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Cover Picture

Coconuts bending under the winds of Cyclone Tia near Lavena Village, Taveuni, Fiji. Photo by H. E. Moore, Jr. See p. 138.

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Coconut "Stones" or "Pearls": Early Descriptions by Alzina, Kamel and Rumphius

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The coconut palm yields so many useful products that it is justifiably referred to in some cultures as the "Tree of Life." If their origin from *Cocos nucifera* L. could be established with certainty, so-called "coconut pearls" would undoubtedly qualify as the most exotic in the long list of coconut palm products and uses. There are relatively few published reports on coconut pearls, however, and most of the more recent of these express considerable doubt as to whether authentic ones really exist. Only one of the standard recent books on coconut to which I have had access even mentions coconut pearls. In *Coconuts* by Child (1964), there is a single page in an appendix that essentially dismisses the pearls by stating they are "actually derived from *Tridacna* species, a group of bivalve molluscs." Child further states that "The story seems (like so many legends) to be traceable back to Rumphius, who in 1741, described the pearls . . . ."

Some years ago, without ever having seen Child's book or having been aware of any doubts on the part of others as to their authenticity or coconut palm origin, I read about "coconut pearls" and my curiosity was aroused. When I asked Hal Moore about them, he told me that he knew virtually nothing about coconut pearls and encouraged me to investigate the matter further. Sporadically and as circumstances have permitted, I have done this and will probably continue to do so. Because Hal was a perfectionist and had a zest for completeness and an appreciation for what might be called "the comprehensive approach," I am certain that he would have been pleased to be brought up to date on the details as they surfaced. Because the precise facts are important to the overall case but occasionally can become tedious even to the most dedicated and interested reader, and because, in my view, it will be some time before definitive conclusions can be drawn, my intention is to present in parts what is known about coconut pearls. In short, the case will be built "piecemeal." The work is dedicated to Hal's memory as a small token of my appreciation for the friendship, help, and encouragement he extended me since our first meeting at Cornell University in 1959.

In this first paper, by far the greatest attention will be given to the description of coconut "stones" as given by Rumphius, the distinguished 17th–18th century naturalist who spent many years on the island of Amboina, one of the so-called "Spice Islands" [part of modern-day Indonesia]. But before this is done, it is appropriate t note that Rumphius was perhaps *not* the first European to know about co-

conut stones or to comment on them. Coconut stones are clearly described by Father Francisco Ignacio Alzina, S. J. (1610–1674), a Spaniard, in an unpublished manuscript of some 370 folio pages dated 1668 on the people and natural resources, etc. of the Visayas (Philippines) entitled *Historia Natural del Sitio, Fertilidad y Calidad de las Islas, é Indios de Bisayas* (cf. De Backer, De Backer and Sommervogel 1890, p. 260). A part of this manuscript, in English translation, "On the Palms which are Called Cocos and their Great Usefulness", was published as recently as 1931 (Alzina 1931). The specific quotation on coconut "stones" is given in its entirety.

> "The white and spongy apple, which is agreeable and sweet in taste, is called *buay* or *boa*. It is eaten with relish and not infrequently there is found within it (I have seen several) a white stone, more or less like a piece of crystal, of the size of an olive, some round, others elongate, and several pearl-colored, although not so fine. This stone is called "sangur" or "mutia", which is the common term for any precious stone. Certain virtues are ascribed to it; I have never verified such claims, although I have many of these stones in my possession; I do not relate them as they are just stories, *but not so is the finding of the stones* [italics mine]" (Alzina 1931, p. 438).

Because Alzina's work was never published, it seems fair to say that it could not have had much circulation or have attracted a great deal of attention. Although I have not seen a copy of the manuscript in Spanish, it appears that the English translation should in no way be suspect since it was translated by one Leopoldo B. Uichancos from a transcription of the original Spanish by a Rev. Miguel Selga, S. J. Moreover, mention is made of the verification of the translation by Father Selga. Several readings of the translation of the section on coconut leave no doubt in my mind that Father Alzina, who had been in the Philippines since 1632 or thereabouts, was a keen and perceptive observer of nature and I find it difficult to interpret the specific statements on coconut stones as anything but corroboration of their existence by a reliable eye-witness. Unfortunately, no easily interpretable or precise information on the biological origin of the coconut stones is provided. I find it impossible, from Alzina's description, to know precisely what he meant by the not infrequent presence of stones *within* the white and spongy apple. Since the white and spongy apple refers to the haustorium (technically the cotyledon) or absorbing organ of the germinating embryo, one can be certain that it is somehow associated with coconut stones but details are obscure.

Another writer who pre-dated Rumphius a bit was Georg Joseph Kamel, S. J. (1661–1706). (Incidentally, Linnaeus named the genus *Camellia* in his honor.) Kamel was sent to the Philippine Islands as a missionary, arriving in Manila in 1688 and remained there until his death in 1706. Kamel was very knowledgeable in matters of pharmacy, medicine, and botany, and it is clear that he was a careful and accurate observer of the world around him. The distinguished English naturalist John Ray (1628–1705), one of several "professionals" who very much appreciated and admired Kamel's botanical work, invited him to contribute to his *Historia Plantarum*. Kamel wrote three parts or "books" on the Philippine flora but for reasons that we need not be concerned with here, only the first and third were pub-

lished by Ray in 1704 and these as an appendix to the third volume of his monumental *Historia Plantarum.*

The first "book", bearing the title *Herbarum Aliarumque Stirpium in Insulâ Luzone Philippinarum Primariâ Nascentium, A Revdo Patre (*sic*) Georgio Josepho Camello, S.J. Observatarum & Descriptarum Syllabus: Ad Joannem Raium transmissus,* comprises some 42 pages. The second part of the appendix (actually Kamel's second "book") comprises 53 pages and appears under the title *Descriptiones Fruticum & Arborum Luzonis, A Revdo Patre Georgio Josepho Camello, S.J. ad Jacobum Petiverium, Pharmac. Londinens. Missae, Anno 1701.* On the first page of this latter part of the appendix, in the course of a detailed description of the coconut entitled *De Palma Coccifera, seu Nuce Indica, Indis* Lubi [*Concerning the Palma Coccifera,* or *India Nut,* Lubi *of the Indians* (Native Filipinos)] may be found Kamel's comments on coconut "pearls." Since they are not extensive, they are presented in full.

> "Fallen from the tree and now altogether ripe, the nut generates into the floating watery liquor *Butung,* a sphere which is spongy, shining white, light and very sweet, the *Buay, Bua* and *Tambong niog* of the Indians [Filipino natives]. In this *Bua* is found a stone, commonly round, and resembling a cheaper pearl in color and quality, called *Mutiang* and *Sangur* by the natives, which they wish to impute with various potent virtues. Of the seven which I have seen and which I had, more were equal to medlar."
>
> [Decidua, & jam omnino matura *Nux,* aqueo liquori *Butung* innatantem spongiosam, candidam, levem & valde dulcem sphaeram, Indis *Buay, Bua,* & *Tambong niog,* in hâc *Boa* (sic) multoties lapis, communiter orbicularis, colore & laevore viliorem mentiens margaritam, Indis *Mutiang,* & *Sangur* dictus reperitur, quem variis pollere virtutibus volunt. Horum ex septem quos vidi, & habui major par erat *Mespillo* (Kamel in Ray, 1704, volume 3, Appendix p. 43).]

The following conclusions may be drawn from Kamel's account. Although it is too short to provide as much detail as I should have liked, Kamel seems to have made his own observations. Unfortunately, it is not possible to state categorically that he, himself, ever found a coconut "pearl" *in situ.* But, there is nothing to suggest that he drew his account from Alzina, or that what he wrote was "hearsay." Like Alzina, Kamel seems to think the pearls are somehow derived from or associated with the apple or haustorium. Indeed, he clearly states *in this Bua* [haustorium] *is found a stone.* He seems to be the first to draw the comparison between a coconut stone (lapis) and a poor quality pearl (margaritam). There is no doubt that Kamel, like Alzina, was very skeptical of the alleged magical qualities of the stones. Of special interest is the fact that at the time of his writing, sometime before 1698, Kamel had only seen seven "pearls." Since he arrived in Manila in 1688, it means that in a 10 year period Kamel had encountered relatively few coconut "pearls." Alzina had seen several in a 32 year period and he likened these "white stones" more or less to "a piece of crystal." As far as Kamel was concerned, however, the stones were more like medlars [major par erat *Mespillo*]. One cannot be certain to which "medlar" Kamel refers but Theophrastus states "there are three kinds of *mespile, anthedon* (oriental thorn), *sataneios* (medlar) and

anthedonoeides (hawthorn) as the people of Mount Ida distinguish them. The fruit of the medlar is larger, paler, more spongy and contains softer stones; in the other kinds, it is somewhat smaller, more fragrant and of more stringent taste, so that it can be stored for a longer time" (Theophrastus, *Enquiry into Plants* III. 12, 5–6). Medlar, as we know it today, *Mespilus germanica* L. (Rosaceae), is a fruit so hard that it would have to be allowed to virtually rot before becoming edible. Be that as it may, anything *mespilus*-like would presumably involve or connote something tiny and very hard but not like a "real" rock or stone.

Although Alzina and Kamel provide rather cursory and brief descriptions of coconut "stones," Georg Eberhard Rumpf (1627–1702) gives a much fuller account. Rumphius (the Latinized form of his name) spent some 49 years (from 1653 to 1702) in the town of Ambon on the island of Amboina in the Moluccas, in the service of the Dutch East India Company. He was so respected that a German learned academy bestowed upon him the title of *Plinius Indicus* [*Pliny of the Indies*]. The story of his life, which deserves to be related in much greater detail than can be done here, is at once a series of achievements and personal tragedies (cf. Merrill 1917, Sarton 1937, DeWit 1952, 1959). Despite loss of his eyesight in 1670, Rumphius continued his studies first with the aid of his wife, and then later with his son and other assistants made available to him through the Company. The two greatest works of the "Blind Seer of Ambon," the results of years of painstaking labor attended by all sorts of difficulties, frustrations, and mishaps, remained unpublished in his lifetime. His magnum opus, although entitled *Herbarium Amboinense, Plurimas complectens Arbores, Frutices, Herbas, Plantas terrestres & aquaticas, quae in Amboina, et adjacentibus reperiuntur insulis, . . . /Het Amboinsche Kruid-Boek . . .* [*An Amboinese Herbal . . .*], was in fact a very detailed flora of the entire Dutch East Indies. It comprised twelve "books" and was published eventually in six big folio volumes between 1741 and 1750 in Dutch and Latin translation in parallel column format. In 1755 a so-called *Auctuarium* (or final gift) or addendum volume was also published. The entire work numbers over 1,660 printed pages and some 699 full-page engravings of plants appear in the work (Rumphius 1741–50; 1755). The *Herbarium Amboinense* is rightly considered the first and most thorough treatment of the flora of the Eastern and tropical world and even today is of great interest and usefulness (Merrill 1917, DeWit 1959).

Because it is much shorter, and although it reached Holland much later than the *Herbarium*, Rumphius' *D'Amboinsche Rariteitskamer . . .* [*Amboinese Cabinet of Rarities or Curiosities*] was first published in Dutch in 1705. Second editions in Dutch appeared in 1740 and 1741. Rumphius' remarks on coconut stones are, for all practical purposes, the same in both the *Herbarium* and the *Rariteitskamer*. In the *Herbarium Amboinense*, the relevant passages are found in Book I, Chapter 3, pages 21–24. In the *D'Amboinsche Rariteitskamer* editions to which I have had access (1705 and 1741), the description appears in Book III, Chapter 68, pages 319–322. Whereas no illustrations of coconut stones are provided in the *Rariteitskamer*, stones are shown on plate II facing page 16 in volume I of the *Herbarium Amboinense*. Since the *Amboinese Cabinet of Rarities* was published first (although it was written later), and is more detailed, it seems desirable to provide that version in

translation here. But to supplement it, the illustrations from the relevant plate in the *Herbarium* are included. Unfortunately, the original watercolor illustrations intended for the *Herbarium* executed by Rumphius himself or drawn under his direction were lost in a fire in 1687 so they had to be prepared again. Because it would have been prohibitively expensive to issue the work with colored plates, Johannes Burman (1707–1779), Doctor of Medicine and Professor of Botany at the University of Amsterdam, the person granted permission by the Dutch East India Company to assume the task of preparing the *Herbarium* for press, had to have the manuscript drawings copied as etchings for conventional reproduction. Since DeWit (1959, p. 11) states that this inevitably involved the loss of much of their charm and some details, I have taken the trouble to obtain both color and black and white photographs from the *Herbarium Amboinense* manuscript, which is in the Department of Western Manuscripts, Bibliotheek der Rijksuniversiteit te Leiden. Although it is not possible to present here the coconut "stones" in color, a comparison of the black and white etching-derived illustrations to the "originals" in the manuscript show that a good level of fidelity had been achieved.

Translation of the complete original Rumphian Dutch text follows. Every attempt has been made to retain the original style and flow but, understandably, it has been necessary in places to translate freely so as to render the text intelligible to the modern reader. Even so, the device of annotating some of the more unusual parts of the text with commentary (indicated by superscript Arabic numerals) has been used. These notes may be found at the end of the article on page 119. Words in brackets [ ] either give the precise Dutch word used or are meant to explain the word a bit further.

Chapter 68 is entitled *Calapites*, a Latinization of the word for coconut [stone] in various Malay languages, kĕlapa, calappus; *Klapsteen*, the Dutch word for coconut stones based on kĕlapa; and *Mestica Calappa*, the Malay words for magic stones or precious jewels from the coconut.

CHAPTER LXVIII

Calapites. *Klapsteen.* Mestica Calappa.

The *Calappus* stone is partially described in Book I, Chapter III, of our *Amboinese Herbal* [*Het Amboinsche Kruid-boek*] in the "History of the *Calappus* tree", but will be fully described now. It belongs to those stones which Pliny calls *Dendritides* in Bk. 37, Chap. II.[1] Indeed Pliny includes there numerous types of stones, many of which one can find in these Easterly Islands and in almost all kinds of fruits and trees.[2] Following Pliny's model, I have given each one a specific name. It is to be believed that these stones are formed from stone juice [steen zap] which is drawn up by trees and fruits from the ground, where it is concentrated and makes the noblest *Gemma* or rare small stone, which as has been frequently mentioned, is called by the common name of *Mestica* or *Mostica* by the Malays. The best known and most widely used from trees and fruits is the *Calappus*-stone, in Latin *Calapites*, and in Malay *Mestica Calappa*. It is a small white stone which is often taken to be an alabaster pebble. However, the *Calappus*-stone is lighter, does not sparkle, does not have the odor of rocks,[3] and several other properties, which separate it from other stones. Divided in long and round: the long ones have the appearance and size of a dove or some other type of bird heart, sometimes also of a lizard egg, thicker on one end with a dark small crown like a tooth which has come out, which is the root, with which it has been connected to the shell [schaal, endocarp] or *Tampoerong*. However, some lack this little crown, which is a sign that they already have become disconnected from the shell and floated loosely in the water, which is similar then to the lizard egg. On the other and smaller end, which slopes like a blunt cone, they

are the clearest and on top with a shining spot like a brilliant sun, which is revealed when one holds them up against the light, and when they lack this brilliance they are considered to be dead [dood].

The *Calappus*-stone is sometimes completely round, like a large pea, sometimes lentil-shaped; as large as a flat fenugreek, surrounded by a small band. These grow in the little apples [appeltje, the haustorium] which one finds in the old *Calappus*-nut, and when they fall off [the little apples] they float loose in the water. Both are pure white, the first type milk-white, the second with slight blue tinge, and sometimes translucent on the edges, because they are all opaque [donker] in general. The round ones also have [p. 314 of the original] on the clearest and raised side the little white sun [brilliance]. On both, one sometimes can notice very small and tiny cracks, which are shallow and do not make the stone any the more fragile. Because the stone grows continually in a moist substance like the innermost cavity of a *Calappus*-nut, so it is to be expected that when the stone encounters dry air, small cracks will develop, [and], which one can also see in the *Umbilicus Marinus*,[4] when one cuts off the same fresh from its animal. How they grow in the *Calappus*-nuts I learned from an eyewitness, a warrant officer [Faandrig], who was sent to the South East Islands in 1672, who opened there a *Calappus*-nut, mature in the kernel [pit] but not hard, and noticed a small red spot sticking out a little bit beyond the flesh, where there were two small white flat stones, which were still connected to the shell. The natives said that if the *Calappus*-nut had remained on the tree two months more, the little stones [Steentjes] would have ripened and become hard.

One does not find these in the Amboine Islands, although thousands of old nuts are opened there to burn oil. However, many are brought from Ceram's northern coast where they are grown according to the natives in their *Calappus*-nuts, which I doubt, because I met no one who had found them there himself. Most are found on Celebes and Makassar, the land of the *Boegis*, *Cajeeli*, and on *Boëton*. It appears that these lands have a property, which stimulates more stone-sap in their fruits and trees than occurs elsewhere, and therefore also most of the *Mesticae* come from these places.

The proof for these stones is mostly made with strong vinegar or lemon juice. When one puts a little of it in the palm of the hand, then places the *Calappus*-stone in it, then it should quickly boil or send up bubbles all around it. Those which don't are considered inferior or dead. I have rejected this proof frequently, because the stone loses its gloss and is left with a dead color, even if washed with water immediately. The same happens to all weak, dark and porous stones, where the vinegar or lemon juice penetrates the pores and drives out the enclosed air, causing the bubbles, like the *Lapis Victorialis* or *Astroites*[5] in Europe which acts the same in vinegar. The second test is the following. When one places the stone on a mat and places rice or *Pady*, then no fowl will dare to eat a single grain, as long as the stone is there. However, I had no luck with this. Had I not removed the stone, the fowl would have eaten it with the rice, and I was under the impression that I had a real stone. The third proof, which I heard from an old Malabar *Empiricus*[6] is even more unbelieveable. When one ties the stone to the trunk of the *Calappus*-tree, all the nuts are supposed to fall off the tree. I did not try it.

Pliny ascribes in the above-mentioned reference his *Dendritis* the property that when buried under the root of a tree which one plans to cut down, the axe will not become blunt.[7] One might give it a try with the next *Dendritis*. The oblong *Calappus*-stone is also very similar to the *Chamites* of the first sort [according to v. Martens 1902, pp. 124–25 *Tridacna gigas*], but can be differentiated in that the *Chamites* commonly have a pearl-like reflection but not the little sun; it also cooks more slowly and less in lemon juice than the *Calappus*-stone. With time the *Calappus*-stone becomes dull, dirty white and dead of color, which need to be cleaned up by this method. One places it for half-a-day in the water of a young *Calappus*, and rubs it with the liplap[8] [soft endosperm] or washes and rubs it in water in which rice one wants to cook has been washed.

The *Calappus*-stone is considered among the most important *Mesticae*, which are worn for good health or good luck and for many other purposes [p. 321] which the natives ascribe through superstition and imagination, such as being lucky in commerce, in making gardens, and in protecting someone in war. The latter has no chance, because what does the peaceful Jupiter,[9] under whom this tree belongs, to do with the war-god Mars? Better reasons include those who use it to break fevers, when one places it in water and then drinks it to put out the feverish fires. Also with water rubbed on a smooth stone and placed in the eye heals the overheatedness of the person. The most beautiful and most round ones are set in silver rings, because it will not stay in gold.[10] The largest are hung on krisses [daggers][11] also closed with silver hoops. The *Malabars*[12] also make ear-rings, worn by the women, set in gold, however, in which they do not remain as clear as in silver. One can buy it for a Rijksdaalder [crown], although the round ones and sparkly ones cost more.

In February, 1691 a young lady came to me, who had opened an old *Calappus*-nut, which was grown on Baguala. On the shell or *Tampoerong* and under the outermost husk [bolster] she discovered a *Calappus* stone, not placed in the eye but on one of the sides of the *Tampoerong* in a shallow hole. In color and substance it was the same as other *Calappus* stones, but it differed in appearance. It was the size of a dubbeltje ["dime"][13] and had the appearance of a flat heart, flat on the underside, raised on the top side and with a small hole, in which one could observe something like a small fiber of the husk. On one of the corners a small chip had fallen off, under which was a small bristle [quastje]. The young lady had put it in vinegar, in which it cooked and moved, but because of this it lost some of its lustre.

CHAPTER LXIX. **Dendritis Calapparia**

Another kind of *Dendritis* from a *Calappus*-tree was found on Ceylon in the wood of the trunk of this tree, which had been hit and felled shortly before by lightning. The following day two Dutch [Duitsche][14] officers passed by with their slaves. The slaves walked to the tree to take out the cabbage [palmyt] from the crown, when they discovered this stone in the trunk. It was readily accepted that it must have grown right there, because it was tightly enclosed by the wood. They gave the stone to their master the captain, who gave it to me in Amboina. This little stone was round with slight unevenness, as big as a black cherry, hard and smooth as a pebble, not translucent, yolk-yellow in color, on which were located many little white eyes or circlets, inside with a yellow area, some large, and some small, as if they were painted. The uppermost eye was the largest, and had within it another dark ring, like the iris of the eye. Some of the other eyes ran over each other, some were also completely white, the sort of circlets one almost sees on a kind of *Lapis Victorialis* or *Astroites*. On one side one saw a white spot, without color [literally: dead of color], where one suspected that it had been hit a bit by lightning. (The captain told me that the Sinhalese told him that such stones were found from time to time in the *Calappus*-wood. However, they could not produce one, nor point one out, although he then was serving as the Dessave, that is the local governing official and exercised authority over these people. His guess was [p. 322] that they had them, but were not showing him, because that nation like so many other Indians held these rare *Mesticae* to be very valuable and wore them for good fortune, especially in war, which I could accept to some extent, should he have been able to protect his trees against lightning. However, the expression goes: When more comes, less has to give way (*Als meerder komt, moet minder wyken*). I have not heard or seen any more about these stones in these Easterly areas. [The one I received] was set in a ring in 1682, and sent with my other rarities to the Duke of Tuscany with the name *Dendrites Calapparia*.[15] I was not willing to test it in a vinegar or lemon juice because I did not want to affect its shine. But at night, when I hit it against a crystal of agate it sparked only a little, like all hard *Mesticae* which are entirely or partially translucent.

The entire quotation should go far towards setting the record straight as to what Rumphius said about *Calappus* stones. Even so, a few comments are in order about his style or approach to the coconut stone "problem." There should be no doubt that Rumphius, characteristically, was meticulous and painstakingly precise in his description of the *Calappus*-stones. This was very unusual for most scientists of the day in Europe, much less an investigator working under difficult conditions in the tropics. He makes no pretense of having found them himself but he does take pains to corroborate hearsay or to seek out eye-witnesses (cf. page 112). Rumphius categorically rejects the existence of stones in coconuts grown in the Amboinese Islands. Even if they are rare, he reasoned, surely one could anticipate their discovery since thousands of coconuts were being opened for oil to burn in lamps, etc. He similarly seriously questions their being found on Ceram's Northern Coast since he "met no one who had found them there himself." At the same time, Rumphius goes on to state that "most are found on Celebes and Makassar." Does this not suggest that he, personally, had been satisfied as to their origin by one means or another? One would think so except for the fact that Rumphius repeatedly questions and doubts the var-

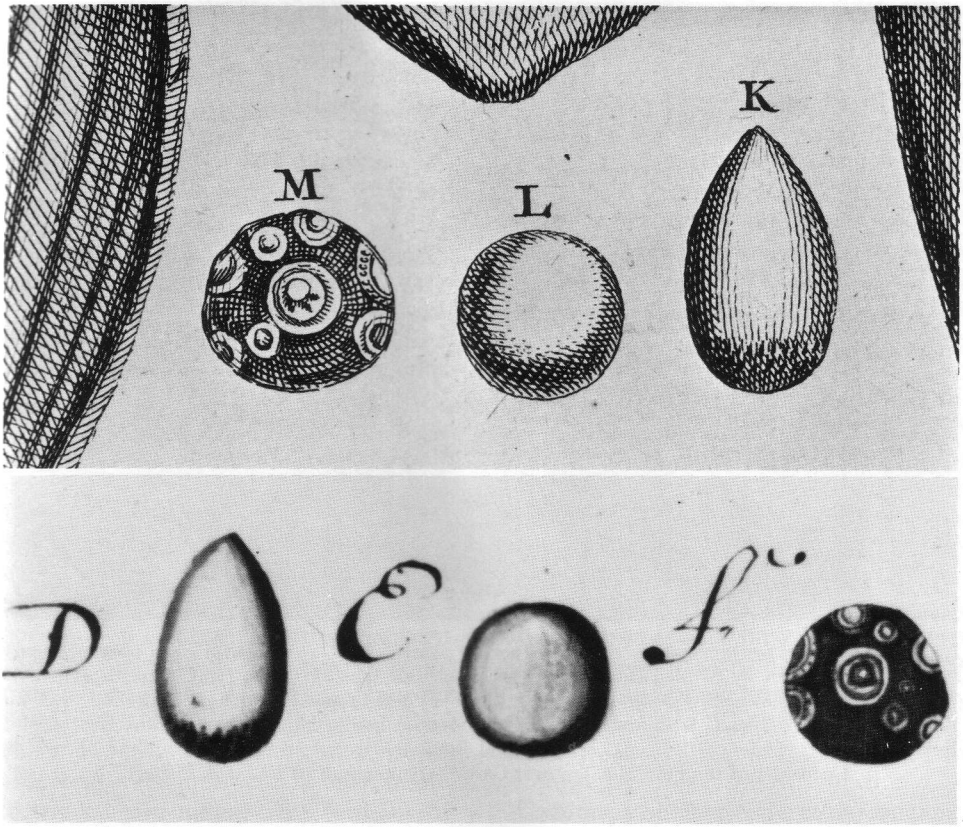
ious "proofs" of authenticity. I get the feeling he is troubled by the failings of these tests. In the presence of citric or acetic acids found in lemon juice and vinegar, respectively, carbon dioxide gas was emitted—i.e. the pearls "boiled" and "sent up bubbles." The dissolution of carbonates in acid, resulting in the loss of the luster, was beyond Rumphius but he did conclude the test could not have anything to do with their being "dead." He does not seem to accept anything on face value. His critical attitude is apparent throughout. To counteract his suspicions or his latent doubts, Rumphius seems to have encountered situations which were close enough at hand to neutralize or even overcome most or all of his reasons for skepticism. The description of the young lady who came to him in 1691 with a *Calappus*-stone complete with a small coconut husk fiber (cf. page 113) is a case in point.

It is particularly significant that Rumphius states that the stones called *Chamites* [from "Chama" species, including the giant molluscan *Tridacna gigas* L. in modern nomenclature] are different from and can be distinguished from real coconut stones. He writes the following about *Chamites*:

> "In the *Tendo*, or the band or the encircling *Spondylo*, sometimes are found several pretty little stones [steentjes] very similar to the stone *Calapites* or *Calappus* taken as alabaster. Some are clear white. Some are dirty or yellow-white. Some have a pearl-like reflection, and translucent like agate on one corner. They can be distinguished from the *Calappus* stone by the fact that the *Calappus* stone is smooth and egg-shaped like a salamander egg, commonly with a dark corner, which is the root [wortel] with which it has been attached to the cap [dop] of the *Calappus*. Or, it can be lentil-shaped, like the one found in the little apple [haustorium]. In contrast, these shell-little stones [Schulp-steentjes], which we call *Chamites*, and in Malay is called *Mesticabiagaru*, are uneven [i.e. not smooth], angular, and mostly yellowish. Few are found in the Amboinese [Islands], but more are located in the Makkassar and Papoea Islands. Even in the smoked *Dendeng* have I found small half-translucent ones. Because, those which are not thicker than a pea, are the clearest and most white. But those with the size of a marble [knikker], are angular and dirty-white. Those who earn a living through fishing and shells carry these stones eagerly on themselves [with them]. However, our Amboinese are somewhat superstitious in carrying these large shells in their vessels across the sea, saying that they otherwise would encounter wind and thunder and lightning. . ..[and R. continues with several other superstitions] (Rumphius 1705, p. 128)."

If it turns out that Rumphius is wrong about coconut pearls (*and this is not the place where this will be examined or tested*) it is not, I contend, for lack of ability on his part, or any negligence. He clearly took all due precaution in relating his findings. Child (1964) has no ground to make perjorative inuendo—i.e. ". . . (like so many legends) to be traceable back to Rumphius."

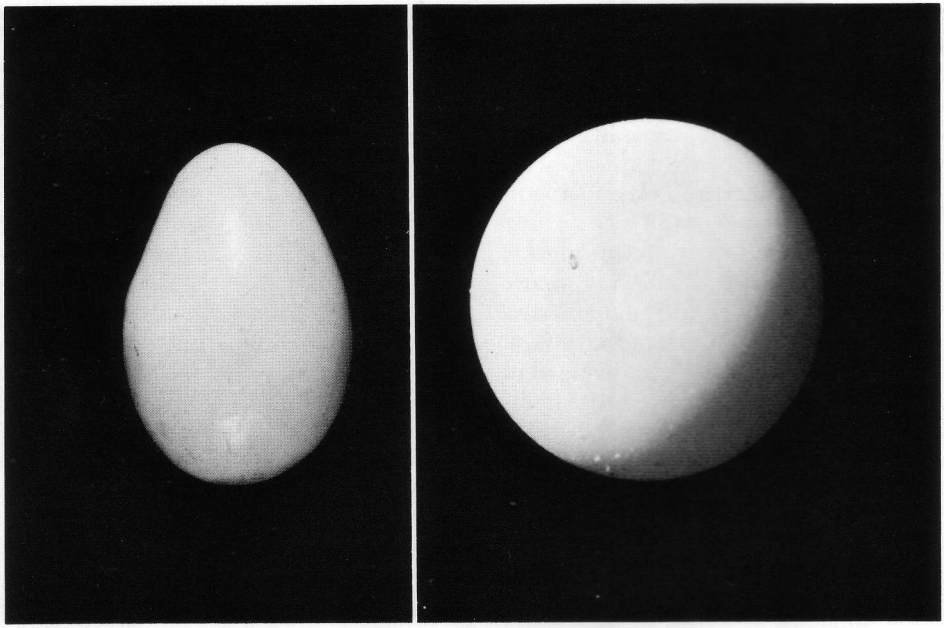
In spite of Rumphius' attempts to provide the reader with an accurate description of how the stones "grow" in the *Calappus*-nut, and despite my own familiarity with the events of coconut floral biology and the growth of coconut embryos etc., in the nut, I am unable to interpret the text with the degree of precision necessary or desirable to come up with a satisfying explanation. The Dutch warrant officer who "noticed a small red spot sticking out a little bit beyond the flesh, where there were two small flat white stones, which were still connected to the shell" may well have been describing the area of the embryo beneath one of the "eyes." The red spot would in fact be the embryo and I have seen fairly freshly excised embryos of coconut being grown (in the laboratory of Dr. Emerita V. de Guzman, University of the Philippines at Los Baños) aseptic-



1. Upper panel, portion of plate II from the printed version of Rumphius' *Herbarium Amboinense/Het Amboinsche Kruid-Boek* showing K, a "Calappites," or a Calappus-stone from the fruit; L, "Calappus-stone out of its little-apple [haustorium] or its innermost water; M, Dendrites Calapparia, or a Calappus-tree stone, found in the trunk of a Calappus-tree." Lower panel, the original drawing [Shelf Mark BPL 311, Boeck I fol. 29 recto] from which the etching for the above plate was made. Published with the permission of the Department of Western Manuscripts, Bibliotheek der Rijksuniversiteit te Leiden.

ally under *in vitro* conditions and a few were red-pink. My unsubstantiated interpretation of the red color is the presence of anthocyanin pigments that had derived from the oxidation of so-called leuco- or colorless-anthocyanins which can occur in the coconut (cf. Steward 1968, p. 167). Under the circumstances and *based on Rumphius' text*, that is the best I can do. Unfortunately, it is impossible to do more. The same holds true for the origin of the *Dendritis Calapparia*, or Coconut-tree stone.

Rumphius earned a reputation as an excellent phytographer, or describer of plants. The same may be said of his ability to provide a lucid description of what might be called the "gross morphology" of the stones. The illustrations from the *Herbarium Amboinense* provided in Figure 1 and a comparison with two museum items originally acquired as authentic stones (Fig. 2) underscores how able a describer Rumphius was. One can even see the "little sun" or brilliance on the pear-shaped stone. It has not been possible, and it



2. Photographs of two objects described as "coconut pearls." Left, an alleged stone or pearl presented to the Kew Museum by Sydney Hickson (cf. Hickson 1889, pp. 331–332); right, a pearl, called the "Maharajah", once owned by David Fairchild at the Fairchild Tropical Garden (cf. Fairchild 1943, pp. 124–125). The Kew "pearl" by Crown Copyright, reproduced with the permission of the Controller of Her Majesty's Stationery Office, and of the Royal Botanic Gardens, Kew. The Fairchild "pearl" by courtesy of the Fairchild Tropical Garden (photograph by Dr. Jack Fisher).

probably never will be, to locate the original Rumphius items. In the 1760's, a catalogue was made by Professor Giovanni Targioni-Tozzetti (1712–1783) of all those materials sent by Rumphius in 1682 to Holland and forwarded to Duke Cosimo III de'Medici in Florence. The manuscript copy of this catalogue was published by Professor Ugolino Martelli in 1903. Detailed inventories of objects which undisputably existed at the time of Targioni's catalogue are provided and compared with the Rumphian transmittal letter. But as far back as 1762–1764 Targioni-Tozzetti complained "I have not been able to find these nuclei or *Calappite* stones . . ." (Martelli 1903, p. 162). Therefore, it seems the *Calappus*-stones, themselves, will have to remain silent on the whole matter.

No heroic effort has been placed on a thorough search of the very early literature to establish whether Alzina, Kamel or Rumphius were indeed the very first to describe coconut stones or pearls. Even so, it does not seem that a more detailed description than that provided collectively by these authors is likely to emerge. In a classic and definitive work entitled "The Book of the Pearl. The history, art, science and industry of the Queen of Gems," Kunz and Stevenson (1908, pp. 78–79) state that "The Raganighantu of Narahari, a Kashmir physician of about 1240 A.D., reported them [pearls] as coming from bamboos, cocoanuts (sic), heads of elephants, bears, ser-

pents, whales, fish, etc., although it is conceded that these were deficient in luster, which is recognized as the characteristic feature of pearls. We understand, therefore, that this use of the word signifies only hard concretions of a spherical form." Upon checking the authority cited by Kunz and Stevenson for this statement, however, I found no mention of pearls from coconuts! The Sanscrit text transliterated and translated into German lists "pearls" as "from the head of elephants, snakes, fish, bears, bamboo joints, marine and fresh water molluscs as well as pearl oysters" but no coconuts (cf. Garbe 1882, p. 75). Dr. Madhav Singh, a visitor in my laboratory from the University of Lucknow, U.P., India a few years ago confirmed the absence of the word for coconuts in the transliterated Sanscrit version. It was not in the German translation either. Clearly, Kunz and Stevenson were mistaken on this point. Since it would not be a profitable venture, no effort has been made to track down manuscript versions of this work in Sanscrit to see whether there are text variations.

It is fair to say that Alzina, Kamel, and Rumphius are more or less contemporary writers. Alzina wrote before 1668; his work has even today not been published in its entirety. Rumphius announced his intention to write what came to be called the *Herbarium Amboinense* in 1663. The manuscript of the first six books [Book I includes the account of coconut stones] were delivered to the Dutch East India Company in 1690 but they were not forwarded to Holland until 1692. The ship on which it was to travel to Holland was intercepted and destroyed by the French. Thus, it was not until 1696 that a copy of the first six books safely reached Europe. We have already noted that the *Herbarium* books were not published until about 50 years after they had been written. The manuscript of the *Amboinsche Rariteitkamer* was completed in 1699 but only remained unpublished until 1705 (cf. DeWit 1959)! As best as I can figure out, Kamel's account was written sometime before 1698 (cf. Lankester 1848, pp. 345; 347–348; 377–378; 395; Raven 1950, p. 301) but was not in Ray's hands until after May 20, 1701 and was finally published in 1704. Alzina's writing, as mentioned much earlier in this paper, was sure to have been the least instrumental in bringing coconut stones to the attention of European scholars. Rumphius and Kamel (through Ray and Petiver) were relatively well known by the standards of the day. Coconut stones or concretions became well enough known so that by 1792 Antoine François de Fourcroy (1755–1809), a distinguished chemist and contributor to the massive and comprehensive *Encylopédie Méthodique*, mentioned them albeit with no reference to Rumphius, Kamel or Alzina (cf. Fourcroy 1792, p. 554–555; 681). By 1818 there is reference to coconut stones under the entry *Mestiques* in the *Nouveau Dictionnaire d'Histoire Naturelle* . . . (1818, pp. 344–345). The article states:

"Mestiques. In the Malay Islands [îles Malaises], one calls stony concretions [mestiques] which one finds in the interior of several fruits or cocos of *Calappa* [cocos du calappa]. The inhabitants of these islands carry these stones as amulettes, mounted in silver. Rumphius has illustrated several (*Herb. Amb.*, vol. I, Tab. 2). One should suppose that these stones have the same origin as tabasheer, a substance of siliceous nature, which collects in the hollows of bamboo. Rumphius asserts that one finds them even in the trunk of coconut trees, and according to what he reports, one must believe that they too are siliceous in nature. One can read, in this author, the ridiculous stories that one attributes to these concretions."

The author of the above entry to the *Encyclopédie*, a man named Leman, a member of the Société Philomathique, clearly had read Rumphius' account in the *Herbarium*. Although he was apparently a member of the Society of Scholars and lovers of learning etc., Leman could not have known much about chemistry, however, for there is no way that a person knowledgeable in even the chemistry of that day and age could have concluded that the coconut stones of Rumphius which "boiled" in vinegar and lemon juice and which lost their shine could have been silica-containing. Tabasheer found in bamboo joints, about which more will be said in a later paper, is virtually acid resistant and dissolves only in hydrofluoric acid. It is closely related to sand!

The most that can be concluded from all of the above is that coconut stones or concretions were thought to exist. They were appreciated as exotic novelties. Although a few scholars had even seen items described as coconut stones, they could not have been widely known. Fourcroy (1792, p. 681) stated that,

> "Several botanists have described vegetable concretions, especially in coconuts, palms, &c. There are several in the collection of de Jussieu [the botanist]. I have seen several, rounded, which, polished like ivory, and which appear to have great hardness. It has not been possible for me to investigate their nature, because of their rarity and the dearness of the concretions. They have been called vegetable bezoars, and the credulity which accompanies all the prejudices of medicine, has even boasted them as heroic remedies".

A substantial block of time was to elapse before the next scene in the story of the coconut pearl was to unfold. This will be discussed in the next installment.

SUMMARY

From time to time reference has been made in the literature about calcareous concretions said to be found in coconuts. These concretions more or less resemble small alabaster stones or poor quality pearls. Certain authorities have disputed the authenticity of these "pearls" and have suggested or categorically stated that they derive not from coconuts but from giant *Tridacna* clams. A careful examination of the early primary literature has been made as a first step towards re-investigating various aspects of the "coconut pearl problem." In this first paper of a planned series, relevant passages from 17th century authors such as Alzina, Kamel, and Rumphius have been fully translated into English and interpreted insofar as has been possible. The accounts of these authors vary in their detail but one cannot help but be impressed by their attempts to be precise. Unfortunately, the descriptive biology of the day does not permit us to understand unequivocally the origin of the "stones" or "pearls" from coconuts but the haustorium or so-called "apple" is implicated in the descriptions of all three writers. Rumphius stands out in particular as a careful, trustworthy observer. He even points out the great similarity between coconut stones and so-called *Chamites* or certain molluscan stones. Even so, Rumphius enumerates means of distinguishing the two types of stone. The translations presented here provide a base on which to build and should permit a better means of understanding how knowledge of coconut pearls first reached Europe.

Acknowledgments

I am particularly grateful to Mr. Evert Volkerz, Special Collections Librarian at the State University of New

York at Stony Brook, for without his help, the English translation of Rumphius presented here would not have been possible. I am also grateful to the Bibliotheek der Rijksuniversiteit te Leiden, especially Dr. P. J. J. Obbema, Keeper of Western Manuscripts, for making available the photographic copies of the relevant Rumphian plates. Appreciation is also extended to Dr. Jack Fisher of the Fairchild Tropical Garden and to the Royal Botanic Gardens at Kew for photographs of the "pearls" shown in Figure 2.

Acknowledgment is also made to the National Science Foundation for aid in the form of a Visiting Scientist Grant which permitted me to visit the University of the Philippines at Los Baños in January 1979. During the visit, among other things, I was able to make inquiries about so-called "coconut pearls" in the Philippines and to gain much first-hand knowledge about coconut embryos and their growth. Thanks go especially to Professor Emerita V. de Guzman for serving as my "scientific counterpart" during that visit.

Notes

1. I have been unable to find anywhere in Pliny even a nominal discussion of a class of gemstones called *dendritides* although all of Book XXXVII deals with gemstones. Book XXXVII, Chapters 11 and 12, deal with amber (fossil resin). Pliny complains "But there is no end to the names given to precious stones, and I have no intention of listing them in full, innumerable as they are, thanks to the wanton imagination of the Greeks" (Pliny Book XXXVII, Ch. 74 §195). "As for the white 'dendritis' or 'tree stone'," Pliny says, "it is said that if it is buried beneath a tree that is being felled the edges of the axes will not be blunted. There are many more stones that are even more magical; and these have received foreign names from men who have thus betrayed the fact that they are ordinary, worthless stones, and not precious stones at all" (Pliny XXXVII, Ch. 73 §192). Eichholtz, the translator and commentator of our copy of the *Natural History*, states that Pliny thus "implies that, had it not been necessary to conceal the intrinsic worthlessness of the stones, they would have been given intelligible Greek names" (Pliny, Natural History Vol. X, p. 321, 1938). I couldn't agree more!
2. I will comment later on some of the different kinds of concretions that have been reported from fruits and trees. Suffice it to say that deposits of calcium carbonate, some rather substantial in size, have been described (cf. Ball 1880). Rumphius described a number of these besides coconut stones. A commentary has been provided by Huth (1887) of the so-called pearls from flowers of *Jasminum Sambac* described by Rumphius.
3. This is a beautiful example, in my view, of Rumphius' ability to draw a so-called "word picture." The reader may agree that rocks do have a characteristic smell.
4. The *Umbilicus marinus*, according to v. Martens (1902, p. 113), is now in the genus *Turbo* (L.) Lam. It is described by Rumphius on pp. 69–72 of the *Rariteitskamer*.
5. I have been unable to ascertain what is meant by the "Victory Stone." "Astroites", mentioned by Pliny in his Natural History Book XXXVII, Ch. 49 §133, refers to some unidentified precious stone of "magical power", perhaps moonstone (cf. loc. cit., p. 272).
6. The 'Εμπειρικοί, or Empirics, were a sect of ancient physicians who drew their rules of practice entirely from practice rather than from philosophical or theoretical bases.
7. See quote in note 1 above.
8. The Dutch referred to the soft "marrow" [endosperm] as liplap. The Malays, according to Rumphius, called it *Calambir* (cf. Rumphius, *Amb. Kruidb.* 1, 4).
9. Rumphius' attitude here reflects belief in what has been called "homeopathic or imitative magic." Inanimate things, as well as plants and animals, may "diffuse blessing or bane around them, according to their own intrinsic nature."
10. Illustrations of some of the jewelry settings will be given in a later paper.
11. From the Malay kĕris. These daggers often have two scalloped cutting edges and a ridged serpentine blade.
12. Malabars or Malabaris came from the Southwestern coast of India, the Malabar coast.
13. A silver coin about 19 mm in diameter minted in Holland since 1614 and then worth two "pennies." It was, according to the *Woordenboek der Nederlandsche Taal* III, II p. 3541–3543 (1916), still in use in Amboina at

as late a date as 1916. I thank the American Numismatic Society for the measurement of the coin in their collection.

14. The Dutch apparently drove the Portuguese from Jaffna, their last Ceylonese stronghold, in 1658. The English took control of Ceylon in 1796.
15. Zaunick (1961) provides a detailed analysis of the Rumphius–Cosimo III, Duke of Tuscany "connection", including a complete copy of the letter of transmittal of six cases or caskets of the "rarest and strangest objects" written and dated by Rumphius from the "Island of Amboina . . . the 15th of August 1682." The asking price for the rarities sent to the Duke was some 650 Crowns or Imperials.

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Lethal Yellowing in Mexico

Lethal yellowing (LY) has been found in the Cancun and Puerto Juarez areas in the State of Quintana Roo, Mexico according to a report from Dr. W. B. Ennis, Co-Director of the International Council on Lethal Yellowing. The report states further that Dr. Randy McCoy traveled to the northeastern region of the Yucatan Peninsula in January, 1982 at the request of the United States Department of Agriculture—Animal and Plant Health Inspection Service, and the Direction General de Sanidad Vegetal, Mexico, to survey dying coconut palms. He found the symptomatology to be the same as noted in LY-affected coconut palms in Florida. Electron microscope examination of specimens brought back from Mexico showed presence of mycoplasmalike bodies in the phloem tissues.

The infestation is small now, but the presence of LY on the Central American mainland poses a serious threat to LY-susceptible coconuts throughout the region.

Request for Palm Seed

Brent Tisserat, USDA Fruit and Vegetable Chemistry Laboratory, 263 South Chester Avenue, Pasadena, CA 91106, is conducting research on tissue culture of all palms. His plan is to survey as many palms as possible and he would like to receive donations of palm seed for this purpose. He will provide self-addressed postage labels to potential seed donors.

Principes, 26(3), 1982, pp. 122–125

Additions to the Palms of Fiji

HAROLD E. MOORE, JR., RICHARD H. PHILLIPS,[1] AND SAULA VODONAIVALU

Shortly after an account of the Arecaceae in Fiji was published (Moore 1979), one of us (S.V.) discovered undescribed palms, one on the eastern side of Taveuni and another near Galoa, Viti Levu. Another of us (R.H.P.) has been checking on the cultivated representatives. All three of us joined in an expedition to Taveuni in March 1980 (*see pp.* 138–140), and collected a complete series of what has proved to be a new genus of arecoid palms in the *Clinostigma* alliance (Moore 1973) while Moore and Phillips collected a series of the second wild palm on Viti Levu which proves to be a new species of *Gulubia*, a genus heretofore known from Northeastern Australia to the New Hebrides. We report on our findings below.

Indigenous Palms

Alsmithia H. E. Moore, *gen. nov.* Arecoideae: Clinostigmateae (Fig. 1).
Alsmithia longipes Moore & Vodonaivalu, *sp. nov.*
Gulubia sp. nov.[2]

Cultivated Palms

Areca triandra
Pelagodoxa henryana
Thrinax sp.

Alsmithia H. E. Moore, *gen. nov.*

Palmae monoiceae solitariae. Folia regulariter pinnata vaginis aperientibus pinnis acutis unicostatis. Inflorescentiae interfoliares paniculatim ramosae prophyllo pedunculum longum omnino vaginante. Flores in triadibus dispositi staminibus floris masculi 6 in alabastro filamentis inflexis antheris dorsifixis pistillodio floris masculi in alabastro quam staminibus breviore apice vix capitato. Fructus reliquiis stigmaticis apicaliter praeditus endocarpio operculato fibris crassis adnatis sculpto semine carinato obtusatis ornato endospermio homogeneo embryone basali.

Single-stemmed, slender, unarmed, monoecious, pleonanthic palms.

Leaves regularly pinnate; sheath soon splitting opposite petiole, not forming a crownshaft; petiole rounded beneath, shallowly channeled above; rachis rounded beneath, angled above; pinnae borne in one plane, 1-ribbed, acute, midrib elevated above, prominent beneath and with 3 prominent veins and thickened marginal vein on each side, ramenta not evident.

Inflorescences interfoliar, erect, paniculately branched, protandrous or rarely entirely staminate; peduncle elongate, flattened; prophyll flattened, completely encircling the peduncle at insertion, more or less persistent, tubular basally, unilaterally split at apex; peduncular bract much exceeding the prophyll, splitting along one side, caducous; rachis elongate, with lower branches once-branched, upper simple, bracts subtending axes evident, acute to rounded, bracts subtending triads low, rounded.

Flowers borne in triads of 2 staminate and a pistillate proximally, the

[1] GPO Box 1151, Suva, Fiji Islands.

[2] This species will be described by F. B. Essig in a forthcoming treatment of the genus.

1. *Alsmithia longipes*, on trail along ridge from Wainibau River to crest of the mountains on eastern side of Taveuni. Note long petioles. Photo by H. E. Moore, Jr.

pistillate aborted and staminate flowers paired or solitary distally, bracteoles surrounding the pistillate flower nearly equal, rounded; staminate buds longer than pistillate buds at staminate anthesis, symmetrical; sepals 3, imbricate, rounded; petals 3, valvate; stamens 6, filaments subulate, inflexed at the apex in bud, anthers dorsifixed, oblong, dehiscent by longitudinal slits, emarginate at apex, briefly bifid at base, connective dark; pistillode cylindric-conic, slightly shorter than stamens in bud, rounded apically: pistillate flowers ovoid; sepals 3, broadly imbricate, rounded; petals 3, broadly imbricate except briefly valvate apices; staminodes 3, narrowly triangular, at one side of gynoecium; gynoecium obovoid, with 3 low linear stigmas scarcely exserted, unilocular, uniovulate, ovule pendulous, hemianatropous.

Fruit ellipsoid and smooth when fresh, drying irregular and lineolate; epicarp smooth; mesocarp pale, parenchymatous, thick, with many short, oblique fibers beneath epicarp, tannin cells not obvious; endocarp thin, fragile, operculate, with thickened adnate fibers irregularly sculptured, ridged, and grooved, rostrate at apex, tapered basally and with a mass of slender fibers within framework of thickened fibers at base, operculum rounded, basal: seed angled in cross section, briefly rostrate with elongate hilum adaxially, 3 rounded ridges laterally and abaxially, flattened basally, raphe branches anastomosing laterally and apically; endosperm homogeneous; embryo basal.

Distribution. One species in wet forest at 300 m and higher on eastern side of Taveuni, Fiji Islands.

Alsmithia is distinct from all genera in the *Clinostigma* alliance (Moore 1973) to which it is assigned in its combination of prophyll completely encircling the peduncle at insertion and irregular seed. The latter has a prominent adaxial ridge, three rounded lateral and dorsal ridges, and is enclosed in a fragile operculate endocarp to which very thick fibers are adherent in an irregularly ridged, furrowed, and sculptured structure unique in the alliance.

The nature of the seed suggests a relationship to four genera, two of which—*Burretiokentia* and *Veillonia*—are endemic to New Caledonia, one of which—*Cyphosperma*—is shared by New Caledonia and Fiji, and the fourth of which—*Physokentia*—occurs from New Britain to Fiji but is lacking in New Caledonia. *Alsmithia* differs from these genera, however, in the completely encircling base of the prophyll at insertion, in the oblique fibers that underly the epicarp, and in the extraordinary fibers about the endocarp that resemble to some degree those of *Ptychococcus* among genera of the *Ptychosperma* alliance. There is a striking habital resemblance to species of *Cyphosperma* and it is tempting to suggest that *Alsmithia* represents the sort of palm one might predict for an early stage in the evolution of those genera with irregular endocarp and seed in which the prophyll has become congenitally open abaxially.

In recognition of the many years he has devoted to the study of the flora of Fiji, the generic name has been coined from that of Albert Charles Smith, author of *Flora Vitiensis Nova*. The specific epithet is drawn from the elongate peduncle of the inflorescence and the similarly extended petiole.

Alsmithia longipes H. E. Moore, *sp. nov.*

Caules ad ca. 4.5 m alti. Folia 3.6 m longa pinnis in quoque latere 28–36. Fructus coccineus ellipsoideus 3.2–3.7 cm longus 2.2–2.5 cm in diam.

Trunk brown, irregularly ringed, ca. 4.5 m high, 7.5 cm in diam.

Leaves 10–12, spreading, often reddish when expanding; sheath green with minute pale brown scales, ca. 56 cm long; petiole elongate, ca. 80 cm long or more, green with pale brown membranous peltate scales; rachis ca. 1.8 m long, green; pinnae 28–36 on each side, green above, duller green and neither lepidote nor puncticulate beneath, basal ca. 28–60 cm long, 0.5–0.7 cm wide, median ca. 62–72 cm long, 4.7–5.8 cm wide, apical ca. 32–37 cm long, 0.8–2 cm wide.

Inflorescences to ca. 1.28 m long; peduncle 43–60 cm long, green with brown tomentum; prophyll 30–55 cm long, 2.5–5.5 cm wide, green and minutely brown lepidote; peduncular bract inserted 17–22 cm above prophyll, ca. 50–95 cm long, green with minute brown scales; rachis 27–50 cm long, green with brown tomentum, bearing 17–18 branches, the lower branches to 67 cm long with peduncular base ca. 13 cm long, rachis ca. 13 cm long, ca. 7 branches with rachillae to ca. 42 cm long bearing triads in the lower half or more, the flowering axes puberulous, creamy-white at anthesis, becoming red-brown to green and 6–7 mm in diam. in fruit.

Flowers creamy-white, staminate buds ca. 4.5 mm long; sepals minutely ciliolate, 1.5 mm high, 3 mm wide; petals 4.5 mm long, 3 mm wide, adnate to receptacle ca. 1 mm, lined when dry; stamen filaments white, 4.5 mm long at anthesis, anthers yellow, 2 mm long; pistillode orange, 3 mm long: pistillate flowers ca. 5.5 mm

high; sepals minutely ciliolate, 3 mm high, 5 mm wide; petals 5.5 mm high, adnate to receptacle ca. 1 mm, laterally ciliolate; staminodes white with brownish tips, 1.5 mm high.

Fruit bright crimson, 3.2–3.7 cm long, 2.2–2.5 cm in diam.; mesocarp with parenchyma ca. 4 mm, thick: seed brown, 1.4 cm high, 1.6 cm wide, 1.3 cm thick.

Distribution. Wet forest on ridge and steep slopes, ca. 300–500 m.

Specimens examined. FIJI. TAVEUNI: Wet forest on trail along ridge from Wainibau River to crest of mountains on eastern side of Taveuni beyond Lavena Village, 325 m., 25 Mar 1980, *H. E. Moore, Jr., R. H. Phillips, & S. Vodonaivalu 10545* (BH, holotype; K, P, SUVA, US, isotypes); track from Lavena Village to Lake, 1,500 ft., 12 Sep 1979, *S. Vodonaivalu L.31471* (BH, SUVA).

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Pinanga cleistantha, a New Species with Hidden Flowers

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ABSTRACT

Pinanga cleistantha from Malaya is described as new. Its unusual inflorescence entirely enclosed within the prophyll is discussed in relation to flowering patterns among other species of the genus, and to other genera with enclosed inflorescences.

Flowering in *Pinanga* almost always follows a precise pattern. The rachillae, enveloped by a single bract (prophyll), develop within the confines of the crownshaft, swelling and eventually imparting a "pregnant" appearance to the plant. When the oldest leaf abscises neatly, the inflorescence is released, usually becomes pendulous in a matter of hours, and the prophyll splits and falls off, exposing the flowers. Flower opening appears to be controlled by leaf fall; pistillate anthesis usually occurs immediately. It could be, of course, that swelling of the inflorescence initiates leaf abscission.

The interrelationships of leaf and inflorescence production throughout *Pinanga* would make a very interesting natural history study. In a few species the precise pattern of development noted above is modified. In some acaulescent species or species with tardily abscising leaves, the leaf sheath may rot on the stem, and the inflorescence is not released, but the prophyll splits, and anthesis takes place surrounded by the rotting sheath and, usually, by a great mess of leaf litter. An example of this type is Bornean *P. dumetosa* J. Dransf. An even more remarkable pattern of development can be seen in *P. simplicifrons*, an undergrowth palmlet of Malaya and Sumatra; here the leaves do not fall away neatly but rot on the stem and a crownshaft can scarcely be distinguished. The inflorescences, barely 3 cm long, burst out through the rotting leaf sheaths and become pendulous, but the prophyll does not split, the flowers opening while enclosed within the prophyll. Fruit are produced in abundance and burst through the prophyll; are they produced "cleistogamously" by transference of pollen from staminate to pistillate flowers within the prophyll, or are small insects such as nitidulid beetles finding a way into the inflorescence and effecting pollination? The prophyll does split sometimes at its very base, and this would allow access to the flowers, but the truth is that the flowering process in this palmlet has never been followed in detail.

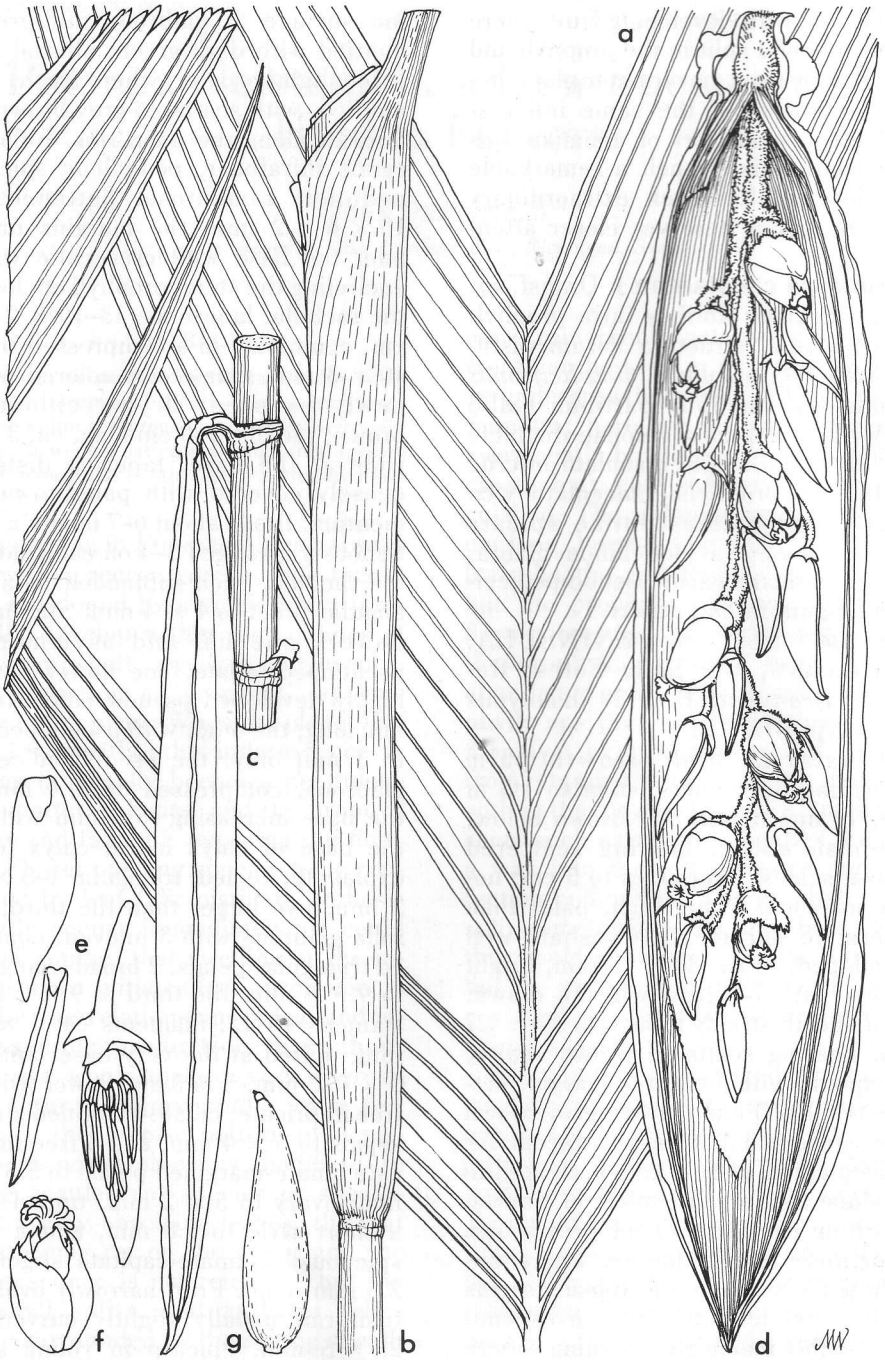
Recently I discovered an undescribed species of *Pinanga* with an inflorescence similar to that of *P. simplicifrons*, growing in superbly palm-rich lowland forest in Trengganu, West Malaysia. In the new species there is a well-developed crownshaft, but, although the inflorescences are released and become pendulous in the normal way, the prophylls remain entire. Occasionally the prophyll opens minutely at its insertion allowing access to the flowers but on many inflo-

rescences with developing fruit, there is no sign of a split in the prophyll and pollination must have taken place between flowers of the same inflorescence, or some sort of apomixis has occurred. This is such a remarkable species and has such extraordinary flowers that it deserves closer attention.

Pinanga cleistantha J. Dransf. *sp. nov.* singularis floribus intra prophyllum occultis, structura florum pistillatorum et fructuum *P. simplicifrondi* affinis sed omnibus partibus multo majoribus, columna coronae distincte evoluta, folio amplo maculato inferne pallidiore, prophyllo lanceolato vice ovato, axe inflorescentiae spicata dense tomentosa vice bifida glabra, flore staminato basin pseudo-pedicellum longum ferenti differt.

Typus. MALAY PENINSULA, TRENGGANU, Ulu Setiu Forest Reserve, *Dransfield* JD 5179 (holotypus K; isotypi BH, KEP).

Clustering undergrowth palm spreading by runners; stem to 1.5 m tall, 10 mm diam., dull brown below, greenish above, bearing scattered brown scales; internodes to 5 cm; nodal scars ca. 2 mm high, paler than internode surface. Crownshaft well developed, to ca. 30 × 1.7 cm, bright green, with 7–8 leaves in the crown. Leaf sheath strictly tubular to 23 × 1.7 cm, bearing scattered brown scales, the mouth with a tattered margin; petiole to 50 × 5 mm densely grey-brown tomentose; lamina unsplit except for a deep apical cleft to 25 cm, or split to produce 2–3 broad leaflets of uneven width on each side of the grey-brown tomentose rachis; lamina where unsplit to 55 × 25 cm, the apical margins with coarse teeth to 1 cm corresponding to the major ribs; lamina where split with leaflets 25–35 × 3–9 cm, the distal pair with apical toothing, the proximal long acuminate; adaxial lamina surface ± glabrous mid-green, mottled with dark green; abaxial surface slightly paler when fresh, not mottled, with scattered grey brown indument along the main ribs. Inflorescence infrafoliar, pendulous spicate; peduncle tomentose, flattened, to 10 × 6 × 2 mm, the margins undulate, the base with crescentic wings encircling the stem; prophyll enclosing the rachilla, lanceolate 13–19 × 2–4.5 cm, acuminate in a compressed tip to 10 × 3 mm, pale cream-colored when newly exposed, drying cinnamon brown; rachilla 7–9 cm long, ca. 3 mm wide at the base, tapering distally, densely covered with pale-brown tomentum; triads about 6–7 in all, ± distichously arranged 3–4 on each side of the rachilla, each subtended by a triangular bract to 4 × 4 mm. Staminate flowers unequal and asymmetric, pseudopedicellate, one flower with a highly developed pseudopedicel to 13 mm long, the other with pseudopedicel to 3 mm only, the pseudopedicel ± glabrous, compressed ca. 0.4 mm at the base increasing to 3 mm wide at the base of calyx lobes; calyx lobes explanate, keeled, triangular 1–3 × 1–2 mm, two larger than the third; corolla glabrous with 3 uneven, contorted triangular petals, 2 broad triangular to 9 × 4 mm, the third to 9 × 2 mm; stamens 10–12; filaments ca. 1 × 0.1 mm, united at the very base; anthers 4 × 0.2 mm. Pistillate flower with 3 free imbricate, ciliate-margined striate sepals to 5 × 4 mm, and 3 free imbricate ciliate-margined petals to 5.5 × 3 mm; ovary to 5 × 2 mm, tipped with a short style to 0.8 mm, and a conspicuous pectinate-capitate stigma to 2.5 mm diam. Fruit narrowly ovoid to fusiform, usually slightly curved, to 25 × 5 mm, epicarp in young state brownish green. Seed to 20 × 4 mm; endosperm with shallow ruminations; embryo basal. Seedling leaf unknown.



Pinanga cleistantha. a, leaf apex ×1; b, tip of stem and crownshaft ×1; c, portion of stem with pendulous inflorescence ×1; d, inflorescence with one face of the prophyll removed to show the unbranched axis and triads ×2; e, staminate flower dissected, showing the unequal sepals and petals and long pseudopedicel ×4; f, pistillate flower ×4; g, almost mature fruit ×2. (Drawn from *Dransfield* JD 5179 by Mary Millar Watt.)

Habitat. This elegant colonial palm was collected in lowland Dipterocarp forest in a valley bottom at 50 m altitude; growing with it were *Salacca multiflora* Mogea, *Calamus minutus* J. Dransf., *Arenga hookeriana* (Becc.) T. C. Whitmore, *A. hastata* (Becc.) T. C. Whitmore and several widespread rattan species. Notes: It differs from all other *Pinanga* spp. except for *P. simplicifrons* in the enclosed inflorescence; from *P. simplicifrons* it may be distinguished by the much greater size of all its parts, by the broad leaf with mottled upper surface and paler lower surface, by the lanceolate rather than the ovate prophyll, the tomentose unbranched rather than glabrous bifid inflorescence axis, and by the staminate flowers with extraordinary pseudopedicels. Like many species of *Pinanga*, *P. cleistantha* would make an elegant horticultural subject, but no fruit was perfectly ripe when I collected it in 1977, and as far as I am aware it has not been collected since. Furthermore, the area where it grew was in the process of being logged, so its survival in the only known locality must be severely threatened. Yet it must surely grow elsewhere in the Trengganu hills.

The specific epithet refers to the hidden flowers. Without further fieldwork I can only speculate on the significance of the enclosed inflorescence. Enclosed inflorescences are a feature of the rattan genus *Ceratalobus*, where the prophyll opens by a minute apical split and potential pollinators have to pass through this restricted passage to reach the flowers. In *Manicaria* the entire inflorescence is enclosed in a net-like bract; through the very small interstices of the bracts pass nitidulid beetles which seem to be the pollinators (Moore & Dransfield pers. obs. in Colombia, 1976). In these two genera the inflorescences are protected and the bracts act as pollinator sieves restricting access to the flowers to small beetles. If the prophylls of *Pinanga simplicifrons* and *P. cleistantha* open at the base then they probably function in a way similar to the prophyll in *Ceratolobus* and the bract in *Manicaria*, but there is evidence that the bract may never open.

Principes, 26(3), 1982, pp. 130–137

TRIBUTES TO HAROLD E. MOORE, JR.

In Remembrance of Hal Moore

Hal Moore's passing is a grievous loss to all of us concerned in one way or another with palms. The loss of a personal friend, as Hal was to many of us, is acute. But to the rest of the world and the ages to come, we have lost the man who brought the scientific study of palms into the twentieth century, who made Principes, the journal of the Palm Society, into a respected scientific journal, and who became *the* authority on the palms of the world. He worked tirelessly, driven by a desire to achieve that which most of us never know. He left a mountain of unfinished work. That is to be lamented, but if he had lived to be 100, he would still have left a mountain of unfinished work, because like his predecessor, L. H. Bailey, his work was his life and he would have continued to the last day. It is our great loss that he did not have another 35 years; even so, his life's work has added up to a staggering accomplishment.

Hal Moore was my teacher. I studied under him for five years at Cornell. He taught me how to look at palms, how to find them, collect them and study them. Hal Moore led by example, not by preaching. He did not seem to feel comfortable in a classroom or before a group of fellow scientists, but he could certainly make his point when describing his work or when making an impassioned plea for the protection of an endangered species. He was always busy. When afternoon tea was served at the Hortorium, he barely stayed long enough to warm his seat, but always long enough to provoke some excited conversation among the graduate students and staff. He was never too busy to sit down and talk with me when I had questions or problems with my research. His excellence as a teacher was expressed in this sort of one-to-one interaction.

1. Hal Moore in the central plaza Quito, Ecuador, September 1970. Photo by Robert Dietz.

Hal Moore was also a perfectionist, or so it seemed at least when I was writing my dissertation. Draft after draft came back filled with red marks and voluminous commentary. No detail escaped him. It made me a better researcher and writer and accounts for the consistent high quality of his own work.

We can hope that the various threads of his work will be picked up by his students and colleagues, but there will never be another Hal Moore.

FREDERICK B. ESSIG

A Rainy Day in the Everglades

It was soon after World War II that I met Hal Moore. He had recently become an assistant to Dr. Liberty Hyde Bailey, who had selected him as an understudy to carry on the great horticulturist's work with the palms. In his quest for knowledge, Hal was a frequent visitor to south Florida, and particularly to the Fairchild Tropical Garden and the Robert H. Montgomery estate, both of which had large palm collections. I was then a reporter on The Miami Herald, doing a Sunday gardening page on the side. Hal's knowledge of the palms made him of prime interest to a writer with columns to fill with material attractive to newspaper readers.

Eventually Dr. Bailey died, leaving his young successor with unlimited opportunities to find a place for himself among the world's great palm authorities. During his early years at the Liberty Hyde Bailey Hortorium, Hal talked freely of his dream: to learn all there was to learn about the taxonomy of palms, then write the definitive book on this great plant family. Alas, there was not to be the time to do both, to learn it all and cap off his study—in his old age—with the big, thick book. Hal died prematurely, at least for a plant scientist. He needed the long life of his predecessor, Dr. Bailey, to complete the work he had set out to do.

The closest Hal got to his definite work was *The Major Groups of Palms and Their Distribution*, published in Gentes Herbarum in 1973. Although far short of Hal's goal, the work is of considerable importance, Hal expanded the groups of palms to fifteen and provided groundwork in technical papers that should be of enormous help to his successors. The work that had to be done before Hal's definitive book could be written proved to be a lot more difficult than Dr. Bailey or his young understudy could have dreamed back in the early 1950s.

Hal's search for knowledge of the palm family took him all over the world where palms grow—into the sweltering rain forests, through torrid jungles, across arid llanas, sometimes high into the chilled atmosphere of elevations where snow on palm fronds is no rarity. Despite his mounting responsibilities at the Bailey Hortorium, he squeezed in trips to out-of-the-way places half-way round the world to get the answers he sought, taking along his climbing irons to enable him to reach the tops of hundred-foot-tall palms, where he often had to fight stinging ants, wasps, small animals, and even snakes that sought to turn him away from his quest of a flower spike or fruit. Wherever there was a kind of palm that Hal hadn't seen he sought to go to the place where it grew and seek it out. It was not until he had done many years of traveling and collecting that he felt competent to complete *The Major Groups of Palms*.

Upon starting this I had not meant to attempt a review of Dr. Harold E. Moore's scientific work with the palms, planning instead to write a brief recollection of the man—to tell a little of his human side, so to speak. For twenty years Hal was a frequent visitor at our house, especially when we lived on Montgomery Drive, a short distance from the Fairchild Tropical Garden and the Montgomery estate. We invited Hal's friends to dinner or to cookouts, and sought to introduce him to people who had unusual palm collections, which he could study at a time before he began to receive grants that permitted him to travel over the world to see palms growing in their native habitats.

While Hal may have been a palm authority, interested specifically in this unique family of plants, it must be

remembered that he basically was an all-around botanist, not only well trained but gifted with sensitive insight. He enjoyed trips into the Florida wilds, botanizing while relaxing on a kind of vacation away from the arduous concentration his study of palms required. A memorable occasion was a visit to Corkscrew Swamp on a cold day in the mid-1950s, before the present boardwalk was built. We had to wade, of course, waist deep and more, with the air temperature in the low thirties.

Through efforts of the National Audubon Society, the swamp had just been acquired from timber interests who had planned to fell the swamp's 500-year-old cypresses and reduce them to lumber. Not only would one of Florida's unique wildernesses have been destroyed, but so would have been an important woodstork rookery among the trees' lofty branches. I had made arrangements with the warden living nearby for Hal to see the swamp, but since it had turned so cold he did not expect us. He was greatly surprised when we showed up ready to go. Hal hadn't mentioned the cold. We had set the day and the time and he assumed we would go regardless of the weather.

In those days I passed up no opportunity to do a story, so of course I had my camera, a bulky speed graphic. My son, Karl, then in his teens, helped to carry camera equipment, mainly the four-by-five-inch film holders and flash bulbs. Now forty-four, Karl looks back on that cold day as just one of the many unforgettable experiences we had in the company of Hal Moore.

Another memorable day was a picnic in the Everglades National Park in the spring of 1954. The morning opened with overcast skies and a drizzle that gradually increased to a wetting rain. Up in the morning Hal arrived, running from his car to the house in a downpour.

"You probably have given up the idea of going," he said, raindrops flying from him as he entered the house.

"Looks bad," I said. "Maybe you don't like to go on picnics in the rain."

"Me? I like the rain," Hal replied, laughing in a boyish way he had. "I was afraid you folks don't like rain."

"I don't like getting wet," I admitted, "but I'm ready to risk it. Maybe it won't be raining in the park."

"It probably will," said my wife, who, like most women, is more realistic about such things than their husbands. "But we can eat in the car if it's raining."

And before you could repeat Everglades National Park twice we were carrying the picnic supplies to the car—a gasoline stove, wieners and buns, some vine-ripened tomatoes from our garden to serve as a salad, oranges for dessert, and, of course, coffee.

We arrived at the park in a steady drizzle. We saw only two other cars. The people in them, we suspected, were as looney as we were. Even the birds were grounded, and we saw but one alligator. If anything was happy it was the frogs. We stopped at a hammock then known as Paradise Key, which, with its present day improvements, including a ranger station, large parking area, and boardwalks over adjacent sloughs and sawgrass, has lost its name and much of its original delightful character. At that time the road wound through the middle of the hammock, with half a dozen picnic tables set up under spreading lysiloma trees. We moved a picnic table into the open, to avoid the heavy dripping from tree branches, and on it set up our picnic stove. With Karl holding an umbrella over me, I lighted the stove

and soon we had coffee perking and wieners roasting. We ate with as hearty an appetite as if we had been normal people.

And what did we do after eating? We strolled along hammock trails, admiring great live oaks whose branches were covered with resurrection fern, bromeliads and orchids, studying with amazement the sleek, red trunks of gumbo limbo, at other times stopping to see if it was possible to identify a tree by studying its trunk—perhaps a species of eugenia, mastic, or pigeon plum. Of foremost interest to Hal, of course, were the very tall royal palms that had pushed their tops thirty to forty feet above the green hammock, so tall, in fact, that they could be seen for many miles around, providing an unmistakable landmark for anyone who might become lost in the surrounding Everglades.

Eventually gaining the exterior, we found an old road that took us along the border between the evergreen hammock and the sawgrass. Inside the hammock it had been dark, with the branches and foliage of trees high above our heads. We had trouble telling which trees fallen flowers and fruits belonged to. Outside, under a drizzily, overcast but bright sky we had no trouble seeing. Most things were close at hand, and Hal could nip a tiny flower and examine it under a hand lens, making it reveal its relationship to plants he knew, if not its complete identity.

Although the Everglades may appear to be mainly sawgrass, it is a veritable botanical garden where countless species, including orchids, thrive. Having an incomplete knowledge of south Florida's native flora, Hal saw many plants he was unacquainted with. But being a botanist, he knew the family and usually the genus to which the unfamiliar plant belonged; he just didn't know the species because he had never seen it before.

Sure, we got a little moist, and we had to do some wading. But it was a worthwhile experience, seeing the woods on a rainy day. "Gloomy weather" may have described the day to many persons, but the expression had no meaning for us. On an overcast, drizzily day there are no deep shadows in which small things can hide; you see everything more clearly than on a bright, sunshiny day.

Returning home late in the day, we built a fire to warm ourselves. After we ate supper—Evelyn served us hamburgers, as I recall—Hal lay down on the carpet before the fire and dozed.

It was another day that our family has never forgotten—a rainy day in the Everglades, botanizing with Hal Moore.

NIXON SMILEY

Letter to the Editors

I wanted to write you a few lines about the late Harold E. Moore, Jr. and enclose a photo (Fig. 1) I took of him in the summer of 1966 on a one day trip to the Arthur Langlois Estate, "The Retreat," in Nassau, Bahamas, which immediately followed the Palm Society Biennial Meeting held at Fairchild Tropical Garden in Miami.

I was a new fledgling to the Palm Society then, and it was by chance we sat together on the flight over. You can imagine the thrill I felt to be able to ply my questions to the world's foremost authority on palms. I remember well his kindness towards me in a situation that surely must have been tiresome for him as I bombarded him with every question I could think of, mostly of a very elementary nature I'm sure. Yet, he took the opportunity to encourage me.

Since that meeting, Hal Moore and I have corresponded frequently over

1. Dr. Harold E. Moore, Jr., holding an inflorescence and standing in front of *Coccothrinax miraguama*, at "The Retreat," home of Mr. and Mrs. Arthur Langlois, Nassau. Photographed in 1966 by K. Foster.

the years. He always found time to answer thoroughly whatever bit of knowledge I sought, mainly about locations of palms in the wild. The little success I may have had on my various collecting trips was due in large measure to his sharing with me some of his vast knowledge.

Ironically, his last letter arrived just a few days before his passing in which I had hoped to get the specific name of a new palm discovered only last spring near Suva, Fiji. *Gulubia* was the genus, but without the female flowers that he was expecting to receive soon to complete his herbarium sheet, he would not venture forth with a species name, and indeed, as he indicated, the discovery vastly extended the known *Gulubia* range, thus making the naming of this palm important in the world of palm taxonomy.

Now, as my tiny *Gulubia* sp. *nova* seedlings grow on, how long will it be before they will be named? Hal Moore, I and all the palm world will miss you.

KENNETH C. FOSTER

Our Contribution to the Special Memorial

Joining with many others I would like to pay tribute to Professor Harold E. Moore, Jr.,—known to many of us as just plain "Hal"—for all that he has done for the understanding and clarification of the palms.

Ours was a friendship of thirty years in which my husband and I did what we could to assist in the furtherance of the palm work. We sent him gladly any material he requested from the Retreat Garden. For his part he never failed to send us the periodicals in which he had described a new genus, a new species, or made a transfer. This continued up to the end, the last ones covering the new genera described by him from New Caledonia, the information still coming even after my husband's passing. I appreciated this because it encouraged me to carry on and not to give up interest in the palms. It was also helpful in assisting me to bring up to date the palm records we had accumulated for over fifty years, including about 5,000 photographs, and which we had promised to the library of the Fairchild Tropical Garden in Miami, Florida.

We were very grateful for Hal's answering patiently countless questions when Arthur's book was in the making. In this book are seen many transfers due to clarification of genera named by Hal over the years. The book described and illustrated many of the genera described by Max Burret

which are in "An Official List of the World's Valid Palm Genera and Some Synonyms" published by Max Burret and Eva Potztal in February 1956 in Willdenowia and reprinted as Bulletin XXI. The List was brought up to date by Burret and Potztal in September 1959 and published in "Palms of the World" by James C. McCurrach, 1959. Inasmuch as Arthur's book was a supplement to "Palms of the World" and illustrated only those genera not shown by McCurrach, it was necessary to follow the list of valid genera, as at that time, as far as I know, no other list had replaced it. It was therefore necessary to include in the "Supplement" palm genera accepted in the list and then give Hal's rejection of the validity of the genus, with the name of publication, date, and reason for rejection.

Thus, it was made clear to palm students just what had happened. I am sorry to say that my husband's motive was misunderstood and botanists in particular were critical of his including and illustrating such genera as had been invalidated by Hal. I know that Hal understood. His name in the book is the most prominent one and keeps recurring frequently. He personally says of this book, "The copy that you so kindly sent me is in my reference library here and a very useful book to have" (letter August 31st, 1978). Arthur's purpose in writing the book was for it to be of use and there is much gratitude that the world's authority on palms should find it so.

When did we first meet Hal and how did it happen? It was this way: Professor L. H. Bailey was a friend of ours for many years. We would send him material from the field and when he visited Nassau he never failed to get in touch with us and dine with us. In a letter dated January 19th, 1951, thanking us for photographs, he says—"I have also talked over the question of a visit to your place by Dr. H. E. Moore. He is a very keen young fellow. He is driving to Florida with one or two of our staff in March to look after the bromeliads collected by Foster near Orlando and then going on to Fairchild at Coconut Grove. I have told him that we would pay his way from Miami over to Nassau if he wanted to go. He does want to go and says if he can arrange for someone to drive his car back he will make the trip. You will find him a very agreeable young man. He has travelled much in Latin America for his age and speaks Spanish fluently. He is a Harvard graduate and a thorough student." Hal did come and not having a spare bedroom at that time we offered him a bunk on our 30-foot cabin cruiser moored at the Nassau Yacht Haven. He accepted and enjoyed it. Hal was equal to any occasion that might arise, and continued to be so for the rest of his life.

Palm lovers and students will never cease to be grateful for his dedication to the understanding and clarification of the palms; that includes my husband and myself.

MARGARET LANGLOIS

Hal's Last Palms

Like everyone else, I was deeply saddened by the loss of Dr. H. E. Moore, Jr. Hal had given us all a tremendous quantity of knowledge concerning palms, yet he did so in a very humble manner. I feel indebted to Hal for the knowledge he shared with me, especially concerning the palms of New Caledonia, although he would have said that my feelings of indebtedness were unwarranted.

Although I had corresponded much with Hal since 1974, I had only met him on two occasions before the 1980 Biennial Meeting in Hawaii. These

1. *Pritchardia* sp., *Moore et al. 10570*. occurs in open, mixed *Metrosideros* rain forest near Honomalino, S. Kona on the island of Hawaii. Dr. Moore thought this to represent an undescribed species.

2. Dr. Moore (right) taking notes under *Pritchardia* sp., *Moore et al.* 10570, on his last day in the field collecting palms.

were at the 1974 Biennial Meeting in Miami and in Honolulu in October 1978, for a few short hours on the eve of his departure for his beloved New Caledonia. So it was with some eagerness that I awaited the June 1980 Biennial Meeting in Hawaii. Hal was to be in Hawaii for the Biennial Meeting and I had made arrangements to take him into the field to look at several species of *Pritchardia* that are located not far from where I lived in the Kona District of Hawaii. It would be Hal's first experience with *Pritchardia* in the wild in Hawaii and, although not mine, it would certainly be a real treat for me to be accompanied by Hal.

The agenda for the 1980 Biennial Meeting had Wednesday and Thursday, June 18 and 19, as free days before the Meeting was to reconvene in Honolulu on Friday. We began our palm hunting Wednesday morning by observing different populations of *Pritchardia affinis* including those at the type locality of *P. affinis v. gracilis* at Kiholo Bay, North Kona. Along with Dr. Moore and me were Anne, my wife, Dick Phillips, our house guest and fellow Palm Society Member from Fiji, and Timi Judd, my close friend and associate. Hal made two collections of *P. affinis* that morning, *Moore, Hodel, Judd* and *Phillips 10568* and *Moore et al. 10569*. We all watched with undivided attention as Hal, with great modesty, demonstrated expertly how to take notes and prepare specimens for pressing.

For me, Thursday, June 19, was the climax of Hal's visit. With Timi driving as he had the previous day, and loaded with ice chests of food and refreshments, we headed for South Kona and Kau for an all day outing to observe a *Pritchardia* sp. near Honomalino, S. Kona, and *Pritchardia eriostachya* in the Kau rainforest. The former is quite impressive and the tallest of the genus in Hawaii. I believe it to represent an undescribed species so I was espe-

cially eager to have Hal see it (see Fig. 1). Only a dozen old, tall individuals remain in the wild and with no young, short trees to collect from, it took us some time to find fallen inflorescences, flowers, mature fruit, and one battered leaf. These represented *Moore, Hodel, Judd,* and *Phillips 10570*. Hal also believed this to be an undescribed species and while he intently took notes, the rest of us searched through the pasture grass for additional fallen fruits (see Fig. 2).

Late morning found us out of South Kona and driving up a rocky track behind Naalehu and into the Kau rainforest to look at *P. eriostachya*. After eating lunch at the car, we headed out on foot under overcast skies and a constant drizzle to a lone individual of *P. eriostachya* located in the dense, wet, mossy forest about a half mile away. We clambered up a muddy slope through a tangle of tree fern fronds and there on a basalt outcropping stood the lone individual of *P. eriostachya, Moore, Hodel, Judd,* and *Phillips 10571*, the very last palm that Hal was to collect.

The hour long drive back to Kona under a setting Hawaiian sun and late afternoon mauka shower was marked by a wide variety and endless stream of palm talk and other light topics that were characteristic of the entire two days. We were a joyous and happy crew, yet inside me a touch of sadness lingered as I realized that these two wondrous days of chasing *Pritchardia* with Dr. Moore were now over. I wanted it to continue, not to end. When would I have the opportunity once more? Less than four months later, while living in Tahiti, I received a letter informing me of the unfortunate news of Hal's passing. The memory of those two days and Hal's last palms will be with me for a long time.

DON HODEL

Dear Natalie,

I first became acquainted with Hal when I began working on taxonomic identification of a large plant collection during the winter of 1974. It would have been a dreary task had I not by chance chosen a working place on the bench adjacent to Hal's office in the Bailey Hortorium. During the months that followed, Hal and I became good friends. Although he had no formal connection with my degree program, he gave freely of his knowledge of taxonomy and taxonomic literature, helping me almost daily with the various problems I encountered. Working in this way with Hal was one of the best educational experiences of my years at Cornell. Although he did not consider himself a teacher in the traditional classroom sense, he knew his subject well and could communicate it wonderfully in an informal setting. Hal's generosity also went beyond the time given in helping me with my work. I was a frequent dinner guest during my last years at Cornell, and I always had a warm welcome.

There are many other things that I'll remember about Hal. He was an enormously hard worker, often putting in 10 to 12 hour days for weeks at a time. It was clear that he loved his work, and I never saw him tired or discouraged despite the seemingly endless hours. In fact, Hal had a delightfully youthful and optimistic outlook on life along with a wonderful sense of humor. Both were infectious!

With Hal's passing we lose a valued friend and co-worker. I do hope that you will be able to continue the work he loved so much and to put the finishing touches on unfinished projects. My best wishes to you, Natalie, and please feel free to share this letter with anyone who would appreciate reading it.

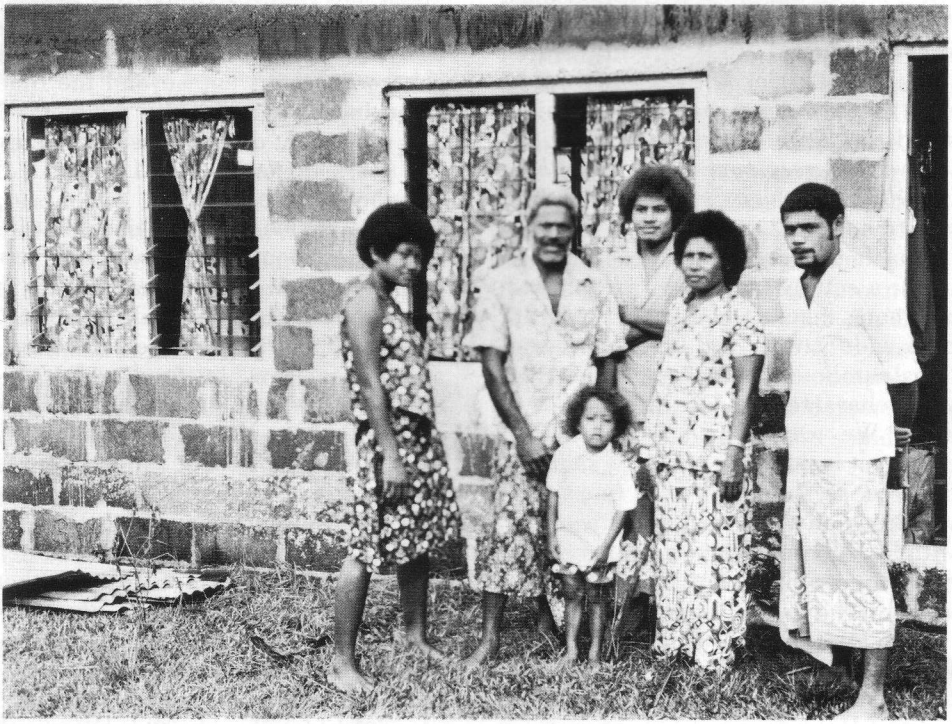
TOM WENTWORTH

Principes, 26(3), 1982, pp. 138–140

PALM BRIEFS

Collecting Alsmithia: A Last New Genus from Fiji

Early in April 1980, I received a letter from Dr. H. E. Moore, Jr. describing the collection of a new clinostigmatoid palm on Taveuni. Usually he included only brief notes about field experiences in his letters but getting the Taveuni palm proved exceptionally adventurous and also provided observations and pictures of coconut palms under stress (See cover and Fig. 1). Dr. Moore named the palm for his longtime friend and colleague, Dr. A. C. Smith. This incident is now of increased interest for *Alsmithia* has turned out to be the last new genus that he collected and described. His treatment appears in this issue (pp. 122–125) but excerpts from his letter and his photographs (Figs. 1–3) show the excitement and difficulties encountered in obtaining the palm:



1. The Soralau family, Lavena Village, Taveuni.

29 March

Dear Nat,

. . . On the face of it, it looks as though we have another new clinostigmatoid genus in Fiji (*10545*). Getting it involved a bit of fun. We left Suva for Taveuni at 2 p.m. (25 March) and after being transported to Bouma Village walked in a downpour to Lavena Village where we moved in on the Sorolau family who have a new cinderblock house with tin roof. The sound of rain beating on such a roof became familiar as it rained hard to very hard all night and most of the next morning while we listened to gale warnings on the transistor radio someone provided. Just before 2 p.m. the sky cleared, the wind dropped, and we went out to relish the outside. And then Cyclone Tia hit! I barely made it into the house from the outside "john" and the door was nailed behind me. For an hour and

2. Coconuts with crowns damaged by Cyclone Tia.

3. Dick Phillips and guides at lunch halt above Wainibau River.

a half the wind blew salt spray under the eaves and through the house while we bundled mats and belongings under the three beds. Fortunately the glass in the windows held but don't let anyone tell you that coconuts only bend in hurricanes (see Cover). They snap as well, and their crowns can be severely damaged as was evident when we could leave the house again toward nightfall (Fig. 2). Kitchens were blown down, toilets left standing like monuments in the open air, roofs torn off, and gardens ravished. The villagers said they had never known such a storm.

The next day, while others put the village to rights, the three of us (Saula Vodonaivalu, Dick Phillips, and I) with three "guides" set off for the trail up the ridge beyond the Wainibau River that angles upward toward the crater lake in the middle of the island (Fig. 3). The carpet of leaves, branches, and fallen trees in the forest suggests some possible explanations for forest types here in the cyclone zone to be talked about with Jack Putz. It took 1½ hours to reach the Wainibau, nearly an equal time to cut our way to 325 m and the new palm of which I have a complete series. It resembles *Cyphosperma* in many respects but has a complete prophyll and terminal stigmatic residue on the fruit plus probable differences in endocarp and seed. After such a preface, the finding of the palm was a great relief. On Wednesday the road was blocked part of the way to the airport, our transport failed to show, and it was with some relief that we saw a truck approach as we hoofed it well beyond Bouma. Said truck got us to a taxi whence to the airport. . . .

NATALIE W. UHL

Palm Fruits as Fish Food

Information about palm biology is scattered throughout the natural sciences, as anyone doing research can affirm. A case in point is Michael Goulding's new book *The Fishes and the Forest: Explorations in Amazonian Natural History*, University of California Press, Berkeley, 1981.

Goulding studied the ecology of larger fishes of the Amazon and found that many species spend part of the year in flooded forest areas feeding on various fruits and seeds. Fruits of four palms which occur in such areas were found to be part of their diet: jauari (*Astrocaryum jauary*), marajá (*Bactris* sp.), assai (*Euterpe* sp.) and bacaba (*Oenocarpus bacaba*). Fish masticate and ingest the fruit pieces; in some instances whole fruits are swallowed which pass through the digestive system without losing their viability. Thus certain fishes of the Amazon serve as both seed predators and potential dispersal agents of the four palms.

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Notice

Chapters can obtain a list of names of the new members in their areas by writing The Palm Society, Inc., P.O. Box 368, Lawrence, KS 66044.

Principes, 26(3), 1982, pp. 141–143

Commercial Palm Products of Brazil

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It comes as no surprise that Brazil, which ranks as the largest tropical country in the world, has the greatest number of native palm species (Corner 1966: 230). The country also holds the distinction of having the largest number of commercial palm products, defined as those for which statistics are published on a regular basis. Some of the products have been discussed in previous studies. Moses (1962) in a general paper on Brazilian palms provides information on most commercial products; Kitzke and Johnson (1975) and Hodge (1975) mention some Brazilian products as part of their world surveys of commercial palm products.

The purpose of this paper is to examine the current status of commercial palm products derived from native Brazilian species. This focus excludes only the coconut, which is grown widely in Brazil and especially along the east coast. Although the oil palm (*Elaeis guineensis*), known in Brazil as dendê, has been grown for many years in the state of Bahia, and in recent years has been established as a new plantation crop in the Amazon, production levels apparently do not justify inclusion in national statistics.

Table 1 lists 14 palm products derived from 13 different species. Production is highly concentrated in individual states, with the Northeast and Amazon regions standing out. The degree of concentrated production ranges from 60 to 100 percent and is a reflection of the density of native stands of the individual species in those states. The products are separated into commodity groups to facilitate discussion.

Oil seed represents the largest and most economically important group, with babaçu being predominant. Babaçu production comes largely from the extensive palm forest which covers much of Maranhão and the neighboring state of Piauí. These two states, in reverse order, also account for most of the tucum oil seed production. Ouricuri, or licuri as it is also known, oil seed comes entirely from Bahia, southernmost state of the Northeast region. Macaúba palms have a broad distribution in Brazil, but commercial exploitation is concentrated in Minas Gerais in the Southeast region of the country. A very small amount of oil seed comes from the murumuru palm of Pará state in the lower Amazon.

The seed oil from all of these palms is edible and is used domestically for cooking oil, shortening, and soapmaking. All production comes from the exploitation of native stands. Fresh tucum, macaúba, and murumuru fruits are edible but relatively unimportant as food because they contain only a small amount of fruit pulp. The Food and Agricultural Organization of the United Nations publishes each year a production yearbook which includes statistics on palm seeds and oil. The figures reported for Brazil appear to represent the combined production of this group of palms. The potential of these and a number of other promising Amazonian oil palms is discussed in a recent paper by Balick (1979).

Fiber ranks as the second most important group of palm products, led by piaçava which is derived from *Attalea funifera* in Bahia and *Leopoldinia*

Table 1. Brazil: Commercial palm products—1977

Portuguese and scientific names	Production in metric tons	Leading production state and percent of national total	
	OIL SEED		
Babaçu *Orbignya speciosa* Barb. Rodr.	236,755	Maranhão	76
Tucum *Astrocaryum tucuma* Mart. *A. ayri* Mart.	8,556	Piauí	77
Ouricuri or Licuri *Syagrus coronata* Becc.	7,364	Bahia	100
Macaúba *Acrocomia* sp. (*A. sclerocarpa* Mart.)	2,062	Minas Gerais	94
Murumuru *Astrocaryum murumuru* Mart.	29	Pará	86
	FIBER		
Piaçava *Attalea funifera* Mart. *Leopoldinia piassaba* Wallace	50,290	Bahia	97
Crina Vegetal or Butía *Butia capitata* Becc.	1,617	Santa Catarina	60
Carnaúba *Copernicia prunifera* Mill (H. E. Moore)	1,557	Ceará	90
Buriti *Mauritia flexuosa* L.	961	Maranhão	97
Tucum *Astrocaryum tucuma* *A. ayri*	101	Ceará	68
	WAX		
Carnaúba *Copernicia prunifera*	19,074	Ceará	64
Ouricuri or Licuri *Syagrus coronata*	112	Bahia	100
	FOOD		
Açaí *Euterpe oleracea* Mart.	53,623	Pará	93
Açaí, Juçara *Euterpe oleracea* *E. edulis* Mart.	35,123	Pará	85

Source: *Anuário Estatístico do Brasil—1979.*

piassaba in Pará. Both palms yield a leaf sheath fiber used to make stiff brushes and brooms. Crina vegetal, also known as butía, literally means "vegetable horsehair." It is a leaf fiber used as a filling material in mattresses and upholstered furniture. *Butia capitata* which provides this product is a popular subtropical ornamental palm in the United States and bears a tasty

orange fruit. Production originates from Santa Catarina and other southern states of Brazil.

Carnaúba fiber is a new commercial product in the sense that its production statistics were first reported in 1974. This reflects the increasing use of the leaf fiber to make hats, bags, mats, etc. for the domestic tourist trade in Ceará. Buriti is another palm important in Maranhão. The leaf and leaf stalk fibers have the widest application of any of this group. Buriti fruits are also used to make a soft drink and a sweet preserve. Tucum leaf fiber is used, especially in Ceará, to make fishing nets and hammocks. The leaves of all of these palms are also used as thatching material. Production of leaf fiber comes entirely from the wild stands of palms.

Two vegetable waxes are derived from palms and the carnaúba is probably familiar because of its use in making floor and car polishes. The cuticle wax from the leaf of the carnaúba palm is industrialized in Ceará and neighboring states of the drier portions of the Northeast. The carnaúba palm is cultivated to a limited degree for wax, but the majority of the production comes from natural stands which get some management. Ouricuri wax is very similar chemically to carnaúba wax and can serve as a substitute in most products, but production is very small and is a secondary product to the oil seed of the palm.

Edible palm fruits number in the dozens in Brazil, but only the açaí is included in national statistics. Açaí palms occur in great numbers in the lower Amazon and the ripe fruits are gathered and used to make a popular soft drink and to flavor ice cream. Large numbers of açaí palms are felled to extract the palm heart, palmito, which supports a sizable industry in Pará. The juçara palm (*Euterpe edulis*) grows in the Southeast and South regions of Brazil where it provided the majority of Brazilian palmito production before the native stands were depleted. Unfortunately, the same overexploitation is occurring in the Amazon.

Brazil possesses a valuable renewable resource in the native palm stands which provide commercial products. All of the palms discussed here have potential for systematic management and plantation cultivation, especially those which currently yield two commercial products. The fact that some degree of industrialization already exists is an added advantage and incentive for Brazil to lead the way toward maintaining and expanding the diversity of palm products.

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Principes, 26(3), 1982, pp. 144–149

Opsiandra gomez-pompae, A New Species from Oaxaca, Mexico

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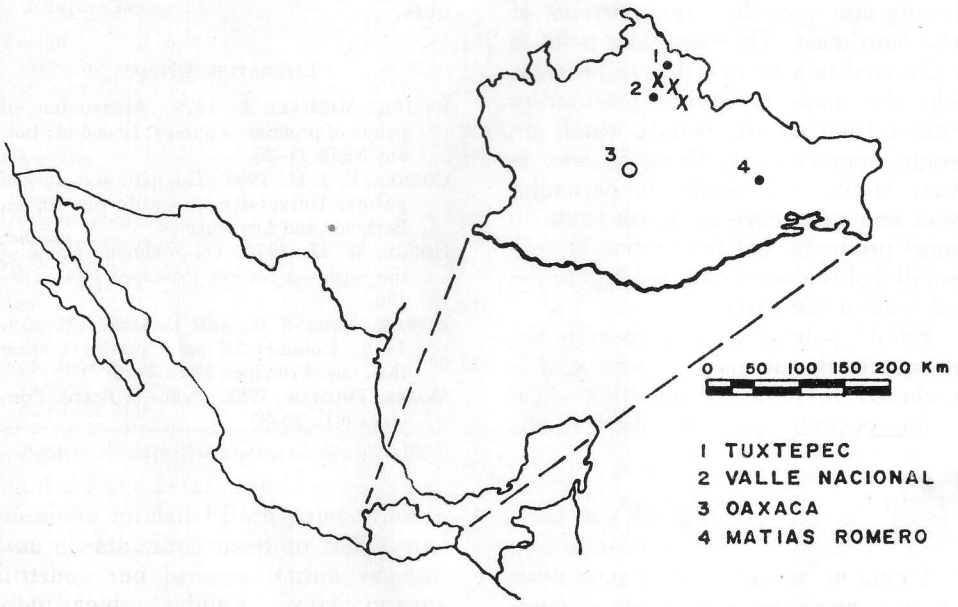
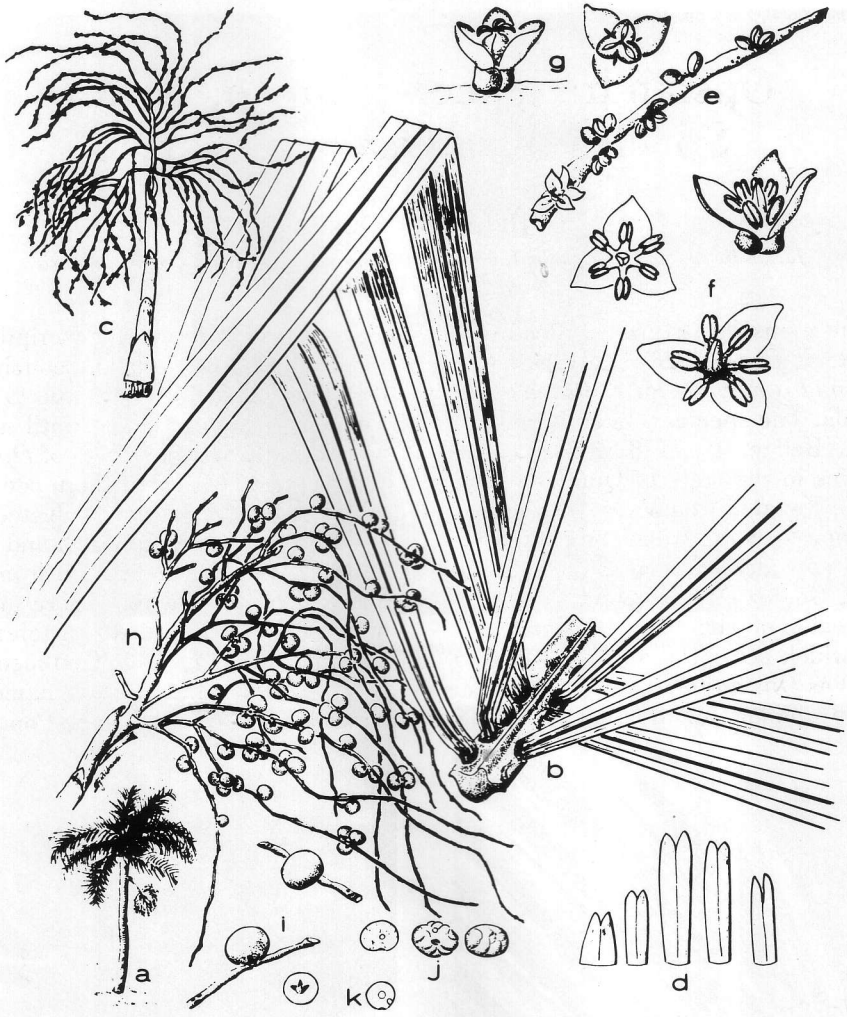
The genus *Opsiandra* was described by O. F. Cook (1923) and typified by *Opsiandra maya* from El Peten, Guatemala. The species was collected later in Belize. In 1978, I found this species in the state of Quintana Roo, in the Yucatan Peninsula, Mexico.

Since its publication the genus has been considered to be monotypic. In 1960, Gómez-Pompa found a palm in the region of Tuxtepec, Oaxaca, Mexico, which he reported (Gómez-Pompa 1963) as *Opsiandra maya*, stating that the specimens from the population differ somewhat from the description in the Flora of Guatemala and concluding that the differences were due to environmental factors. Thus, until now it was thought that the range of *Opsiandra maya* extended to Tuxtepec, Oaxaca. However, when I collected this palm in the Tuxtepec region and compared it with the population from Yucatan, I concluded that there are remarkable differences sufficient to consider the palm from Tuxtepec as a new species. This palm is named in honor of Dr. Arturo Gómez-Pompa of



1. Map showing the distribution of *Opsiandra gomez-pompae*.



2. *Opsiandra gomez-pompae*. a) general appearance of the palm; b) part of a leaf; c) inflorescence $\times 1/25$; d) bracts $\times 1/15$; e) rachilla $\times 1\,1/2$; f) staminate flowers $\times 2\,1/2$; g) pistillate flowers $\times 3$; h) fruiting branches $\times 1/6$; i) fruits $\times 1/3$; j) seeds $\times 1\,2/5$; k) cross section of seed with sub-basal embryo $\times 1/3$.

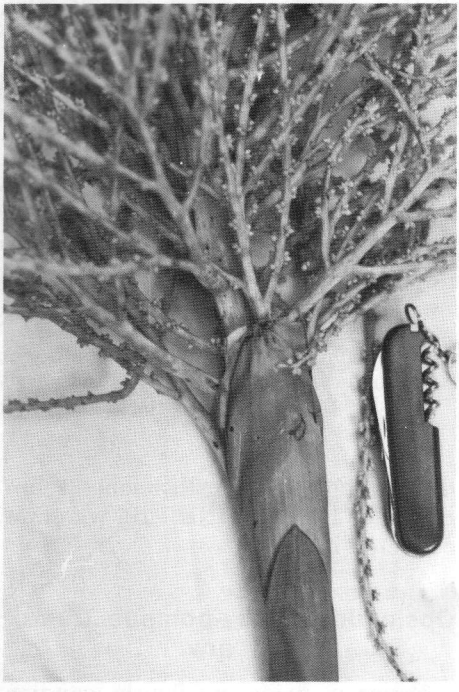
the Instituto de Investigaciones sobre Recursos Bióticos (INIREB), who first collected it.

Opsiandra gomez-pompae Quero, sp. nov.

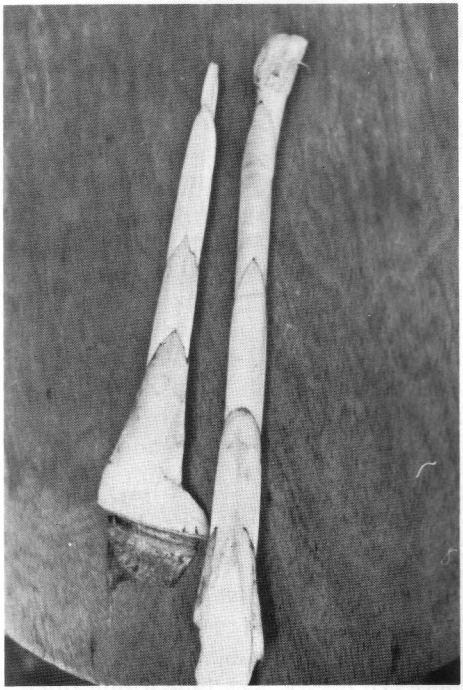
Palma monoica, mediocris, caudice inermi, annulato, erecto vel decumbenti; folia pinnatisecta usque ad 3 m longa, 85–100 paribus pinnarum lanceolatarum in 2 seriebus utrinsecus, basi incrassato marginibus recurvis, petiolis supra canaliculatis, rachidibus infra convexis supra carinatis; inflorescentiae usque ad 1 m longae in ordines 2 ramificantes, bracteis primariis 5, compressis, apice bipartitis triangularibus, prophyllo bicarinato; flores 2–4 aggregati plerumque 3, in-

3. *Opsiandra gomez-pompae* growing in a high forest near Tuxtepec.

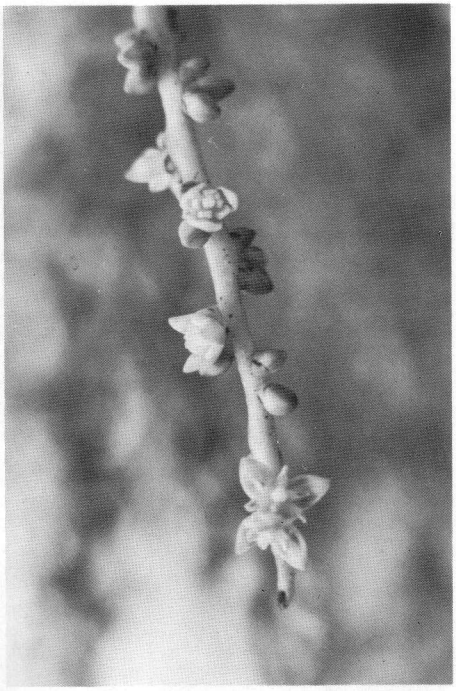
4. Leaf: note the two rows of segments, the swellings at their bases, and the prominent ribs.



5. Close-up of the inflorescence showing the last two peduncular bracts and the ramified primary branches.



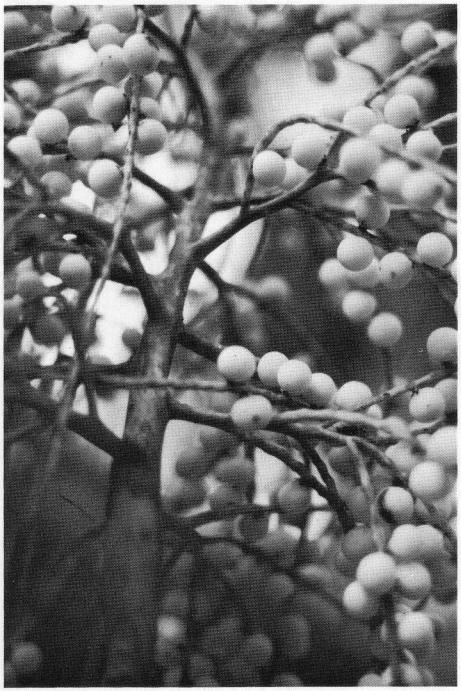
6. Young inflorescences showing the bracts, the one on the left incompletely developed.



7. Close-up of rachilla with mature male flowers.

fima pistillati, staminati solitarii in apicibus ramorum; fructus globosi vel fere subglobosi, immaturi luteoli dein rubescentes, semina subglobosa, hilo basali, ramis raphis ascendentibus semen cingentibus, ramosis vel reticulatis, albumine homogeneo cavitate centrali, embryone laterali vel subbasali. Typus: Mexico, Oaxaca, *Quero 3002* (holotypus MEXU; isotypi NY, UAM-I, US, XAL).

Solitary palm, mostly 10–14 m tall, sometimes taller; trunk columnar, with annular scars, erect or sometimes decumbent, to 30 cm in diameter toward the base, internodes very short at the base of the stem, ca. 3 cm long, increasing to 6–10 cm at the middle and becoming shorter above, supported by abundant, thick, adventitious roots. Leaves pinnate, mostly 10 in the crown, 2–3 m long; petiole grooved, not distinct from the sheath, with involute edges, closing beyond the insertion of the first pinnae; rachis keeled above, rounded beneath; pinnae 85–100 pairs, arranged in four rows, two along each side of the rachis, the base of the pinnae forming swellings or calluses very near each other, proximal pinnae more or less in the same plane but directed to different points, 33–45 cm long, 1–1.5 cm wide, largest pinnae towards the middle of the leaf, 70–75 cm long and 4–4.6 cm wide, the apical ones about 20 cm long and 1 cm wide, with a very prominent, yellowish midrib, a prominent vein on each side of it and other veinlets between the veins. Inflorescences infrafoliar at maturity, rather robust, 90–100 cm long, with 30–40 primary branches, the most proximal twice ramified, 40–45 cm long; ra-



8. Infructescence with globose immature fruits.

chillae slender, 20–30 cm long, the middle primary branches mostly forked, about 30 cm long, the apical single, 15–20 cm long; peduncular bracts including prophyll 5, each tubular, flattened, opening in a triangular apex; prophyll bicarinate, 8–13 cm long, 3.5–5 cm wide toward the base, the second bract slightly bicarinate, 16–18 cm long, 2.5–3 cm wide, third very slightly bicarinate, 21–25 cm long, 2–2.6 cm wide, the fourth not keeled, 21–24 cm long, 1.5–2.5 cm wide; the fifth not keeled, not flattened, papyraceous, 16–21 cm long, 1.8–2.5 cm wide. Flowers creamy-white, sessile, unisexual, mostly in groups of 3, but sometimes in groups of 2–4 or solitary, the basal flower usually pistillate, the solitary ones always staminate near the ends of the rachillae or between the groups, the staminate flowers slightly larger than the pistillate but similar, with 3 imbricate sepals and 3 valvate petals; staminate flowers with orbicular sepals slightly wider than long, petals narrowly triangular, about 4.5 mm long and 2.2 mm wide; stamens with broad filaments almost as long as the anthers, anthers dorsifixed, about 1.2–1.4 mm long, thecae slightly unequal, retuse to slightly bifid at the apex, sagittate at the base; pistillodes pyramidal to columnar ca. 2 mm long; pistillate flowers with sepals similar to those of the staminate, petals narrow triangular, about 2.5 mm long and 1.4 mm wide, ovary trigonal about 2.5 mm long, stigma trifid, staminodes rudimentary, less than 0.5 mm long. Fruit globose to slightly subglobose, sessile, 1.4–1.6 cm diam., yellowish when immature, becoming reddish with maturity, with a basal stigmatic remnant, pericarp fleshy, less than 1 mm thick, epicarp smooth. Seed subglobose, 1.3–1.5 cm diam., slightly compressed toward the base near the embryo, raphe ramified to reticulate, the seed thus somewhat cerebriform; endosperm homogeneous, sometimes slightly intruded by the raphe branches, with a central cavity; embryo lateral to sub-basal.

Specimens Examined. MEXICO: Oaxaca: 26 km SE of Tuxtepec on road to Matias Romero, *Quero* 3002 (Holotype MEXU; Isotypes NY, UAM-I, US, XAL); between Chiltepec and Valle Nacional *Gomez-Pompa* 365 (MEXU); 23 km SE of Tuxtepec, *Grether* 1509 (MEXU, UAM-I); 20 km SE of Tuxtepec *Quero* 2949 (MEXU, UAM-I); 12 km S of Chiltepec *Quero* 3025 (UAM-I); 23 km SE of Tuxtepec *Quero* 3026 (MEXU), *Quero* 3027, (MEXU).

Distribution. So far this species has been found only in the vicinity of Tuxtepec towards the region of Valle Nacional and on the road to Matias Rom-

ero, growing on rugged limestone hills. It is an important element in the physiognomy of the high forest of that region.

Notes: This new species can be distinguished from *Opsiandra maya* by its habit, thicker trunk, longer leaves and segments, and larger inflorescences, but the most important differences between them are as follows:

	Opsiandra maya	*Opsiandra gomez-pompae*
No. of leaves	4–6	8–12
Inflorescence	Proximal primary branches simple or bifurcate	Proximal primary branches highly ramified
Peduncular bracts	4	5
Fruit	Subglobose-reniform with a median groove	Globose-subglobose without a median groove
Seed	Reniform, less than 1.2 cm in diameter	Subglobose, more than 1.2 cm in diameter
Pericarp	More than 1 mm thick	Less than 1 mm thick

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H. E. Moore, Jr.

The last letter I wrote to Hal was the first he never answered. As the silence lengthened I somehow knew that he was gone.

Hal's letters were always a joy to receive: even the shortest notes would bring me melting ice crystals from Ithaca or dancing moonlight from the Pacific. He could never bring himself to communicate in the brittle, business-like style which his profession demands. Like everything he did, Hal wrote with the love and care and purpose of a craftsman.

With infinite patience, Hal tried to make a craftsman out of me. But I was too young and hungry for instant answers. Hal's dream to preserve in a crystal some of Nature's enchanting complexity made little sense to me. Only much later, after seeing for myself the destruction throughout the tropics, did I realize that the world is tearing itself apart precisely because people lack love and care and purpose.

The crystal was never finished. But many of us whom he touched will not forget his dream.

Anthony Anderson

Principes, 26(3), 1982, pp. 150–152

The Pejibaye Palm (Bactris gasipaes) Comes of Age

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In 1921, Wilson Popenoe and Otón Jiménez published the first modern article on Pejibaye pointing out the enormous nutritive and commercial potential of this palm (see Journal of Heredity 12(4): The Pejibaye: a neglected food plant of Tropical America). Since that article various persons at various times have initiated studies on Pejibaye resulting in a certain amount of information, most of which supported Popenoe and Jiménez's thesis. Unfortunately these beginnings did not have the required continuity. As a result, knowledge about Pejibaye expanded slowly and irregularly until the mid-1970's. At this time several individuals and institutions turned their attention to Pejibaye and contact between these interested groups in different countries became more regular. The result of this international attention to Pejibaye in Latin America was that on 29–30 September 1980, the First International Meeting on Pejibaye Genetic Resources was held at CATIE, Turrialba, Costa Rica, sponsored by the International Board of Plant Genetic Resources—IBPGR. This report is a brief outline of the discussions and recommendations of the reunion.

The taxonomy of Pejibaye was found still to be unclear. Evidence from diverse authors seems to indicate that *Guilielma* should be recognized at some taxonomic level. Martius described the genus, and it was accepted by Dahlgren and Bailey. Tomlinson, in his Anatomy of Monocotyledons—Palmae, supports this thesis on an anatomical basis. However, McBride, in the Flora of Peru, suggests its maintenance as a subgenus, while Glassman denies its existence by putting all *Guilielma* spp. into *Bactris*. Unfortunately, no new taxonomic information was available at this time, and it was therefore recommended to follow the recent trend of using *Bactris gasipaes* HBK, while acknowledging the possible usefulness of *Guilielma* as a taxon, indicating a probable evolutionary relationship among these species. A request was made at the reunion for international help to sponsor a detailed morphological, anatomical, palynological, and taxonomic revision of this complex to clarify the classification and to identify the closest wild relatives of *B. gasipaes*. The hypothesis that Pejibaye may be of hybrid origin was put forward so that this alternative could also be included in the proposed study.

The principal objectives of the meeting were to determine the state of Pejibaye germplasm collections in the participating countries (Brazil, Colombia, Costa Rica, Panamá), to study the origins of these collections, and to determine the areas for priority exploration and collection in order to obtain the most promising genetic resources as soon as possible. Because Costa Rica has given greater emphasis to Pejibaye research for more years than any other country, it has the most ex-

tensive collection, both in terms of numbers and origin of the material. Brazil and Colombia follow with relatively small collections which reflect the more recent origins of their programs. Panamá, with the most recently initiated program, has the smallest collection. Other countries within the area of distribution of Pejibaye have not yet organized germplasm collections.

Discussion of the origins of these collections showed that most acquisitions are from reconnaissance surveys covering approximately 15% to 20% of the total area of distribution of Pejibaye. Only about 1% of this area has been well explored, primarily in Costa Rica and in small areas of Colombia and Brazil. Not all of the remaining areas needing exploration are of equal interest in terms of germplasm for breeding programs. However, it was recognized that future germplasm needs are largely unknown and that most of the existing genetic variability should be collected. Because of the vast area in which the Pejibaye occurs and the need to obtain representative samples of as many ecotypes (especially the most immediately important ones) and related wild species as possible, a list of priority exploration areas was drawn up. Due to the extensive distribution of Pejibaye these priorities will still only cover about 25% to 30% of the known area of distribution, with emphasis on a few populations known to be especially promising because of fruit characteristics and spinelessness. Included also in the list were areas known to contain populations that are not so immediately valuable but appear to be threatened with extinction, either by the eradication of small farms by cattle ranching, by a lack of interest in the crop, or by the substitution of newly introduced Pejibaye with better fruit characteristics. Including these less immediately important genotypes in the collections ensures that they will be available for future breeding programs.

The importance of extensive germplasm collections was also recognized as a source of resistance to diseases. This observation was made while considering the exchange of material and quarantine. Although Pejibaye is not now attacked seriously by any disease, it was recognized that several palm diseases occur in the Caribbean region, notably lethal yellowing and hartrot. This second is already in Surinam, which is within the distribution of Pejibaye, and although it attacks several cocosoid palms in that country, no information was available about Pejibaye's susceptibility or resistance. No documented information was available about lethal yellowing and Pejibaye. It was therefore recommended that IBPGR help to arrange studies on these diseases in relation to Pejibaye, and in the meantime, strong palm quarantine measures be applied when genetic material is transported between affected and non-affected areas.

A partial annotated bibliography was prepared for the meeting; this can be obtained from the Biblioteca Conmemorativa Orton, CATIE, Turrialba, Costa Rica. For those who are interested, a copy of the detailed report, from which this summary was drawn, can be obtained by writing to the International Board of Plant Genetic Resources—IBPGR, FAO, Via delle Terme di Caracalla, Rome 00100, Italy.

This meeting brought together the principal researchers presently active in Pejibaye studies. Although the meeting was specifically about genetic resources of this crop, many other subjects were discussed. One of the principal observations made was that the number of people working, and the

importance that institutions are attaching to this work, indicates that there is now sufficient international, if not national, cooperation to take the studies in Pejibaye to their logical conclusion—that of developing this palm as a major humid tropical, perennial crop to supply carbohydrates, oils, proteins, vitamins, and income to the people of this region, just as Popenoe and Jiménez pointed out 60 years ago.

Principes, 26(3), 1982, pp. 152–153

NOTES ON CULTURE

Get Those Palms in the Ground

Almost without exception, palms grow faster with their feet in the ground. Once a container is filled with roots and the nutrients have been used up, growth will slow appreciably. The theory that palms enjoy being rootbound is a myth. The part of the palm we see above ground is directly proportional to the size and health of its root system.

We surface dwellers only enjoy the portion of the palm above the surface, but if we could share the view of the earthworm, we would appreciate how extensive palm root systems are. This spring, while putting in new plantings, I was suprised to find palm roots growing many feet beyond their drip line. Large, fleshy roots were growing horizontally at a depth of 1 to 3 feet.

Many of us water only around the base of a palm or to the drip line. Instead of frequent, shallow watering, less frequent, and deeper soaking of an area several times larger than the palm head would be more effective. To conserve water and direct it to the plant, a large basin should be constructed.

The method I use for palm planting and basin construction is as follows: a suitable location is selected and the hard surface of the soil is soaked for a few days before digging. A soil amendment is spread to a depth of 4 or 5 inches, or about 2 wheelbarrows full for a five gallon palm. For an amendment, any organic material such as nitrogen-treated saw dust or well-rotted manure is suitable. Using a rotary tiller, I go back and forth over the area until the soil has been thoroughly mixed with the amendment to a depth of about 10 inches. This homogenized mixture is then easily dug out with a shovel and piled to the side of the hole. This process is repeated several times until the walls of the hole become too steep to use the rotary tiller. A large rectangular hole about 18 inches deep can be dug using this method. If additional depth is required, the soil at that depth is soft and can easily be dug with a shovel. The hole should be at least 6 inches deeper than where the root ball will rest, then partially refilled with the loose mixture from the hole. The palm, in its container, is set into the hole and soil is either added or taken away until the proper planting depth is determined.

The palm is removed from the hole and the bottom of the hole is watered. The palm (previously soaked for several days with a vitamin B-1 solution) is removed from its container and placed in the hole. The root ball is quickly covered with the homogenized mixture, minimizing root exposure to sun and wind. Firm the backfill material with your hands or the heel of your shoe until three-fourths full. Water thoroughly to settle the plant and eliminate air pockets, and check to see that the top of the root ball is slightly above soil grade, as some fur-

ther settling is likely to occur. Finish filling the hole to grade.

The soil amendment plus the root ball will leave some soil that won't fit into the hole. This is raked into a circle around the palm creating a basin about 6 inches deep. The palm should be watered well, preferably with a B-1 solution, and frequently watered for the first few weeks. (There are various brand-name root stimulants on the market which contain vitamin B-1 and/or hormones which are thought to reduce transplant shock and promote root development.) To conserve water and retard weeds, several layers of newspaper are put into the basin, wet down, and then covered with 2 or 3 inches of mulch.

Do not add chemical fertilizers in your planting hole, and do not fertilize a newly planted palm, until it is actively growing. An exception might be made by incorporating a slow-acting organic fertilizer, such as bonemeal, in the soil beneath the root ball.

Now that you have all this advice from the voice of experience, I must go out and plant a lot of palms! Unfortunately, I have palms stuck away here and there that should have been planted years ago. Their brothers and sisters tell me so! I can lean against their trunks while their relatives languish in their rotted-out cans.

RICHARD DOUGLAS

NEWS OF THE SOCIETY

News from California

The Southern California Chapter held its annual banquet February 7th at San Juan Capistrano. Sixty-four members enjoyed a delicious buffet style dinner at the El Adobe restaurant. Guest speaker Ken Foster gave an excellent talk and slide presentation on his palm collecting trips to New Guinea. Last on the program was a raffle of door prizes which were donated by several members. They included live palms, carvings from *Palandra aequatorialis* seeds, and several cans of hearts of palm.

In March a joint meeting with the Northern California Chapter featured a visit to Lotusland and is described further below.

On April 17th members journeyed to Palm Springs to tour the home and garden of Frank Batey and Craig Corbett. Their beautiful mountainside house overlooks the city. By utilizing existing rocks they have achieved a natural garden with rock pathways leading you in for a closer view of many plants. Refreshments and a raffle of palms donated by members concluded the meeting. Those desiring to see *Washingtonia filifera*, California's only indigenous palm, were invited to view large stands in Palm and Andreas Canyons.

FRANK KETCHUM

The Northern California Chapter of the Palm Society enters 1982 with enthusiasm. Our public palm garden in Oakland's Lakeside Park is nearing completion in terms of the procurement and planting of palm species in our landscape plan. Mounds and contours have been created and our watering system completed. The expensive project of surfacing paths and procuring ground cover and companion plants remains to be done. Our members have provided the plant material, irrigation system, labor and all normal maintenance. Mayor Lionel Wilson of the City of Oakland has honored the Palm Society for the past 2 years at his annual reception commending volunteer efforts in Oakland. The money and effort expended by our chapter was a consideration in non-profit status being accorded to us.

Quarterly meetings in 1981, our spring banquet in 1982, and our joint meeting hosted by the Southern California Chapter in Santa Barbara on March 28, 1982 have been well attended. Special mention must be made of the joint meeting. A turnout of 198 Palm Society members and guests including 36 Northern California members who journeyed the 400 miles, were privileged to visit Lotusland, the fabled estate of Palm Society member Madame Ganna Walska. Whatever your fantasy may be of a beautiful garden, this 41 acre estate met and surpassed that dream. From Lotusland we walked one half mile to the estate of Palm Society member Jerry Lanning, where we enjoyed lunch and refreshments. Mother nature refused to cooperate and steady rain ensued. Undaunted, most members, with and without umbrellas, walked under the mature groves of howeas and *Rhopalostylis*.

Our chapter was able to finance the construction of the palm garden, and our quarterly Bulletin, with nearly $2000 in proceeds from our palm auctions, and a generous $1000 anonymous contribution. Additionally, many members, from both California chapters have contributed specimen and rare palms for our garden.

JIM MINTKEN

News from Florida

The Central Florida Chapter of The Palm Society held a meeting on March 6th 1982 at Walt Disney World. Palms on Discovery Island were admired. After lunch there was a drawing for door prizes of palms donated by members. A second meeting was held at the St. Petersburg Palm Arboretum on May 16th.

FRANK RADOSTA

News from Texas

The Houston Area Chapter of The Palm Society met on March 27th 1982 at the Houston Garden Center. Guest speakers were Chuck Catchings and Lois Skrocarczyk, growers from Rhapis Gardens Nursery in Gregory, Texas. (An article on *Rhapis* gardens will appear soon in *Principes*—Eds.)

On May 1st and 2nd the Chapter held a Palm Show and Sale at the Houston Arboretum. The regular May meeting was held on the 19th at the home of Bob Maurice. The program was presented by Richard Douglas, Vice President of The Palm Society.

BONNIE RUHLAND

Reminder

Be sure and return the brown paper cover from this issue if you plan to attend the 1982 Biennial Meeting.

ITINERARY FOR THE PALM SOCIETY BIENNIAL MEETING IN FLORIDA

PART I—Tampa–Sarasota–Fort Myers–Miami

Sat. Nov. 20, 0930: Begin tour with visit to Dr. & Mrs. U. A. Young's Garden in TAMPA.
1130: Leave TAMPA via Sunshine Skyway, St. Petersburg, Bradenton Beach, and Longboat Key to arrive SARASOTA to visit Selby Gardens. Luncheon at the Gardens.
1530: Depart Selby Gardens for the BEST WESTERN GOLDEN HOST MOTEL. After check-in, continue to Dr. & Mrs. Byron Besse's for Garden Tour and supper. Return to Motel.

Sun. Nov. 21, 0930: Leave SARASOTA and drive via the Tamiami Trail to arrive Ft. Myers about 11:30 a.m. for rest and lunch.
1315: Visit the Thomas A. Edison Home and Garden.
1530: Continue to nearby SANIBEL ISLAND for overnight at the MOTEL RAMADA INN.
Dinner and evening on your own.

Mon. Nov. 22, 0900: Leave SANIBEL ISLAND and drive to Corkscrew Swamp Audubon Sanctuary, arriving about 10:00 a.m. for boardwalk stroll into the cypress swamp.
1200 Noon: Leave Corkscrew Swamp and drive via Carnestown with luncheon enroute, continuing via the Tamiami Trail across the Everglades to arrive MIAMI about 4:30 p.m. (about 80 miles). HOTEL HOLIDAY INN.
This evening attend a Welcome Cocktail Party at the HOLIDAY INN, hosted by the South Florida Palm Society.

PART II—Miami, Biennial Meeting and Banquet

Mon. Nov. 22, 0700: For those participants beginning the arrangements for the Miami portion only, the program will begin with a Welcome Cocktail Party at the HOTEL HOLIDAY INN, with overnight accommodations at the HOLIDAY INN.
Tue. Nov. 23, 0930: Leave the HOLIDAY INN for visit to Matheson Hammock Park. View Beach, walk jungle trails to see native Royal Palms. Tour Paul Drummond's Palm Garden, followed by a picnic lunch in the park overlooking the lagoon.
1315: Depart for the Jennings Estate and afternoon tour of the grounds. Return to the HOLIDAY INN.
2030: Evening program with Guest Speaker at the HOLIDAY INN.
(at 7:00 p.m. there will be a meeting of the present Palm Society Board Members only)

Wed. Nov. 24, 0830: Leave for tour to Miami Beach including Sunset Islands, La Gorce, Collins Avenue.
1100: Arrive at the Hotel Fontainebleau Hilton to view the garden area, followed by lunch at the hotel.
1330: Arrive at Fairchild Tropical Gardens for a stroll through the grounds, followed by a General Meeting for all members of The Palm Society.
1700: Return to the HOLIDAY INN.
1900: This evening attend the Biennial Banquet at the HOLIDAY INN.

Thu. Nov. 25, 0900: Leave for Parrot Jungle Show and Garden Tour. Luncheon at the Parrot Jungle and continue to Fairchild Tropical Gardens for a comprehensive tour.

1700: Return to the HOLIDAY INN.

1900: This evening a special buffet dinner at Dr. and Mrs. Jude's Java Head home hosted by the South Florida Palm Society.

Return to the HOLIDAY INN for overnight.

Fri. Nov. 26 This morning all tour arrangements terminate except for those participants taking part in the post-tour arrangements to Key West.

PART III—Florida Keys and Key West

Fri. Nov. 26, 0830: Leave MIAMI and drive to the Florida Keys to arrive at the Baxter Gentry Estate for lunch and visit to the garden.

In the afternoon continue driving through the Keys to arrive at KEY WEST and the HOTEL ISLAND CITY HOUSE.

Evening at your disposal to enjoy the Key West atmosphere and sunset at Mallory Square.

Sat. Nov. 27 In Key West

Morning trolley tour of the city followed by lunch at the Casa Marina.

1430: Leave KEY WEST for the return drive to MIAMI, arriving about 5:00 p.m.

All tour arrangements terminate upon arrival Miami.

Moore's Checklist of Cultivated Palms

Hal Moore's Checklist published in Principes 7(4) in 1963 has proved to be one of the most useful parts of Principes ever published. Yet since its publication, many more plams have been introduced into cultivation. There is thus need for a revision of the checklist, not only to account for new introductions, but also to account for nomenclatural changes. The task of revising the list is daunting; one of the most difficult aspects being obtaining a list of names of the new introductions. Some of the basic bibliographic searching is being done by Dr. Soejatmi Dransfield. Members of the Society can help a great deal by sending to the editors the names of palms in their collections which do not appear either as a main entry or as a synonym in the 1963 Checklist. The greater the response to this request, the greater will be the value of the revised checklist. The most useful method of sending such information will be to write or type the names on a sheet separate from any accompanying correspondence and to indicate the source of seed where possible (but don't worry if you cannot indicate the source) e.g.,

Calamus spectabilis	Palm Society Seed Bank
Licuala lanata	own collection, Sarawak, 1977

J. DRANSFIELD
N. W. UHL