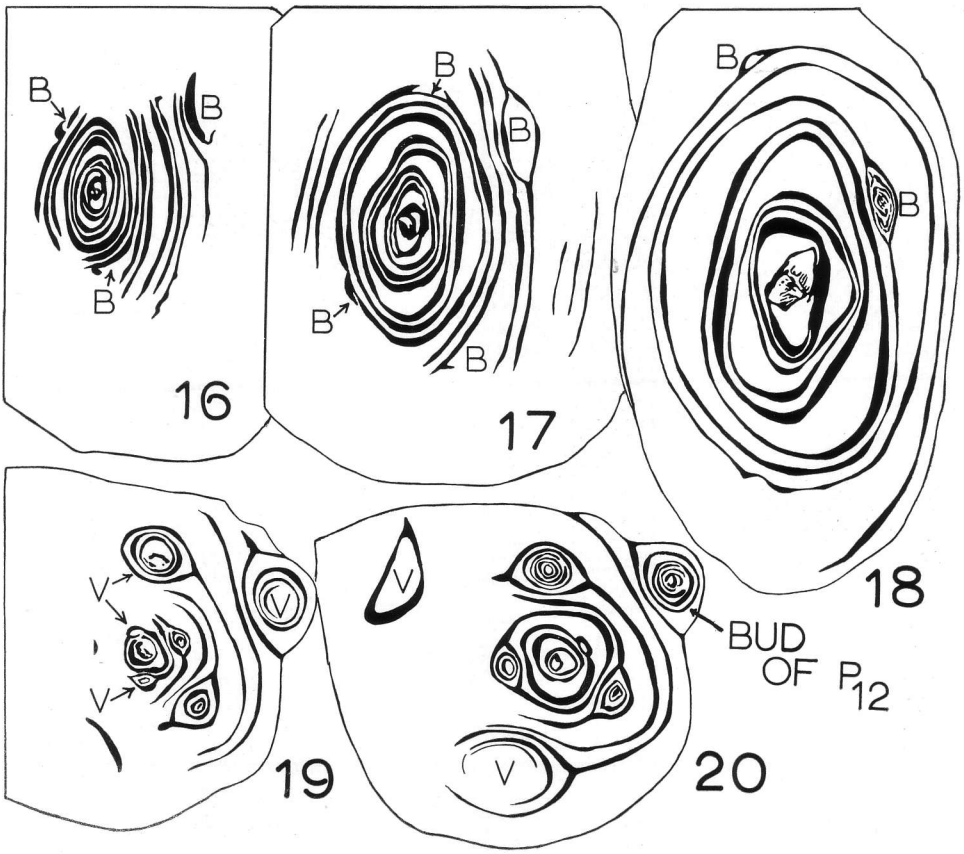


7–10. *Serenoa repens*. 7. Seedling four years old grown under nursery conditions, many buds grown out as suckers and equalling or exceeding main axis (× 7/16). 8A–F. Sequence of leaves removed from a single sucker, starting with the prophyll (A) and ending with the first segmented leaf form (F) (× ½). 9. Expanding vegetative bud, in axil of second youngest visible leaf in the plant shown in Fig. 7. (× ½). 10. Unexpanded vegetative bud, in axil of youngest visible leaf in the plant shown in Fig. 7. (× ½).

leaf when it is in position P_5 is well-defined and elliptical in transverse section, but occupying only a narrow section of the stem circumference. The prophyll of the branch first becomes distinguishable on the bud in the axil of the leaf in position P_5 or P_6, i.e. about the second or third youngest bud. Older buds develop an increasing number of leaf primordia (Figs. 19 and 20), e.g.



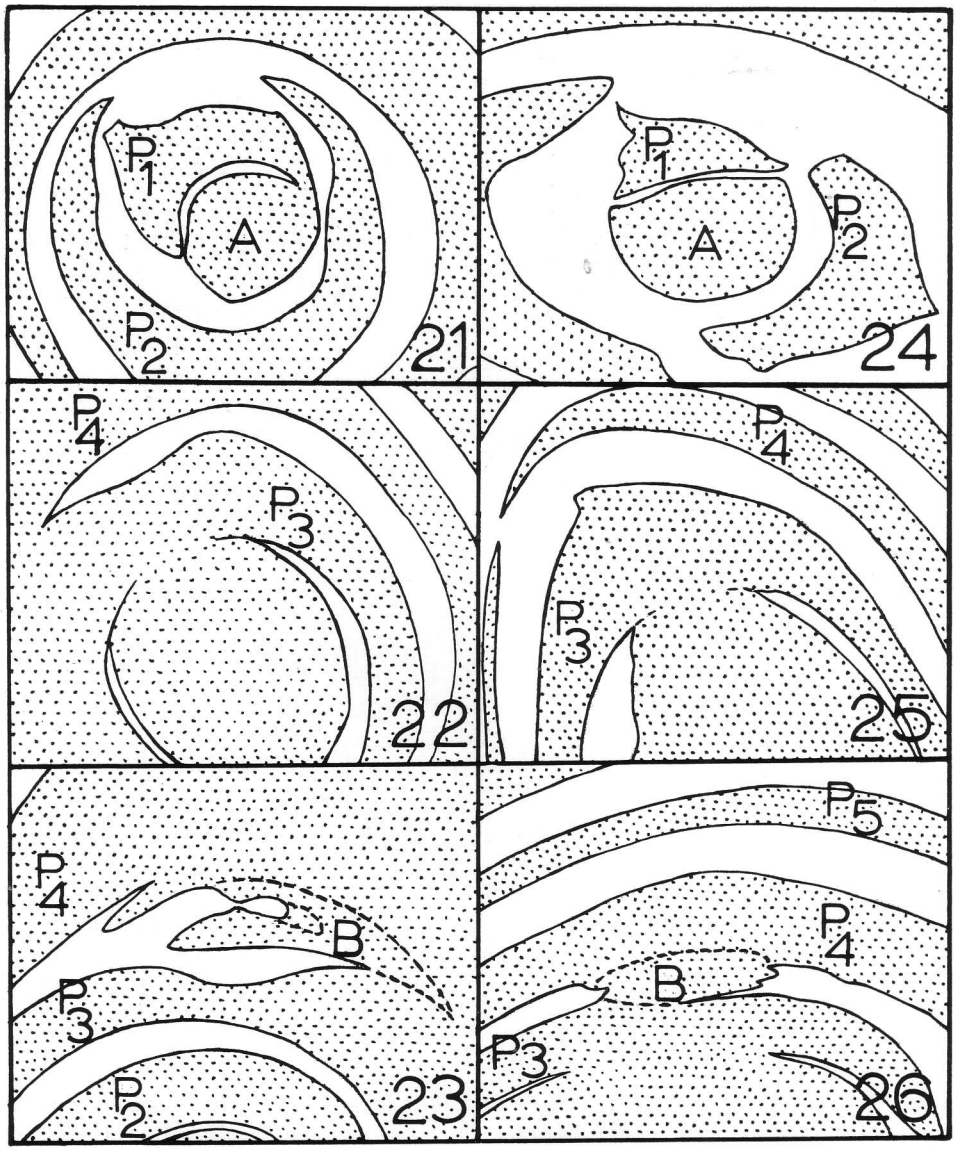
11–15. *Serenoa repens*. 11. Adult plant in field with suckers (× 1/22). 12. Detail of adult plant showing an inflorescence and its subtending leaf (× 1/22). 13. Expanding inflorescence bud (× 1/3). 14. A–J. Sequence of bracts dissected from axis shown in Fig. 13, starting with prophyll (A), first branch of inflorescence is subtended by bract C (× 1/2). 15. Base of a fully expanded inflorescence (× 1/3). P = prophyll in Figs. 13, 14 and 15.



16–20. *Serenoa repens*. Transverse sections of apical buds at different levels. 16–18. Sections from adult stem at (16) level of apex, (17) 200 μm above apex, (18) 520 μm above apex respectively; the outermost leaf = P_{21}. This stem had 8 green leaves, with the youngest visible leaf = P_{23}. 19–20. Sections from sucker on a seedling: (19) at level of apex, (20) 200 μm above apex respectively. The outermost bud is in the axil of P_{12} which itself was the fourth leaf of the sucker; all buds will become suckers (all $\times$ 6⅓). B = bud of adult axis (either sucker or inflorescence); V = vegetative bud of seedling.

in Fig. 20, the bud in the axil of leaf P_8 has two leaves while that in the axil of P_{12} has six leaves.

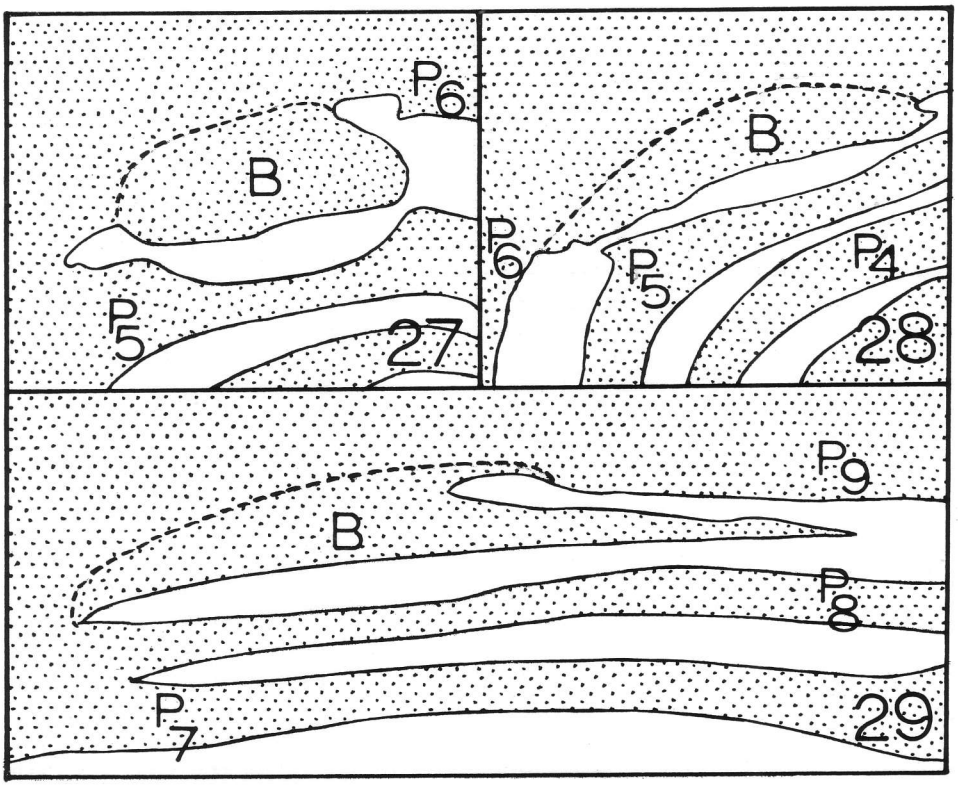
Initiation of axillary buds on adult shoots. The youngest axillary bud of the adult apex is first evident in the axil of P_3 or P_4 (Fig. 26) and all leaves older than this primordium subtend single buds (Figs. 16 and 18). Early stages of bud development are similar to those of the seedling axis. However, at position P_6, i.e. when a bud is the third youngest, it clearly undergoes more encircling growth than a seedling bud (Fig. 27) and so occupies a greater sector of the parent stem (Fig. 28). At position P_9 (when the bud is the sixth youngest) its sheathing base is striking (Fig. 29). The prophyll first appears at position P_{19} to P_{22} (when the bud is the 16th to 19th youngest) although at this stage bud size is no longer proportional to bud age, i.e. younger buds can be larger than older buds. This suggests that some



21–26. *Serenoa repens*. Serial transverse sections of shoot apices (all × 130). 21–23. Seedling apex at three different levels. (21) Apex and axil of P_1 without a bud. (22) Axil of P_3 without a bud. (23) Axil of P_4 subtending youngest bud. 24–26. Adult stem apex at three different levels. (24) Apex and axil of P_1 without a bud. (25) Axil of P_3 without a bud. (26) Axil of P_4 subtending youngest bud. B = bud; A = apex.

buds are subjected to an inhibiting influence.

Since there were very few vegetative (sucker) buds compared with either inflorescence or aborted buds, we have insufficient information to be able to decide when reproductive and vegetative buds diverge in their individual develop-

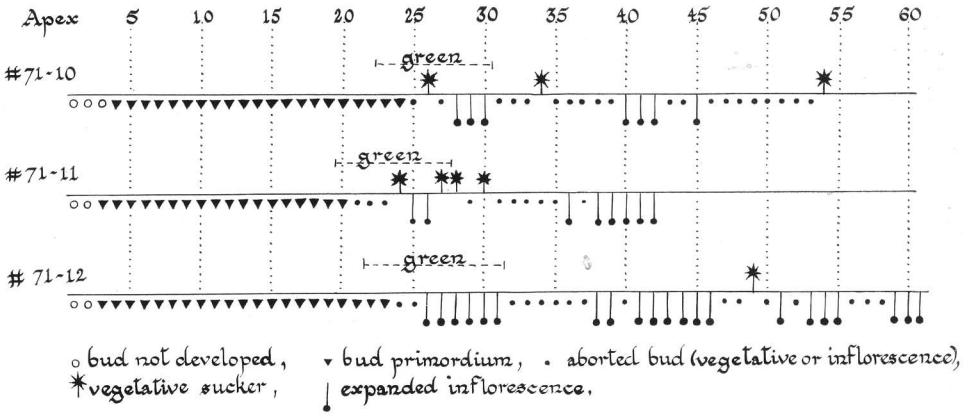


27–29. *Serenoa repens*. Serial transverse sections of shoot apices. 27. Sucker from seedling as in 21–23; axil of P_6, third bud (× 130). 28. Adult stem as in 24–26; axil of P_6, third bud (× 130). 29. Adult stem as in 28; axil of P_9, sixth bud. B = bud.

ment. At later stages a distinction is possible because the vegetative sucker has a wider insertion, i.e. is more elliptical in transverse section, whereas the inflorescence is narrower, i.e. more crescent-shaped in section.

Morphology of the young inflorescence. The inflorescence bud has a narrow sheathing base (Figs. 13 and 15). The first leaf (prophyll) is tubular and its mouth splits as younger parts grow through it (Figs. 13 and 14A). Subsequent bracts are distichously arranged, scalelike and without a developed blade. They also encircle the main axis of the inflorescence (Figs. 13 and the sequence of leaves B–J shown in 14). After fruits mature the inflorescence axis disintegrates gradually, rather than abscising as a unit.

Morphology of vegetative suckers. Suckers are found at intervals on older parts of the stem (Fig. 11). They typically develop after the subtending leaf has rotted. The base of the vegetative bud partially encircles the stem axis and is swollen just above its attachment, unlike the base of the inflorescence (cf. the base of Figs. 4 and 13). In early stages of development of suckers on the adult axis the first few leaves are entire and resemble the first leaves on a seedling (cf. Figs. 2 and 3). Subsequently segmented leaves are developed, transitional to the adult type (e.g. arrow, Fig. 5). The prophyll and the base of the first



30. Diagrammatic representation of distribution of buds along three different shoots of *Serenoa repens*.

leaves of the sucker are split by the development of younger leaves (Figs. 5 and 6). Continued development of the sucker depends on its production of roots which penetrate into the soil through the rotted remains of leaf bases. It seems that normally suckers remain small and partially inhibited, their further enlargement being stimulated either by damage to the main apex or possibly by continued growth of the main apex a sufficient distance away so that apical dominance is no longer effective.

Morphology of aborted buds. A large proportion of buds commonly remain small and inactive, eventually drying up but persisting simply as a brown flap of axillary tissue.

Branch Periodicity

Seasonality of flowering. We have thus shown that every leaf of the adult plant subtends a single axillary bud. These buds have three possible courses of development. They may either abort, or grow out as inflorescences, or least frequently, develop as suckers. The age of first flowering after seedling development has not been determined.

The unfolding of inflorescences on mature plants is striking and evidently seasonal. In South Florida inflorescences first emerge from within the crown of foliage during February and new inflorescences continue to appear from mid-March to mid-April (Hilmon, 1968). Flowering starts about the end of April and continues until June. Fruits develop during the summer and ripen blue during September and October. Fruit productivity is highly variable (Smith, 1972).

The expansion of new leaves is least active during January to March, at the time of rapid inflorescence emergence. Most new leaves expand during the period June to September (84% of the annual production according to Hilmon). Hilmon's data also indicate that an expanded leaf is alive for about 18 to 26 months.

Sequence of bud types. Three adult axes were examined carefully for the distribution and kinds of buds along them. The individual results are presented separately in the diagrams which form Fig. 30. In the dissection of these shoots the oldest recognizeable bud or its remains was noted and successively

younger leaf bases were removed as far as the youngest expanded green leaf, with records taken of the type of branch in each leaf axil. Microscopic examination was needed to observe buds subtended by younger leaves and leaf primordia (i.e. those younger than those labelled "green" in Fig. 30). As described earlier the youngest bud is in the axil of leaf P_3 or P_4 (younger leaves represented by open circles in Fig. 30). Vegetative (sucker) buds and inflorescence buds are indistinguishable until about P_{20}. In buds associated with older leaves the distinction between abortive (solid unstalked circles in Fig. 30) and non-abortive buds becomes apparent. Of the non-abortive buds, after about P_{20} vegetative buds (stars in Fig. 30) can be distinguished from inflorescence buds (stalked circles in Fig. 30) because they are shorter and thicker. Both types of buds occupy precisely the same position within a leaf axil.

Summary and Conclusions

These observations show that in *Serenoa repens* both the reproductive branches (inflorescences) and vegetative branches (suckers) arise from buds identical in their position in a leaf axil and indistinguishable in their early development. Later, buds that develop into suckers on the adult axis tend to have a thicker but less crescent-shaped attachment. This feature is especially noticeable in vegetative buds of the seedling in which all axillary buds develop into suckers.

In the adult plant, a high proportion (about 50%) of all axillary buds abort; of the remainder, the great majority (80%) become inflorescences and the minority (20%) become vegetative suckers. Inflorescences grow out within the crown of existing (i.e. green) leaves but suckers grow out much later, after the subtending leaves have died. These vegetative buds are partially inhibited. There is no regular sequence in the production of these two kinds of branch, and this irregular alternation of reproductive and vegetative buds along the adult axis represents a notable exception to the general pattern of branching in palms. Furthermore, inflorescence expansion is seasonal with several inflorescences of different ages flowering within a short period.

On this basis vegetative and reproductive branch buds are homologous, their differences being determined by a relatively late change in growth pattern.

Acknowledgements

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Palmologue
Letters and Excerpts

Before the old year was out, it began to look as if not enough palm letters would reach me in time to meet the deadline for this issue of PRINCIPES. *Letters there were, but not of a palmy texture. I confided this fact to the editor, and said that it might be necessary to substitute some of my own lucubrations unless the mails would soon provide better stuff. This seemed not to worry him much, though perhaps it should have. Shortly afterward, however, some palmaceous letters came to hand and saved the day for this department, at least for the time being. No guarantee is expressed or implied by that lucky circumstance, and it may be that a dearth of suitable letters will cause the metamorphosis of "Palmologue" into nothing more than a monolog, and not a very inspiring one at that. I never did aspire to be a monologist in any case, not even if amply paid, and therefore suggest this contingency can be avoided if a few readers will comment in a letter now and then, just so long as the comment deals directly or indirectly with a palm or palms.*

In "Palmologue" for October, 1972, the final paragraph of the letter from Mr. Kyle E. Brown may have seemed contradictory of his preceding observations. This paragraph was not part of his letter, and so should have been printed in italics to indicate that the comments were mine. Apologies to Mr. Brown.

—Dent Smith

From Mr. David Barry, Jr., Los Angeles, Cal., September, 1972.

Just received today a letter from a plant friend in Riverside who informs me of the listing of the following books on palms:

Glassman—A revision of B. E. Dahlgren's "Index of American Palms," subscription price £12; after publication, £14.

Martius—"Historia Naturalis Palmarum," 3 vols., 1823–1850. A facsimile reprint, somewhat reduced in size, is in preparation. Price not yet fixed.

Wallace—"Palm Trees of the Amazon," 1853. Reprinted 1971, £4.75.

Barbosa Rodriguez—"Sertum Palmarum Brasiliensum," 1903, £225.

The above publications are offered by the firm of Wheldon & Wesley Ltd., Lytton Lodge, Codicote, Hitchin, Herts, SG4 8TE, England. I print this formidable address and the titles here in the hope that the information might prove useful to bookish growers and palmocrats. Also offered in the Wheldon & Wesley catalog, subsequently sent to me by Mr. Barry, is the American reprint of McCurrach's "Palms of the World," also available in the United States. The American reprint of Wallace's "Palm Trees of the Amazon" is likewise available in the United States. Its author, by the way, was the co-originator of the theory of natural selection, though nowadays only Darwin is commonly mentioned as the proponent of that theory.

From Mr. Charles C. Cole, Quebeck, Tenn., December, 1972.

I live in Quebeck, Tennessee, where I have been growing hardy palms for eleven years and testing them in this climate zone through eleven winters, beginning in 1961. As far north as Macon I had seen what kinds of palms are hardy in central Georgia. There are twelve different kinds of palms in good health and growing well here in my yard, as follows: *Trachycarpus Fortunei, T. Martianus, T. excelsa, Sabal minor, S. texana, S. Palmetto, S. louisiana, Rhapidophyllum hystrix, Jubaea chilensis, Chamaerops humilis, Butia capitata, Washingtonia filifera.*

Two different fan palms are the very hardiest, namely, *Sabal minor* and *Rhapidophyllum hystrix*, which suffered no damage in any of the winters. But other fan palms, namely *Trachycarpus Fortunei, Sabal Palmetto, S. texana, Chamaerops humilis* and *Washingtonia filifera* were killed in some of the hardest freezes, as in December 1962, 12° below 0; January 1963, 9° below 0; January 1966, again 9° below 0; and in 1969, 3° above 0, and in 1970, 1° below 0. In 1971 *Trachycarpus* was not killed or badly damaged by 5° above 0.

When protected with plastic covers, both *Butia capitata* and *Sabal Palmetto* have come through alive and O.K.

The worst freeze started December 10, 1962 at 4 p.m. and lasted until 1 p.m. on December 14, a total of 93 hours between 32° above 0 and 12° below. Other notable freezes were in January, 1963, for a total of 48 hours with a minimum of 9° below 0; in January, 1966, 72 hours with a minimum once again of 9° below; and in January, 1970, the longest freeze recorded, lasting 126 hours with a minimum of 2° above 0.

I wish you would come here in the summer of 1973. You would like to see the palms growing here in Tennessee in my yard. It is only 890 feet above sea level, and is about half a mile from Caney Fork River.

Yes, I'd surely like to see palms growing in that boreal region, and it may come about if heaven wills it. Certainly Mr. Cole is unique in having a palm garden in Tennessee. All the more remarkable is the fact that he is a deaf mute, but has not allowed this severe handicap to deter him from pursuing his palm hobby, nor from farming his 200 acres and herding 84 head of cattle. With several members of his family he came early in January this year to see the palms that own me, and we toured the place for about three hours. We communicated by means of pad and pencil, which proved quite satisfactory. One scribbled word was usually enough to inform Mr. Cole of something he was seeing, for his handicap has evidently made him more than normally alert and quick at perception. Of the twelve palm species mentioned in the foregoing letter, only two are called by synonymous names, and the remaining ten surely represent some sort of record for such a climate. Since returning home, Mr. Cole advised that seven inches of soft snow had fallen there on January 6th.

From Mrs. Theodore C. Buhler, Miami, Fla., January 1973.

I still think my statement that palms grow up and above your head so they give you room for new plants underneath is a valid observation and is one I have made often when people say they have run out of room for more plants. It is true, of course, that many palms seem far more beautiful when they are still in a fairly young stage and can be seen close to the eye, but a lovely feathery, or sturdy palmate palm silhouetted

against the sky is certainly an object of beauty and once up there, lets us start something new beneath it. This does not apply to royals though, for their falling fronds are so heavy that they break or crush smaller plants they hit; they don't tolerate minor things about their feet. Another big advantage of palms is that they don't need pruning to speak of—all you do is haul away the fronds as they fall, which doesn't take a cherry picker or a monkey to do as when you have rubber trees or some of the others that get so huge they engulf the entire yard.

Second the motion. When space is at a premium, or even if it isn't, there is no aesthetic reason why such palms as chamaedoreas should not be planted under the leaf crown of large palms, for shade is a requirement for their best appearance anyhow. I have planted numerous Phoenix Roebelenii *and other dwarfish kinds in the shade of larger-growing palms. No landscape architect has seemed to be horrified as yet, though one or two may have been too polite to express outrage. The effect pleases me immensely, and it remains only to hope that others would not find it to their dislike.*

Dr. M. E. Darian, Vista, Calif., December, 1972.

I suppose you've heard about our last meeting (hard to judge, about 50 to 75 people). It was at Ralph Velez's—a very nice collection to see if you ever come out. His stuff looks so green and healthy. He also has some of the most tropical palms growing successfully outside, i.e., Dictyospermas, Veitchias, Ptychospermas, etc.

We officially launched the Explorers Club and opened it to all Palm Society members. Three "price" categories: $10 minimal, $100 "good fellows" and $1,000 life membership. I started the kickoff by being a "good fellow," there followed 13 regular or minimal members, then Joe and Polly Sullivan joined as "good fellows;" and with the take from the raffle and auction we netted a total of over $400 and we may take 50% of our bank account of $500 and add it to the $400 plus. We discussed the ground rules and everybody seemed to go for them. The money would be spent according to a majority vote of the directors, who include Dave Barry, myself, Warren Dolby, Ken Foster, Ralph Velez, Joe Sullivan, and our local president, Jim Wright. All very interested in getting something done, some radically (me) and the rest conservatively, but all united just the same.

Warren was happy to report his *Ceroxylon* is now 3 feet tall. Joe Sullivan's is 5 to 6 feet, and mine of the same species is just over 6 feet, but my *C. alpinum* is about 10 feet plus.

Well, we had our deathly kiss of cold earlier this year. (It usually comes between Dec. 25 and Jan. 5th.) I just hope this is as bad as we'll get it. Warren reported the cold the worst in 30 years, with the lowest temperature down to 20° F. and 30° at the highest (warmest) point on his "frost-free" location. [*Warren Dolby now lives in Oakland, across the bay from San Francisco.-D.S.*] My lowest up to that Dec. 10th was 38°. Last night it dropped to 33° outside, but 44° inside the jungle room—unheated but covered with fiberglass. Today it was up to 53° outside and it hit 83° inside, so you see, the fiberglass puts me into the Miami temp. range, except that I have it colder at night, especially in winter. It's beautifully sunny today. I can see snow on the mountains in three areas. First noticed it before Thanksgiving.

Received a letter from Brazil—reports he's sending me some Copernicias, *C. macroglossa, C. hospita, C. cowellii,* but not *C. fallaense,* the gem of the genus.

I have one, but it's so damned slow it could make your *Jubaea* look like a fast grower.

The "Explorers Club" mentioned in the foregoing letter is a name either tentative or official of a voluntary group in California banded together with the intent of financing the collection of palms or palm seed that might expand the number of palms now thought to be suitable for cultivation in California. The cost of sending a collector to such places as Madagascar or some of the Pacific islands would be substantial, so perhaps the group will try to interest Society members elsewhere than in California, as for example in Louisiana, Texas and a large part of Florida, where the demands of successful palm culture are somewhat similar in one or more respects. Cold tolerance seems to be the main consideration.

From DeArmand Hull, West Palm Beach, Fla., December, 1972.

Presently I am extremely concerned over the spread of lethal yellowing in our coconut palms and into other palm genera including the *Adonidia* (*Veitchia Merrillii*), *Pritchardia*, and *Ptychosperma*. Presently the *Adonidia* are dying by the hundreds in the Coral Gables area. Because of my concern over the spread of this disease, I hope to start a very massive "Save the Palms" campaign in order to raise research funds to study this disease. The Palm Beach County Board of Commissioners have already donated $30,000.

As a Palm Society member would you be willing to lend your support to such a campaign? I certainly would appreciate any comments and suggestions you would have on such a venture. I think it is imperative that we do something early in 1973.

Mr. Hull is an extension agent of the Florida Cooperative Extension Service, an affiliate of the University of Florida. If lending support means non-monetary approval of a "Save the Palms" campaign, there can be little doubt that every member of The Palm Society would approve it, but the money to finance such a campaign would have to come from the cities and counties in the affected areas, or from concerned foundations and other organizations able to contribute significant sums. Perhaps, also, meaningful funds could be realized by popular subscription in the threatened areas, though this might entail putting on a hard-sell drive. And perhaps any necessity for finding solutions to the problems will no longer exist by the time these words see print, but such a development seems unlikely in the near future. In January of this year the spread of "lethal yellowing" of coconut palms in south Florida is ever more alarming. The rapid advance of the disease in Coral Gables is believed a threat to the millions of coconut palms in Miami and the rest of south Florida, for no means of preventing the spread has yet been found, nor any cure for infected palms. According to late reports, not only the coconuts but several other palms are now being attacked, viz., Veitchia Merrillii *(called* Adonidia *in the trade), and species of* Pritchardia *and* Ptychosperma, *though no positive proof at last account. Nor had there been any final conclusion as to the exact nature of the disease or its cause, although "either a virus or a mycoplasma-like organism" seemed to be indicated. Suspicion is now thrown on a leafhopper as the most likely airborne vector that spreads the disease. If that suspicion proves well founded, the only way to stop the spread would be to exterminate the leafhoppers, but without exterminating any people also, which means the crux of the problem would be to stop*

the spread of the disease without poisoning the environment. It is, as Mr. Hull says, imperative that something be done, and soon.

From Dr. Jerome P. Keuper, Melbourne, Fla., December, 1972.

Under separate cover you will receive photographs of a tall *Acrocomia Totai* and of a large *Phoenix canariensis*. These palms are typical of many gifts Florida Institute of Technology has received as additions to its growing palm garden. From time to time, friends of the university have donated palms they were no longer able to take care of, as in the case of the *Pigafetta filaris* that you gave us last November because it was growing too fast for you. Then, also quite recently, Billings McArthur of Winter Park, Florida, contributed more than two dozen large and rare palms, thus aiding the objective of creating one of the great palm gardens of the world right here on the F.I.T. campus.

Dr. Keuper, the President of Florida Institute of Technology, got the palm plantings off to a flying start just a little over five years ago. The result is amazing to have been achieved within so short a time. Very likely the palms already planted now number over two thousand, but those in charge of the work have been too busy at planting more and more palms to have any time left for a census. . . . Yes, that pigafetta was too hot to handle. Not because it is so spiny and not because red spiders

Acrocomia Totai (left) and *Phoenix canariensis* (right), recent gifts to Florida Institute of Technology

love it, but because it had outgrown any ready means of protecting it through another winter in a climate not suited to it.

From Mr. Nixon Smiley, Miami, Fla., December, 1972.

For someone so close to the saw-palmetto as I am, you might expect him to be interested in the letter from Mr. Kyle E. Brown of Raleigh, N.C., which appeared in the October, 1972, issue of Principes.

As you know, I have preserved a great number of this species on my five acres. I think they are among our most attractive palms, and esthetically they look right among the pines. Moreover, I have never lost my admiration of them, although we have lived among them since 1951.

My only regret is that these palms are growing out of character. Except for a few areas, they have not been subjected to fire since about 1946, and many have grown skyward until the trunks are higher than my head. Formerly, the woods in this area were burned every year or two. When we moved here the palmettos were little more than knee high, and in the richest areas about waist high. So long as they were subjected to fire, the stems, or trunks, remained reclining on the ground. But as a result of long protection the trunks have grown vertically.

Among my *Serenoa repens* are several forms, or "varieties," you might say. They vary in leaf character and in color. Some are gray and some are bright green. Some are perfectly fan shaped and some are imperfect.

The longest stems I have grubbed, when clearing vistas, were between 60 and 75 feet. But the stem branches off in several directions. I figure that my palmettos all grew from a relatively few seed. One "variety" might have covered an acre or more originally—before I cut the vistas. This means that such a palmetto might have been a century old or more, perhaps several centuries, since in grubbing them you could trace stems to where they had decayed and gone to dust.

When we first settled at Montgomery Drive the palmetto had few friends. People visiting us were surprised, even flabbergasted, that we were preserving palmettos. To them it was a weed.

"Why don't you get rid of these weeds and plant something useful?" they asked.

In recent years the friends of palmettos have grown and hardly anyone today suggests that they are weeds. Is it because palmettos are becoming rare?

During the more than 21 years we have lived among the palmettos only one person has, on his own, discovered that palmettos come in varieties and in different colors. This person was a Brazilian, a noted artist and landscape architect, Roberto Burle Marx. The first time he saw the place he became excited as we entered.

"Stop the car, stop the car," he shouted. I stopped, wondering what he had seen. Marx jumped out and ran to the palmettos.

"Look at that," he said. "Different varieties, different colors. You've got to get me some seeds of these."

I later sent him several palmetto seeds. That was 15 years ago. Presumably Brazil now has the saw-palmetto.

Unfortunately, *Serenoa repens* creates a great hazard unless the pine woods are burned regularly. As they grow larger, more upright, and pine needles accumulate, the palmetto offers a dangerous threat to the life of the trees in the event of a fire. A fire that raced across a corner of our property two years ago killed every pine that grew among the rank palmettos. Those palmettos created

a fire that reached to the tops of the pines and leaped from tree top to tree top. It was a complete disaster except for the palmettos, all of which recovered.

One visitor, a Texan, a few years ago told me with great authority that the palmetto "is the best fire break you can have." He was a person so sure of himself that I knew he would argue with me if I challenged his statement, so I just let it go. It is obvious to anybody who knows the character of this plant that this is one Texan who didn't know what he was talking about.

Yes, I am trying to grow some saw palmettos from seeds. Stanley Kiem collected them from that blue palmetto that Mr. Brown refers to. The plants are small, but at least a few appear to be coming true to color.

Cattlemen I have talked with in central Florida believe the upright-growing palmetto is a different species from the reclining palmetto. None I've talked to takes into account the difference in habitat. When these palmettos grow in shade, or are forced to grow upward as a result of becoming crowded after years of protection from fire, they tend to develop upright stems, as every palm buff knows.

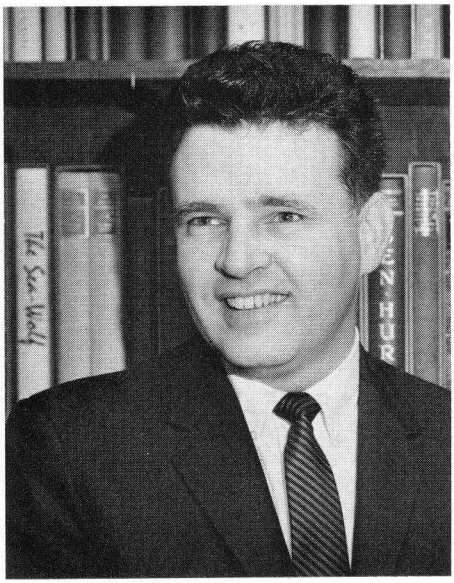
I have noted that people who transplant the saw-palmetto set the stems upright to encourage arborescent growth. But this palm is more in character, and more esthetically satisfactory, when grown in sprawling low clumps. For that is its nature.

Mr. Smiley is a Miami Herald staff reporter, a former Director of the Fairchild Tropical Garden, and the author of several books on Florida gardening and other topics. His latest is entitled "Florida, Land of Images," and two other books are in preparation. The almost indestructible Serenoa repens, *of which he writes in the foregoing letter, is never destroyed by fire alone. In less than a year following a seemingly fatal wildfire, the palms will be again in leaf and, in the proper season, again in bloom.*

NEWS OF THE SOCIETY

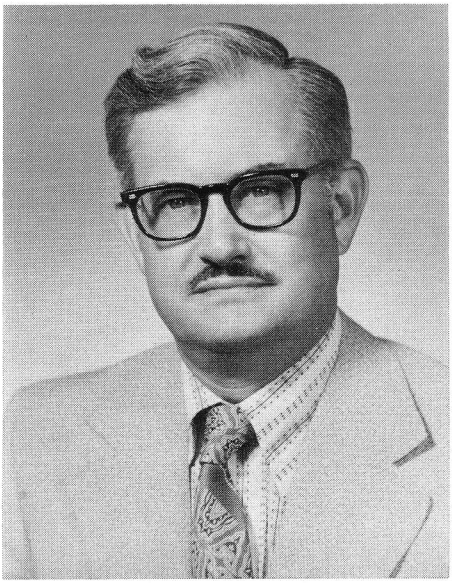
Some of our new officers whose portraits have not appeared in past issues of PRINCIPES have been prevailed upon to provide brief biographical notes and photographs which follow.

Kenneth C. Foster, new President of The Palm Society, was born October 4, 1929, in Chelsea, Mass. and was brought up in the Boston area. He majored in French Horn at the New England Conservatory of Music and spent four years with the U. S. Army Field Band in Washington, D.C. Later he studied commercial photography at Brooks Institute of Photography, Santa Barbara, Calif. and he has traveled extensively as a church photographer, photographing church interiors for colored reproductions. His eight years of graphic arts background has been useful in publishing and edi-



Kenneth C. Foster, new President of The Palm Society.

torial ventures—publishing The Palm Society Western Chapter Newsletter and serving as assistant editor of Palms. Ken has been active in The Palm Society for twelve years and now operates a nursery distribution business working with cacti, succulents, and foliage plants. His tropical palm house was destroyed on Christmas Eve with the loss of many rare plants collected by himself or grown from seed but he is starting over again.



Dr. U. A. Young, new Vice President of The Palm Society.

Dr. U. A. Young, new Vice President, writes: "I am a native Texan, having been raised in Waco (no palms). After graduating from Baylor University in Waco there was an interlude in the Army during World War II prior to entering medical school. I received my Doctor of Medicine Degree from Baylor Medical School in Houston (a few palms) in 1948 and went to the Henry Ford Hospital in Detroit (occasional hotel lobby *Howea*) for my internship and residency in Orthopaedic Surgery.

"After another Army tour in Japan (more palms) I entered private practice in Tampa, Florida in 1954. My interest in palms was aroused while walking through the Fairchild Tropical Gardens in 1957 and has not abated since that time. I now have 73 genera and over 250 species of palms planted in my garden.

"My wife Ben enjoys my hobby but has to share it with all the other variety of plants she collects. My three boys have tolerated my hobby over the years, even when digging king size holes for tiny seedlings. They do, however, enjoy the collecting trips to tropical countries."

Mrs. Theodore C. Buhler, Executive Secretary of The Palm Society.

Our new Executive Secretary on whose shoulders rests the day-to-day operation of the society is Mrs. Theodore B. Buhler or "Teddie" to most of us. Mrs. Buhler was born and grew up in New Jersey. In her teens she was sent to Switzerland

to learn German as well as French. Later she worked in the American Consulate General in Zurich where she met Theodore C. Buhler, an American studying at the Swiss Polytechnical Institute. In 1935, shortly after being married, they moved to Miami. Once there, she became interested in the unusual and exotic plants she saw about her. She joined the oldest Garden Club in the area and, although she became its President in the early 1940s, later was President of the Council of Garden Club Presidents of Dade County, of the Miami Orchid Circle, and of the Metropolitan Miami Flower Show, she finally decided she preferred gardening to doing club work.

She had joined the Fairchild Tropical Garden shortly after its inception. In the early 1940s too, she started growing palms from seed and was one of the first members of The Palm Society. It has been a gratifying experience to grow most of the plants in her garden from seed, cuttings or small plants and to see these plants reach maturity. Mrs. Buhler sometimes finds it difficult to come indoors to her desk even though she is enthusiastic about The Palm Society and enjoys her work for and with it.

South Florida Palm Society Sale

The South Florida Palm Society will have a sale on Saturday, April 28th, 1973, from 10:00 A.M. to 2:00 P.M. at the Museum of Science in Miami (U.S. #1 and South Miami Avenue).

Members' sale will be Friday night, April 27th, from 5:00 P.M. to 8:00 P.M. at the empty lot East of 931 Obispo in Coral Gables, Florida.

For donation of plants, contact any of the three individuals listed below:

Mrs. F. E. Harlow
931 Obispo
Coral Gables, Fla.
Phone: 443-3083

Mrs. Theodore C. Buhler
1320 South Venetian Way
Miami, Fla.
Phone: 373-4279

Mrs. Lucita H. Wait
7229 S. W. 54th Avenue
Miami, Fla.
Phone: 665-5534

SPREAD THE WORD! LET'S HAVE A BIG SALE!

The lethal-yellowing-resistant Malayan Coconut Palms will be available at this sale.

Back Issues of Principes Needed

Members who no longer wish to retain old copies of *Principes* can do the Society a favor by returning them to Mrs. T. C. Buhler, Executive Secretary, 1320 S. Venetian Way, Miami, Fla. 33139. Mrs. Buhler will be glad to reimburse members for postage. Back issues are needed to complete sets for libraries or persons who wish to obtain complete sets. Mrs. Buhler notes that perhaps people should leave notes to the effect that back issues should be returned to the Society so that old copies aren't destroyed when they die.

Palm Symposium

The Society for Economic Botany is to hold its annual meetings at Cornell University, Ithaca, N. Y., from June 12 through June 15, 1973, under the sponsorship of the L. H. Bailey Hortorium. A symposium on palms is scheduled for June 14 with two full sessions. The morning program will be devoted to the natural history of palms with H. E. Moore, Jr. speaking on the nature of palms, N. W. Uhl on protection in palms, F. B. Essig on pollination biology of palms, and R. W. Read on ecology of palms. The afternoon session will be devoted to the utilization of palms with

J. Dransfield on palms in the every day life of Indonesia, R. S. Schultes on palms used by Amerindians in South America, W. H. Hodge on oil palms, and D. Johnson and E. D. Kitzke on lesser commercial uses of palms.

Members of The Palm Society may attend if interested and may obtain further information by writing to Dr. David M. Bates, Director, L. H. Bailey Hortorium, 467 Mann Library, Ithaca, N. Y. 14850.

PALM BRIEFS

Habit of Chelyocarpus chuco

It seems most audacious (or should I say pretentious) for someone like me to suggest a correction in a scientific treatise from the pen of our Editor, Dr. Hal Moore. However—here goes. In Vol. 16, p. 70 of PRINCIPES he starts his description of the genus *Chelyocarpus* with "*Solitary*, unarmed hermaphrodite palms. . ." He has previously given reasons and a key to explain why he placed the former *Tessmanniodoxa chuco* in *Chelyocarpus*.

Some years ago I received, as a distribution plant from Fairchild Tropical Garden, the palm then known as *Tessmanniodoxa chuco*. The plant is doing well, is about to start forming a trunk, and *it is suckering*. Last summer when this fact became clearly evident, I called Stanley Kiem at the Garden to say my palm did not agree with his printed description in the January 1963 FTG Bulletin listing the distribution plants. He laughed and said when he had collected the seeds in Brazil the gardeners had been keeping the *C. chuco* palms to a single trunk and he thought the many small plants beneath them were all seedlings! The *C. chuco* at the Garden is also suckering at this time (December, 1972).

T. B. BUHLER
Miami, Florida

Editor replies:

Mrs. Buhler's note is a splendid example of something that is neither audacious nor pretentious but rather extremely helpful. I had seen the cultivated palms from which Stanley Kiem collected seed and like him had thought them single-stemmed. I had never seen *Chelyocarpus chuco* growing wild and unfortunately collectors only infrequently note whether palms have single stems or multiple stems. Thus plants in cultivation and the watchful eye of the grower can provide information that is not always available to the scientist who must sometimes work only from herbarium specimens. A correction is made in this issue together with two other changes which escaped the author in reading manuscript revised and retyped for the nth time.

Perhaps a little background on the article Mrs. Buhler referred to is permissible here. Ever since 1960 I had been perplexed by the palm which I recently named *Itaya* and had been intrigued by what little was known of *Chelyocarpus chuco*. In 1971 I had wanted to visit the remote frontier fort on the Brazilian-Bolivian boundary where d'Orbigny had originally collected this palm. One must now arrange with the Brazilian government at least six months in advance to collect plants and since my plans had to be made at rather shorter notice I had expected at best to visit the fort as a tourist, to see living palms, and to take with me a Brazilian colleague to make collections. It turned out that Fort Principe da Beira is in a restricted zone so out of bounds for tourists. Thus my visit was cancelled and I hoped to make other arrangements to obtain material or to visit when arrangements could be made well in advance.

As luck would have it, a package arrived on my desk early in 1972 with two

collections of what was clearly *Chelyocarpus chuco* sent for identification. These provided critical information (but not on habit!) that permitted the completion of a study of *Chelyocarpus* and its allies after more than ten years. Botanically, this little group of genera proves to be of especial interest because it includes some of the most primitive of all palms.

H. E. Moore, Jr.

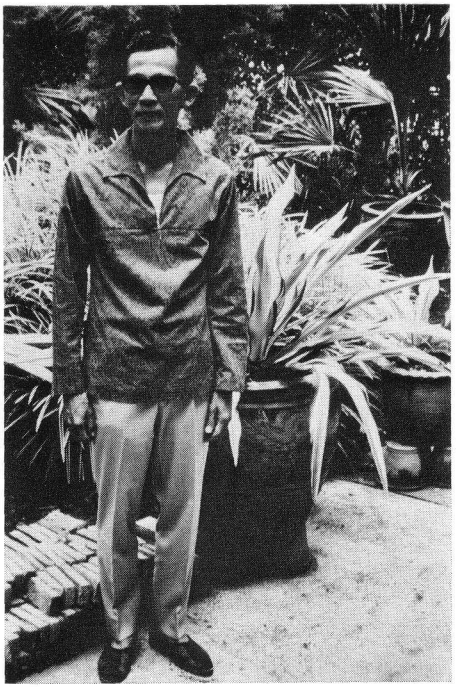
The Present Status of Two Rhapis Palms from Thailand

When in Bangkok in 1962 I bought several *Rhapis* palms from Deewan Raggandee, a local nurseryman, and sent them to my nursery in Los Angeles. He told me that he had collected them about 125 miles from Bangkok in an area of limestone soil. He had mature specimens in his nursery that were four to five feet in height and in flower. Their leaves were a dull, light grey-green and of thin texture, the leaflets narrow, one-half inch in diameter and ending in single points.

The trunks were three-eighths of an inch in diameter. They were obviously *Rhapis* and distinctly different from the commonly cultivated species, *Rhapis humilis* and *Rhapis excelsa*. No species of *Rhapis* from Thailand are described in Dr. L. H. Bailey's article on the genus in *Gentes Herbarum*, Vol. 4, Fasc. 6, 1939. I concluded that this palm was a new, undescribed species of *Rhapis*.

During the last three years seeds of this palm have been collected and distributed as *Rhapis humilis* by Cmdr. Watana Sumawong of Bangkok. They were eagerly bought because of the short supply and great demand for *Rhapis humilis*, a palm that rarely produces seed in cultivation.

The main reason that I returned to Bangkok in October, 1971 was to meet Cmdr. Sumawong and to learn more of this *Rhapis* palm. We had been in correspondence about it and other palms. He and his nice family live in an attractive two-story, modern home on the outskirts of Bangkok. The yards and gardens around the house are filled with countless palms and cycads. Their containers range from large native ceramic jars to hundreds of typical, clay nursery pots. Not many palms were planted in the ground as the water table is close to the surface and the soil is very heavy.



1. Commander Watana Sumawong in his garden at Bangkok, Thailand.

Cmdr. Sumawong is a communications engineer by profession and a collector of palms and cycads by choice. He is a valued member of The Palm Society and is one of the most important contributors to the Seed Bank. He goes far afield in his hunt for plants, often under difficult conditions. As an example of some of the problems, a giant specimen of *Cycas siamensis* that now graces his yard took

2. Two unidentified species of *Rhapis* from Thailand. At left, the palm erroneously called *R. humilis*, at right a recent discovery.

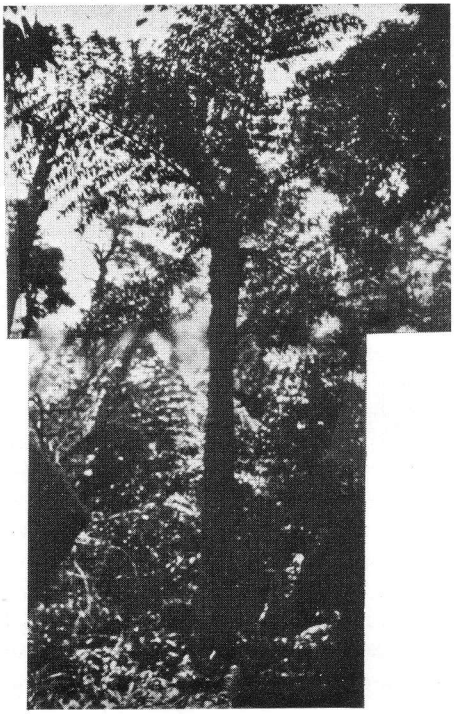
ten men to handle in the field. Very few palms native to Thailand have been brought into cultivation and at this time Cmdr. Sumawong is probably the only person collecting them. He is also interested in exotic palms and cycads and wishes to exchange his native seeds and plants for them.

Cmdr. Sumawong's most notable plants, I should say, his trophies, are *Cycas siamensis*, tall venerable specimens with trunks to ten feet. He grows these in containers as well as other endemic cycads such as *C. Rumphii*, *C. pectinata* and *C. Micholitzii*, and a variety of native palms. One in particular should be mentioned, an unidentified *Licuala* that is like a giant *L. grandis*. A mature plant of this species is one of the important specimens in the Waterfall Gardens in Penang where it has never produced seed nor been named. Cmdr. Sumawong has distributed seeds of this species through the Seed Bank and to collectors, and in doing so has made a major contribution to palm culture. Another important credit for him is the distribution of seed of various pinangas, including one that has ivory-colored crownshafts and is of very fast growth.

A most interesting discovery by him was another Thai *Rhapis*. It resembles *Rhapis excelsa* from which it differs in at least three ways discernable at a glance, being smaller, darker-green, and with leaves of a much heavier more leathery texture. It promises to become a fine addition to the cultivated species of *Rhapis*. When I was at Cmdr. Sumawong's home he had but one plant of this species which I photographed with a plant of the first *Rhapis* mentioned. Since then Cmdr. Sumawong has discovered sources of seed of this new species and they are now being distributed by him and Peter B. Dow, seedsman of Gisborne, New Zealand. Mr. Dow also continues to offer erroneously seeds of the first Thai *Rhapis* as being *R. humilis*.

Both of these two new Thai *Rhapis* are of tropical origin. The extent of their usefulness in the semi-tropics has not been determined. Because they are *Rhapis*, it is easy to assume falsely that they will be as cold resistant as the familiar *R. humilis* and *R. excelsa*. I have reliable reports of these last having withstood 18° F. I hope that growers will report their experiences with the hardiness of these two new species to the Society.

Cmdr. Sumawong plans to continue his explorations. In this he will without doubt make other fine discoveries. A rather formidable example is shown in the accompanying photograph taken by him of a giant *Caryota* found near the Malaysian border. It is two pictures pasted together. The jungle was so dense that he could not get far from the palm,



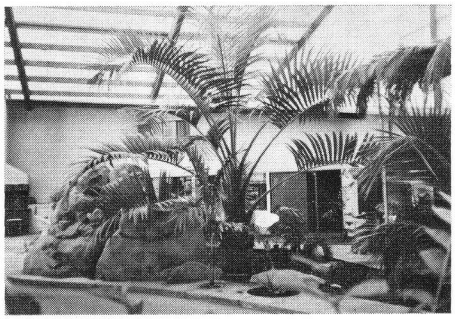
3. An unidentified *Caryota* in southern Thailand. Photo by W. Sumawong.

and the light was dim. No identification was made, and no fruit found. It might be *C. equatorialis* that sends its crown above the forest canopy in that part of the world.

DAVID BARRY, JR.

Pigafetta filaris

The palm collectors dream *cum* nightmare is *Pigafetta filaris*. From its tiny seed about one-fourth inch wide and one-eighth inch thick (like a miniature Hershey's candy kiss) to its phenomenal growth, it is truly an amazing as well as a magnificently beautiful palm. I agree with David Fairchild that it is the most beautiful palm. If it is watered frequently and kept warm there is no palm on earth to match its growth rate. *Pigafetta* is a very poor shipper when it gets



1. *Pigafetta filaris* beside rock outcrop in home of Dr. M. E. Darian. The rock is eight feet high, 12 feet across; dimensions of the palm are height 22 feet, diameter 24–30 feet. Photo by A. B. Graf.

over four feet tall so it is wise to start with seed or small plants.

My large specimen reached a height of 22 feet in three years from seed, carrying 10 to 15 beautiful leaves from a foot-thick base and putting out a new leaf as quickly as once every twelve days. Leaflets are now three feet long and four inches wide with three main ribs and spiny top and sides. The biggest leaves so far are about nine feet long with another four to six feet of petiole. During warm weather, the newest emerging leaf spike grows four to six inches each night. In June, the plant starts to accelerate its growth rate and a new leaf takes three weeks to mature. The bases of the six-foot-long petioles are covered with blond spines that quickly turn to brown in a very dense pattern which looks like a rodent's fur, for example a beaver or muskrat. The spines are unpleasant but are soft on the petioles and not too long (longest to date are 3 to 4 inches but most are ¾ to 1 inch long). However, they penetrate the skin easily and break off under it causing typical splinter lesions.

If *Pigafetta* is grown indoors, as mine is, it is quickly infested by red spider mites and the resultant damage is devastating and rapid so that I now inspect

2. Another view of a *Pigafetta* under glass in the Darian home. Photo by A. B. Graf.

the leaves every day. I've known plants to die very quickly, to hang on for months, then die, to grow very slowly like most palms, or to attract every red spider to itself and to die from the attacks of these mites. I lost over 30 palms in three-gallon cans in one week. A mite attack in two days nearly killed my last big specimen even though I had been using Cygon 2E regularly. It took four consecutive sprayings with Kelthane to finally kill all the mites and I'm using Temic 10G until it runs out—it's not available in California—as well as Kelthane regularly.

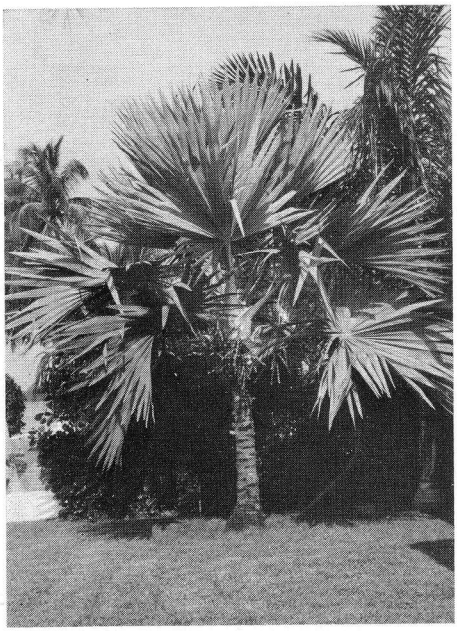
I water *Pigafetta* four times a day from June until December. This is our warm period with night temperatures staying about 70° F. I also have a heating cable under the palm kept on full force the year around. I fertilize almost daily with dilute organic fertilizer plus a fertilizer with trace elements every ten days during rapid growth.

If I had known that the species was dioecious, I would have planted two or three more in the ground, but the only information I had available was McCurrach's *Palms of the World* which has incorrect information on fruit size and sex. The very small fruit measures less than one-half inch long by one-fourth inch wide and is straw yellow with black margins on the overlapping scales—a yellow miniature of *Raphia* fruits. Mine were obtained from the Celebes, a very costly experience but worth it for the results. Germination ran from two to three months and after seedlings appeared above ground they grew six feet the first year when in full light, to more than 12 feet the second year. This is not a spindly palm by any means; it is very stout and full of *green, green* leaves. The crown gets so full that the newest leaves push the smaller older ones down so that they lie flat against the ground where they remain green but look strange—only one to two feet long compared to the largest ones on top. If I could afford to heat the room in the winter to keep the night temperature above 70° F, I'm sure that a plant could easily grow eight feet in a year. Since my plant is less than 25 feet tall now and the roof above it is 30 feet, it may be kept for for two to three years or longer if I cut out the nitrogen in its diet. Otherwise I may cut a hole through the fiberglass roof and let it try to survive with its roots heated by cables and its crown chilled nightly each winter.

M. E. Darian
Vista, Calif.

Palm Society Palm

Pictured here is my "Palm Society Palm". I have named it this because the seed from which it grew was given



1. Mrs. Buhler's "Palm Society Palm," a *Latania* hybrid. At the far right the base and leaves of *Rhyticocos amara* are visible.

to me the day The Palm Society was organized. Those of you present on that occasion will remember with pleasure our fascinating tour of the Jennings Estate in Miami and possibly you will recall the large female plant of *Latania loddigesii* at the left of the drive in front of the house.

Since latanias are dioecious and there was no mature male of the same species on the estate, the seeds were obviously hybrid. My seed produced a plant that was quite red in all its parts even for some time after it was set out in full sun. A goodly dose of manganese sulphate turned it to greenish gray and it is now, in 1972, a very handsome and silvery gray, fully mature plant. It is in an exposed location about 25 feet from the bay-front seawall and has gone unscathed through two minor hurricanes which washed its roots with salt water. It produced its first bloom in the fall of 1966, but due to my ignorance I failed to realize when the blooms were receptive. In September 1967 the sun gleamed on what seemed a drop of dew on each flower. I had learned my lesson and knew the appearance of the nectar announced the receptiveness of the hard, globe-like lumps that were the actual flowers. My next problem was to locate pollen, which was no easy task as the pollen on all the *L. loddigesii* near my home had long since dried. I finally found one small spike on one of the large plants at Fairchild Tropical Garden. There also I found a *L. lontaroides* (*L. borbonica*), fragrant, humming with bees, and full of pollen. (This plant has since succumbed to the depredations of the rhinoceros beetle.) I carefully kept my two precious pollen stalks separated, shook and rubbed them on the flowers on opposite sides of the palm, then left the bedraggled spikes among the female flowers in the hope that insects might add their efforts to mine. On the side where the *L. loddigesii* pollen had been spread, approximately 170 fruits developed; on the *L. lontaroides* side nearly every flower produced so that there were close to 400 fruit. Evidently the *L. lontaroides* pollen was in better condition, probably fresher, and there was more of it. It also tells us that the latanias easily cross-pollinate.

Several interesting facts have come to my attention regarding the fruit. It takes 17–19 months for the seeds to ripen although new bloom spikes appear each year long before the previous fruit is mature. The fruits vary in size according to the number of seeds actually developing in each capsule. There may be three seeds, two or only one. A curious result of this imperfect development is that the stigma end of the fruit is no longer directly opposite the stem

end; if all three seeds develop, the axis from stem to stigmas is through the center of the fruit. If some seeds are aborted, the stigmas may be on the equator of the fruit.

The seeds turn a dark brownish color when ripe and fall off. In a very few days the outer hull becomes brittle while the flesh turns black and wet-soft. It is easy to clean the fruit by washing it with a hose, then put it into a coarse basket and rinse away all traces of flesh. The seeds sprout rapidly if the seed coat is carefully cut away from the embryo; without such removal sprouting may be very slow and many seeds do not germinate. The seeds should be planted in a deep container or in the open ground as a cotyledon is sent down which may attain 12 inches before starting the shoot. The first leaf as it emerges looks like a reddish spike but it soon opens into a tiny red and green fan far more deeply cut than the adult leaf.

Initially my plant produced about 1,000 seeds. The second time I lost count at 2,300! Some of you may have received these seeds through the Seed Bank in April-June 1971. Unfortunately, in April 1972 the endosperm of most of the nine-month-old seeds was gnawed into by rats and so the fruit fell. I was unable to devise a method to keep the rats away.

I experimented with growing some of the seeds, first carefully cutting away the seed coat over the embryo with a sharp knife. The seeds then were laid longitudinally onto a damp mixture of peat and perlite in a cut-down Clorox container and were pushed part way into the growing medium. The top of the container was covered with a sheet of plastic held in place by an elastic band and the container was put on a shelf above the gas water heater where the temperature is 99°F. In about 10 days the embryo began to swell; soon the white cotyledon emerged and started to grow downwards. From this container the sprouted seeds were transferred into tall juice cans which contained regular potting soil.

When the seeds were completely fresh each one germinated. Older seeds which I planted later on did not all germinate.

It is advisable to treat the seeds with fungicide; some rotted before or after sprouting, especially when the peat and perlite was no longer fresh. It is also probably that the heat in the closet hastened the formation of the mold.

THEODORA B. BUHLER

PALM QUESTIONS AND ANSWERS

Q. I have never had any success in transplanting the seedlings, from around the base of my Sargent's or cherry palm, *Pseudophoenix sargentii*. Why is it I always lose these seedlings?

A. Palm seedlings are very difficult to transplant, especially when they have been seeded around the parent tree. One easy method is to use a hose and running water, the water pressure making it easy to dislodge the seedlings and still being able to obtain all the minute root hairs. Seedlings should never be allowed to dry out, even for a moment, and should be potted in a porous mixture, perhaps treated as unrooted cuttings. An equal mixture of perlite, peat and soil has often proven satisfactory as a potting media for newly transplanted seedlings. Excellent drainage is necessary, as oxygen is just as important to growing roots as water. An application of a good fungicide

will also help prevent loss of the seedlings. Perhaps one of the newer systemic fungicides (taken up in the plant juices) would be even better.

Q. Is there an easy method to clean palm seeds? Is it necessary to clean the seeds? This seems to take a tremendous amount of my time.

A. It is very important that palm seeds be cleaned. Often the outer fermenting fleshy coat will cause the seeds to rot or inhibit germination. Seeds are easier to clean after they have been soaked in water overnight, or for two or three days, depending on the type of palm seed. Larger quantities of seed can be cleaned by using a professional depulper or, if this is not available, a simple kitchen blender. The seeds are put in the blender and water is added. Turning the blender on for a short period of thirty seconds to a minute will help to dislodge the flesh and fibers of many palm seeds. If the seeds are left in the blender for a longer period of time, damage can occur. Small quantities of very rare seed should never be treated by this method, but it is an effective, efficient method for cleaning many fleshy and fibrous seeds.

DeArmand Hull
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West Palm Beach, Fla. 33406

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I certify that the statements made by me above are correct and complete.

Signed, *Mrs. Theodore C. Buhler*, Executive Secretary.