



PRINCIPES

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Palmyra avenue; rows of *Borassus flabellifer* at the Indian Botanic Garden, Calcutta. See also page 115.

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The Indian Botanic Garden, Calcutta

S. K. BASU

Indian Botanic Garden

The Indian Botanic Garden, Calcutta, is located near sea-level (4.5 m. alt.) in the state of West Bengal in the eastern part of India. It comprises an area of 109.29 hectares or about 270 acres. The approximate annual rainfall is 1536 mm. (about 61.4 inches) and temperatures range from 21° to 31° C. or about 70° to 88° F.

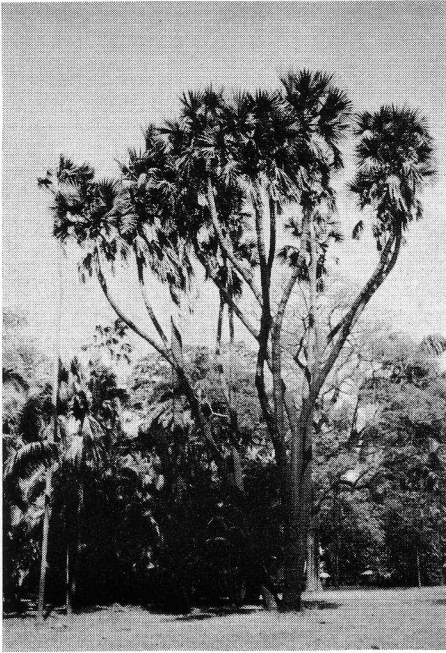
The garden was established in 1787 by a British Colonel named Robert Kyd under the management of the then East India Company. With nearly two centuries of glorious history, the garden has become one of the leading botanical research institutes in the East. At present, the garden is under the Botanical Survey of India, Ministry of Education, Government of India, and includes within it the National Herbarium of about three million specimens of dried plants.

A plant population of more than 12,000 species is spread over the landscape. Among others, palms play a dominant part in enhancing the picturesque and scientific aspects of the garden. On entering the main gate of the garden, and extending up to the Kyd monument, an appreciable area is covered by stately palms as hedges, groves, avenues, or as isolated groups of different species. The species which are seen from the entrance leading towards the center of the garden are *Livistona rotundifolia*, *L. chinensis*, *Licuala grandis*, *L. spinosa*, *Corypha elata*, *Acoelorrhaphe Wrightii*, *Areca triandra*, *Ptychosperma Macarthurii*, *Arennga pinnata*, *Orbignya Cohune*, *Caryota mitis*, *C. urens*, *Chrysalidocarpus lutescens*, *C. madagascariensis*, *Calamus arborescens*, *Bactris major*, *Rhapis excelsa*, *Borassus flabellifer*, *Cocos nucifera*,

Phoenix sylvestris, *P. rupicola*, *Roystonea regia*, among others.

The palmyra avenue, with tall rows of graceful *Borassus flabellifer* on both sides from the main entrance leading towards the northwest part of the garden, and the avenue of *Roystonea regia*, connecting the old water gate with Kyd Monument, present magnificent sights to visitors. Along the stretch of marshy land at the southeast corner of the garden by the river bank, large collections of *Corypha elata* and *Phoenix sylvestris* at different stages of growth present a contrasting scene. An interested visitor may also find some *Corypha* plants either in flowering or fruiting stages.

Further northwest from the Kyd Monument is situated the large palm house, a large circular greenhouse for the more unfamiliar but very interesting palms. At the center of the palm house, beneath a central dome, is grown a double coconut, *Lodoicea maldivica*, of imposing stature with its giant leaves spreading gracefully. Around the *Lodoicea* there are good specimens of *Acanthophoenix crinita*, *Ptychoraphis singaporensis*, *Aiphanes caryotaefolia*. At the corners of the radiating paths, four beautiful specimens of large *Orbignya Cohune* are grown. *Raphidophora* and some aroids growing on the *Orbignya* palms add further to the stately appearance of the palms. Seedlings beneath these palms have simulated a habitat and condition comparable to those obtained in a natural tropical rain forest. There are also specimens of *Licuala peltata*, *Livistona australis*, *Bentinckia nicobarica*, *Elaeis guineensis*, *Thrinax parviflora*, *Washingtonia robusta*, *Rhapis humilis*, *Rhapis*



1. *Hyphaene thebaica*



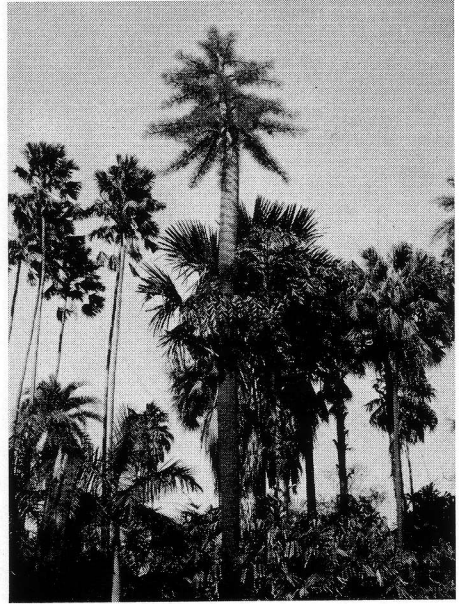
3. Leaves of *Arenga obtusifolia*.



2. *Hyphaene* sp. (*indica?*).



4. Leaves of *Arenga undulatifolia*.



5. Inflorescence of *Corypha elata* among *Livistona rotundifolia*, *L. chinensis*, *Licuala spinosa*, *Roystonea*, *Caryota* and other palms.

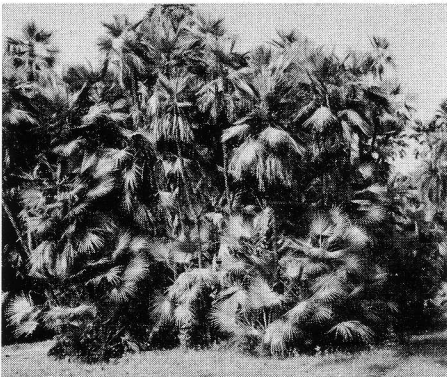


6. Rows of young *Corypha elata*.



7. *Latania Loddigesii*.

excelsa, *Pritchardia pacifica*, *Heterospatha elata*, *Mascarena Verschaffeltii* and many other species which are growing in the open. A little beyond the large palm house is the small palm house in which also flourish similar species, quite in a similar pattern. Two large cardamon trees, *Cinnamomum zeylanicum*, are also attractions of the conservatory. Other interesting species in the vicinity are *Latania Loddigesii*, *Arenga un-*



8. *Acoelorrhaphe Wrightii*.



9. *Orbignya Cohune*.

dulatifolia, *A. obtusifolia*, *Hyphaene thebaica*, *Corypha umbraculifera*, *Howeia Belmoreana*, *Salacca edulis*.

The nursery no. 1 located opposite the river Hooghly also contains large numbers of palms in pots. This collection includes, besides several of the already mentioned species, several newly acquired ones such as *Archontophoenix Alexandrae*, *Sabal Palmetto*, *Trachycarpus Fortunei*, *Arenga Engleri*, *Coccothrinax inaguensis*, *C. Dussiana*, *Chamaedorea elegans*, *Phoenix Roebelenii*, *Calamus ciliaris* and others which are interesting as new introductions to the Indian Botanic Garden.

The garden, with its rich collection of palms, is a treasure house for palm lovers from all over the world. To appreciate fully the palm wealth of this garden, the following enumeration of the species, flourishing in all their splendor and luxuriance is given.

The author is grateful to Mr. A. Basu of the Indian Botanic Garden for his suggestions in preparing the text.



10. *Calamus leptospadix*.

ENUMERATION OF PALMS AT THE INDIAN BOTANIC GARDEN

Acoelorrhaphe Wrightii, *Actinorhynchus Calapparia*, *Aiphanes caryotaefolia*, *Archontophoenix Alexandrae*, *Areca Catechu*, *A. triandra*, *Arenga Engleri*, *A. obtusifolia*, *A. pinnata*, *A. undulatifolia*, *A. Wightii*, *Bactris major*, *Bentinckia nicobarica*, *Borassus flabellifer*, *Calamus arborescens*, *C. ciliaris*, *C. erectus*, *C. Guruba*, *C. leptospadix*, *C. longisetus*, *C. Rotang*, *C. viminalis*, *Caryota mitis*, *C. urens*, *Chamaedorea elegans*, *Chrysalidocarpus lutescens*, *C. madagascariensis*, *Coccothrinax Dussiana*, *C. inaguensis*, *Cocos nucifera*, *Corypha elata*, *C. Taliera*, *C. umbraculifera*, *Daemonorops didymophylla*, *D. Jenkinsiana*, *Dictyo-*

sperma album, *Elaeis guineensis*, *Heterospatha elata*, *Howeia Belmoreana*, *Hyphaene indica*, *H. thebaica*, *Latania Loddigesii*, *Licuala grandis*, *L. peltata*, *L. spinosa*, *Livistona australis*, *L. chinensis*, *L. decipiens*, *L. humilis*, *L. rotundifolia*, *L. Saribus*, *Lodoicea maldivica*, *Orbignya Cohune*, *Orbignya (Attalea speciosa)*, *Phoenix Loureirii*, *P. paludosa*, *P. reclinata*, *P. Roebelenii*, *P. rupicola*, *P. sylvestris*, *Plectocomia assamica*, *Pritchardia pacifica*, *Ptychoraphis singaporensis*, *Ptychosperma elegans*, *P. Macarthurii*, *Rhapis excelsa*, *R. humilis*, *Roystonea regia*, *Sabal Blackburniana*, *S. mexicana*, *S. minor*, *S. Palmetto*, *Salacca edulis*, *Scheelea insignis*, *Thrinax parviflora*, *Trachycarpus Fortunei*, *Washingtonia robusta*.

A Synopsis of the Genus *Physokentia* (Palmae-Arecoideae)

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Recent exploration in the Solomon Islands has brought to light some interesting new palms, but none more intriguing than the collections which are described herein as species of *Physokentia* and variously referred to as *manusilae* or *garagara* in the Kwara'ae dialect. I first became acquainted with the genus, quite unknowingly, on the Bogotu Peninsula of Santa Ysabel. There, Dr. T. C. Whitmore and I saw sterile plants which are still unknown botanically for lack of fertile material. Later, I saw specimens of *P. insolita* at Honiara which I then, and subsequently at Ithaca, thought to represent an undescribed genus because of the sculptured endocarp and seeds with ruminant endosperm. More recent acquisitions from Mr. G. F. C. Dennis, Forest Department, Honiara, Dr. T. C. Whitmore, now at the Forest Research Institute, Kepong, Selangor, Malaysia, and from the Royal Society Expedition to the Solomon Islands, however, have required a review of the Melanesian clinostigmatoid palms with angled or sculptured endocarp and seed and a reconsideration of the relationship of *P. insolita*. What we now know of *Physokentia* in the Solomons is largely due to the efforts of the aforementioned men whose names are appro-

priately linked to the genus in epithets for two of its species.

It is clear that the genus *Physokentia*, previously known only from three species in the Fiji Islands and the New Hebrides, is as abundantly represented in the Solomons as in those islands, and that the circumscription of the genus must be somewhat broadened to include species with ruminant endosperm and with less sharply angled endocarp and seed than the species in Fiji and the New Hebrides. So emended, the genus remains discrete but with a close relationship to *Burretiokentia* and *Cyphosperma* from New Caledonia and to *Taveunia* from Fiji. All four genera possess in common an unusual type of lower bract or prophyll, which is open abaxially in bud and incompletely encircles the peduncle of the inflorescence at the point of insertion, as well as unusual endocarp and seed.

The unifying characteristics of *Physokentia* are the probable unvarying presence of stilt roots (roots not known in *P. Tete*), the characteristic indument of pinnae, the horizontal, short-pedunculate, stiffly branched inflorescences, the prominent, mostly acute bracts subtending the triads of flowers, the low, membranous, never sepal-like bracteoles surrounding the pistillate flower, the asymmetric staminate flowers with slender pistillode shorter than the stamens in bud, the globose or subglobose fruit with variously angled and sculptured endocarp and seed, and the exocarp smooth, not granulose-roughened, in the dried state.

*From work relating to National Science Foundation grants GB-1354 and GB-3528. I am also indebted to the John Simon Guggenheim Memorial Foundation for the opportunity to study and photograph types in 1955-56 and to Prof. Alberto Chiarugi, the late Director of the Istituto Botanico at Firenze, for permission to remove fragments of *Physokentia Tete* for later study.

Burretiokentia, *Cyphosperma*, and *Physokentia* seem clearly derived from a common stock, yet each has evolved along different lines, and I am not inclined at present to unite them (a parallel instance is to be seen in *Clinostigma*

and closely related genera which I maintain at present). *Taveunia* differs strikingly from the above three in structure of the inflorescence. The genera may be separated as follows:

1. Inflorescence interfoliar, long-pedunculate, the peduncle longer than the rachis, the bracts marcescent; leaf-sheaths split opposite the petiole, not forming a prominent crownshaft; staminate flowers slightly asymmetric, the pistillode columnar, slightly expanded apically, nearly as long as the stamens in bud; pistillate flower surrounded by 2 sepal-like bracteoles; fruit with excentrically apical stigmatic residue, the exocarp drying densely granulose-roughened; stilt roots lacking. Fiji Islands (2 spp.) ----- *Taveunia*
1. Inflorescence infrafoliar, short-pedunculate, the peduncle shorter than the rachis, the bracts caducous at anthesis; leaf-sheaths tubular, forming a prominent crownshaft; flowers, bracteoles, fruit and roots various.
 2. Staminate flowers essentially symmetric, the pistillode thick, columnar, longer than the stamens in bud, expanded into a broadly capitate apex, anthers with locules continuous; bracteoles surrounding the pistillate flower sepal-like; fruit globose with stigmatic residue lateral in upper third, the exocarp drying densely granulose-roughened, mesocarp not readily separable from the very intricately and rugosely sculptured endocarp; stilt roots not present. New Caledonia (2 spp.) ----- *Cyphosperma*
 2. Staminate flowers slightly to markedly asymmetric, the pistillode elongate-conic to angled-columnar, shorter than the stamens in bud, not broadly capitate; bracteoles, fruit, endocarp, and roots various.
 3. Fruit regular and ovoid or globose or somewhat irregular when fresh, sometimes becoming shouldered and angled when dry, the surface densely granulose-roughened when dry; mesocarp not readily separated from the stony, intricately sculptured, 4-5-angled endocarp with an abaxial (dorsal) groove flanked by 2 ridges; bracteoles surrounding the pistillate flower sepal-like; anthers with locules not continuous but interrupted by sterile, connective-like areas; adventitious roots often present at base of trunk but prominent stilt roots not developed. New Caledonia (2 spp.) -- *Burretiokentia*
 3. Fruit globose or subglobose when fresh, sometimes collapsing and drying wrinkled but not granulose-roughened; mesocarp with a shining inner layer adjacent to and readily separated from the endocarp; endocarp sharply 4-angled to variously ridged and sculptured but always with an abaxial (dorsal) ridge; bracteoles surrounding the pistillate flowers very narrow, rarely (*P. Dennisii*) with a slender process but never sepal-like; locules of anthers continuous; stilt roots prominent (*P. Tete?*). Fiji Islands, New Hebrides, Solomon Islands (6 spp.) ----- *Physokentia*

Some of the unifying characteristics and some of the distinctions drawn above call attention to the importance of the inflorescence as a unit, including the primary peduncular bracts, yet sel-

dom is complete material collected. The congenitally open lower bract or prophyll is of especial interest since, apart from the distantly related *Ravenea*, it occurs, so far as I am aware, only among cer-

tain genera of the advanced clinostigmatoid palms (the above plus *Campecarpus*, *Cyphophoenix*, *Basselinia*, and perhaps a few other genera of New Caledonia) all of which are endemic to Melanesia. Certainly this type of bract is suggestive, when considered with other criteria, of a common ancestry for these four genera. It might be argued that at least those genera with irregular endocarp and seed should be united under the oldest generic name—*Cyphosperma*. This, it seems to me, obscures the manner in which and extent to which these genera have diverged. Nor does it serve any practical purpose, especially since there are adequate criteria for distinguishing the genera in inflorescence, flower, and fruit, and since there are vegetative differences, less easily expressed in words, which distinguish each in the field.

Physokentia Beccari, *Le Palme della Nuova Caledonia* 37. 10 Dec. 1920 [Webbia 5:105. Aug. 1921] *nomen*, et in Martelli, *Atti Soc. Tosc. Sci. Nat.* Pisa, Mem. 44:152 [reprint 41]. 1934. Lectotype: *P. Tete* (Beccari) Beccari (vide Burret, *Bishop Mus. Occ. Papers* 11(4):11. 1935 and Pichi-Sermolli, *Webbia* 11:129. 1955)
Goniosperma Burret, *Bishop Mus. Occ. Papers* 11(4):10. 1935.
 Type: *G. vitiense* Burret.

Solitary, unarmed, monoecious palms with prominent leaf scars on trunk; stilt roots prominently developed, often branched basally.

Leaves reduplicately pinnate, spreading-ascending; sheaths tubular, forming a prominent crownshaft; petiole short to nearly lacking; pinnae stiffly horizontal, falcately acute (rarely praemorse? cf. *P. Tete*), numerous, regularly arranged, and with a single primary nerve and decurved margins, or few, irregularly arranged, without decurved

margins, and with (1-) mostly 2-7 primary nerves, densely brown-lepidote or -punctulate at least on the nerves below, the primary and secondary nerves clothed below with conspicuous, basifixed or medifixed, irregularly linear to spatulate, brown, membranous scales.

Inflorescences infrafoliar, solitary in the leaf axils but 1-6 borne on a plant at the same time, horizontal, paniculately branched; bracts 2, inserted near the base, the lower (prophyll) open abaxially in bud, not completely encircling the peduncle at insertion, shorter than the upper, with ancipitous margins, the upper bract terete and enclosing the inflorescence in bud, more or less rostrate, completely encircling the peduncle at insertion, splitting abaxially, both bracts caducous at anthesis; peduncle short; rachis with ca. 12-20 branches, the lower branches once- or twice-branched into branches of the second or third order, the central and upper branches successively furcate to simple; rachillae somewhat flexuous, more or less angled, bearing triads of 2 staminate and a pistillate flower in the lower one-third or more and paired to solitary staminate flowers distally, or sometimes the inflorescence essentially staminate with few or no pistillate flowers and all the flowers then paired to solitary, a cluster of hairs often present on the axis in the slight depression above the triad; bracts subtending the triads prominent, rounded to acute, often reflexed; bracteoles of the flowers narrow, membranous, rounded or rarely (*P. Dennisii*) produced into a slender ligular process, glabrous to white-barbate at the upper margin of the triad or pair.

Flowers white to red: staminate flowers briefly pedicellate, more or less asymmetric; sepals 3, imbricate, acutish; petals 3, valvate, asymmetric; stamens 6, the filaments distinct, strap-shaped, flat, prominently inflexed at the apex in bud;

anthers oblong-linear, basifixed, versatile, the locules continuous, not interrupted by a sterile connective-like area; pistillode elongate-conic and briefly trifid at the apex when fresh, angled-columnar with angled or slightly expanded apex when dry; pistillate flowers sessile; sepals 3, broadly imbricate; petals broadly imbricate with briefly valvate apices; staminodes 3, dentiform, on one side of the ovary; pistil ovoid, with short recurved stigmas, ovary unilocular, uniovulate, the ovule hemitropous, laterally attached the length of the locule.

Fruit globose or subglobose with eccentrically apical stigmatic residue, red or black at maturity; exocarp smooth or drying wrinkled but not granulose-roughened; mesocarp fleshy, with few flat fibers, numerous pale or colored sclerosomes, and a smooth inner surface against and readily separated from the endocarp; endocarp thin or thick,

variously angled or ridged and sculptured, always with a prominent adaxial (ventral) keel and a sharp to obtuse abaxial (dorsal) ridge, operculate; seed shaped like the endocarp; raphe-branches horizontal from the elongate hilum, loosely anastomosing dorsally; endosperm homogeneous or ruminant; embryo basal.

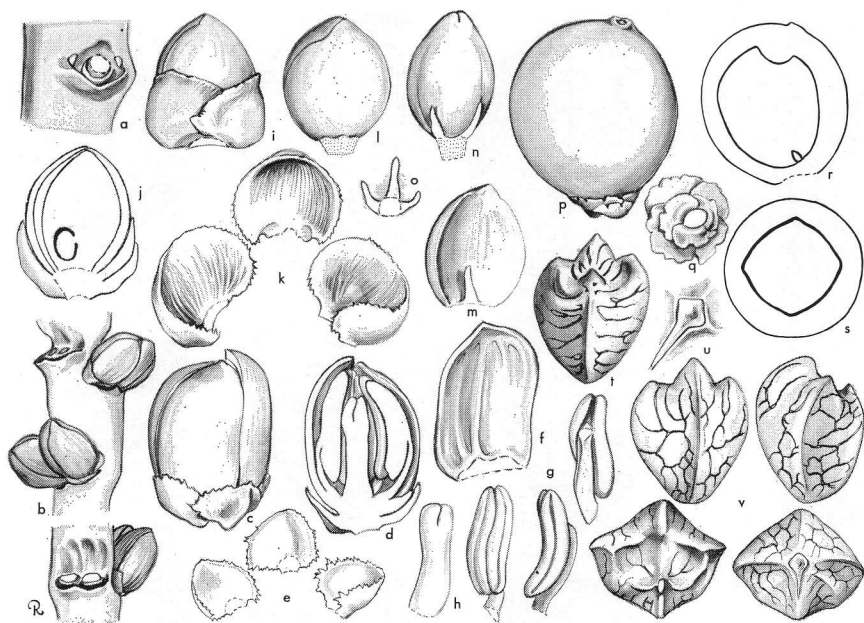
Distribution: rain forests at low to high elevations in the Fiji Islands, New Hebrides, and Solomon Islands.

I have endeavored to suggest relationships to some extent in the following key and in the arrangement of species, though by no means are relationships linear nor is it clear in what direction or directions evolutionary processes have worked. *Physokentia rosea*, *P. Thurstonii* and *P. Whitmorei* do appear more closely related to each other than to remaining species judging from present evidence.

Key to the species of *Physokentia*

1. Fruit red at maturity, the mesocarp with numerous red or blackish sclerosomes; seed with ruminant endosperm; pinnae few, usually with several to many primary nerves. Solomon Islands: New Georgia Group, Guadalcanal. ----- 6. *P. insolita*
1. Fruit black, purple-black, or (*P. Dennisii*) orange-red at maturity, the mesocarp with numerous pale sclerosomes; seed with homogeneous endosperm; pinnae numerous, usually with a single primary nerve.
 2. Fruit maturing orange-red, ca. 1.5 cm. high, 1.1 cm. in diam.; endocarp ca. 1.2 cm. high, 1.1 cm. wide, 1.0 cm. thick, rounded on margins and back, only obscurely and obtusely 4-angled, the operculum rounded; inflorescence much ramified, the lower branches divided into rachillae of the third order to 45 cm. long; bracts subtending the triads rounded or at most acutish; bracteoles surrounding the pistillate flower produced in a prominent, slender, ligular process exceeding the bract of the triad, neither bracteoles nor staminate pedicels conspicuously white-barbate, though occasionally with a few whitish or brownish hairs; leaves of mature plants with petiole scarcely evident or extremely short. Solomon Islands: Guadalcanal. ----- 5. *P. Dennisii*
 2. Fruit maturing black or purple-black; endocarp with 4-5 sharp angles, the operculum rounded to 4-angled; inflorescence less ramified, the lower branches divided into rachillae of the second order to 35 cm. long or less or rarely, through forking, into rachillae of the third order; bracts subtending the triads prominently acute; bracteoles surrounding the pistillate flower rounded, narrow, not produced in a ligular process, the bracteoles and staminate pedicels glabrous to white-barbate; leaves of mature plants distinctly petiolate.

3. Fruit 2.5–2.6 cm. high, 2.3 cm. in diam.; endocarp reticulate-roughened, becoming prominently rugose on each side of the adaxial keel, 2.4 cm. high, 2.1 cm. wide and thick, with prominent adaxial keel and sharp abaxial keel, the sides with 2 ridges, the apex more or less rounded, the operculum rounded-angled; rachillae in bud and at anthesis bearing conspicuous, white, medifixed, substellate or fimbriate scales; bracteoles and staminate pedicels essentially glabrous or, if with a few hairs, then not conspicuously white-barbate on upper margins; pinnae praemorse (?). New Hebrides: Banks Group; Vanua Lava. ----- 1. *P. Tete*
3. Fruit 2.3 cm. high or less; endocarp neither markedly reticulate-roughened nor rugose, sharply 4-angled; rachillae, etc. various.
4. Staminate flowers with rose-red petals, red-black sepals, pistillate buds with red-black sepals, wine-red petals; inflorescence axes deep rose; fruit 1.4–1.6 cm. in diam., 1.6–1.7 cm. high when dry; endocarp 1.5 cm. high, 1.4 cm. wide, 1.3 cm. thick; bracteoles and pedicels of staminate flowers glabrous or with a few brownish hairs but not white-barbate. Fiji Islands: Viti Levu. ----- 2. *P. rosea*
4. Staminate and pistillate flowers white or at most pink-flushed on white or ivory colored rachillae; fruit 2.0–2.1 cm. in diam. or less when dry, 2.3 cm. high or less; bracteoles and margins of staminate pedicels conspicuously white-barbate on upper margin of triad at anthesis.
5. Endocarp ca. 2.1 cm. high, 1.7 cm. wide, 1.6 cm. thick, sharply 4-angled, the abaxial keel pronounced and sharply curved downward and upward to the sharply pointed adaxial keel, the operculum 4-angled; sepals of staminate and pistillate flowers with a prominent dark membranous margin when dry. Fiji Islands: Vanua Levu, Taveuni. -- 3. *P. Thurstonii*
5. Endocarp ca. 1.7 cm. high, 1.5 cm. wide and thick, 4-angled with apex rounded to the adaxial keel, the operculum rounded; sepals of staminate and pistillate flowers lacking a prominent dark margin when dry. Solomon Islands: San Cristobal. ----- 4. *P. Whitmorei*
1. **Physokentia Tete** (Beccari) Beccari in Martelli, Atti Soc. Tosc. Sci. Nat. Pisa, Mem. 44:153 [reprint 42]. 1934. (Fig. 2A.)
Cyphosperma ? *Tete* Beccari, Webbia 3:137. 1910.
- Trunk 6–7 cm. in diam.
- Leaves probably regularly pinnate; central pinnae lanceolate-sigmoid, obliquely truncate and praemorse-toothed at the apex(?), ca. 60 cm. long, 5.5–6 cm. wide, with a prominent elevated midnerve and a prominent secondary nerve on each side, dull green above, the lower surface somewhat paler with minutely punctulate nerves, the midnerve and 2 prominent lateral nerves also with rather prominent, brown, basifixed, membranous scales.
- Inflorescence short-pedunculate, broader than long, the axes with rather dense, substellate, brownish or white scales in bud, glabrous in fruit; upper bract brown, very thin; rachis angled, sinuous, with more than 7 branches; lower branches again branched into flexuous rachillae of the second order to 15 cm. long, upper branches furcate or simple; bracts subtending the triads prominent, acute; bracteoles surrounding the pistillate flowers very narrow, not conspicuously white-barbate on the upper margins.
- Staminate flowers ovoid, somewhat asymmetric and angled by mutual pres-



1. *Physokentia rosea* (a, i-o) and *P. Thurstonii* (b-h, p-v): a, portion of rachilla and triad with flowers removed $\times 2$; b, portions of rachilla with paired staminate flowers $\times 2$; c, staminate bud $\times 4$; d, staminate bud in vertical section $\times 4$; e, staminate sepals $\times 4$; f, staminate petal, interior view $\times 4$; g, stamens in three views $\times 4$; h, pistillode $\times 4$; i, pistillate bud $\times 4$; j, pistillate bud in vertical section $\times 4$; k, pistillate sepals $\times 4$; l, pistillate bud with sepals removed $\times 4$; m, pistillate petal, interior view, and staminode $\times 4$; n, pistil and staminodes $\times 4$; o, staminodes $\times 4$; p, fruit $\times 1$; q, perianth in fruit, exterior view $\times 1$; r, fruit in vertical section $\times 1$; s, fruit in cross-section $\times 1$; t, endocarp, adaxial view $\times 1$; u, operculum $\times 2$; v, seed in four views $\times 1$. (a, i-o from Moore & Koroiveibau 9363; b-h, 9347; p-v, 9353; all preserved in liquid [BH].)

sure, 5.5–6 mm. long, 3 mm. wide; sepals with strongly ciliate margins; petals 2–3 times as long as the sepals; pistillode columnar, very slightly enlarged at the apex, nearly as long as the stamens in bud: pistillate flowers ovoid-conic in bud.

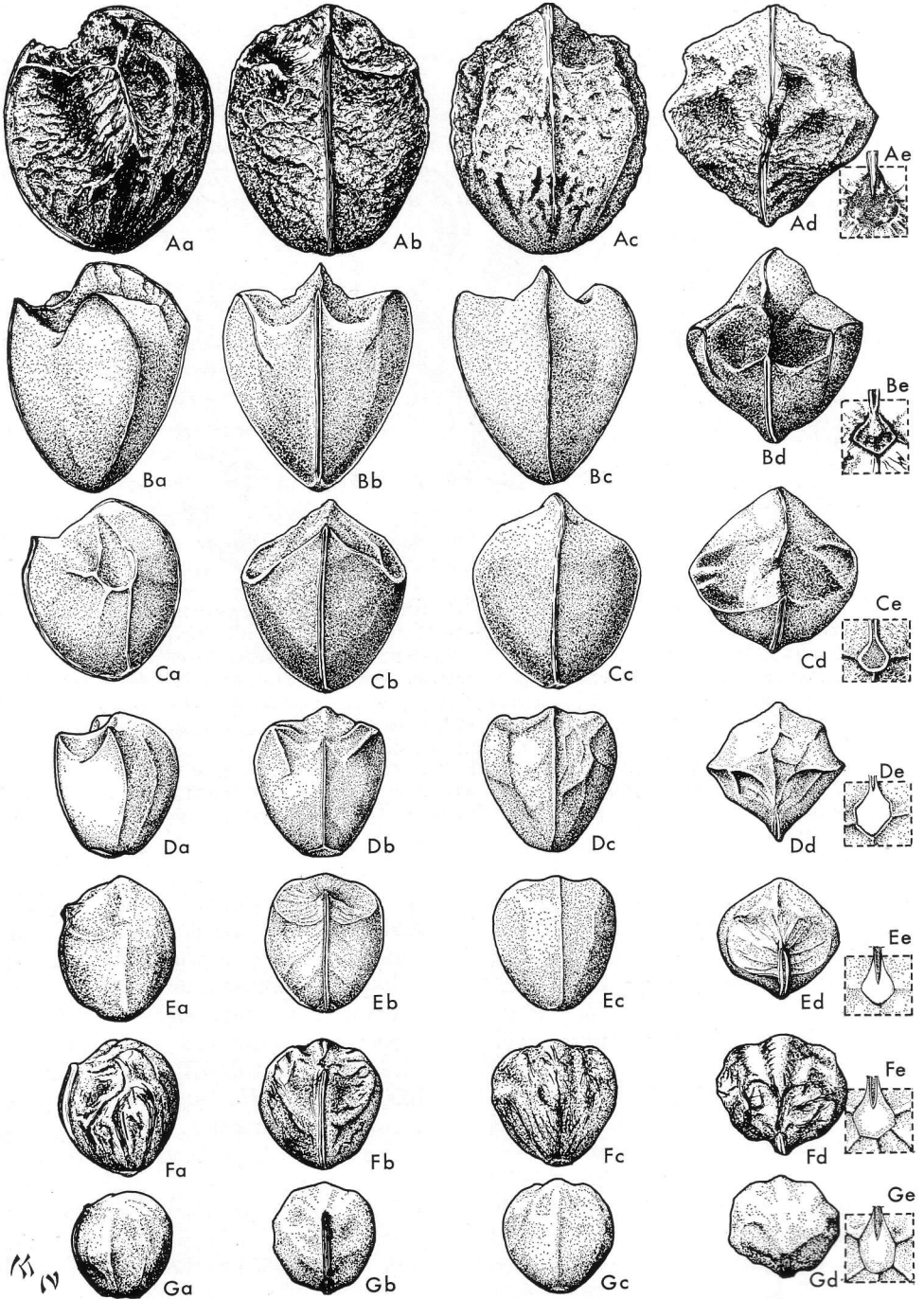
Fruit globose, 2.5–2.6 cm. high, 2.3 cm. in diam., with excentrically apical stigmatic residue, smooth when dry; mesocarp fleshy, with few fibers; endocarp thick, slightly woody, 2.4 cm. high, 2.1 cm. wide and across, with prominent adaxial (ventral) keel, prominent abaxial (dorsal) keel, and 2 prominent ridges on each side, the surface rough and becoming rugose on each side of the adax-

ial keel, operculum rounded-angled; seed shaped as the endocarp, 1.7 cm. high, 1.4–1.5 cm. wide and across; endosperm homogeneous.

Vernacular name: *tete*.

Specimens examined. NEW HEBRIDES, BANKS GROUP: VANUA LAVA; 1000 m., A. E. Harland (FI, type; BH, photos and fragments).

The type of *Physokentia Tete* consists of a fruiting panicle, an inflorescence in bud, and two unattached pinnae. The pinnae appear to be praemorse at the apex, as described by Beccari and noted by myself when I examined the type. With further experience, I now wonder whether the pinnae are truly praemorse



2. Endocarps of species of *Physokentia*: A, *P. Tete* from fragment of type [BH]; B, *P. Thurstonii* from Moore & Koroiveibau 9353 [BH]; C, *P. Whitmorei* from type; D, *P. rosea* from type; E, *P.*

or merely appear so because of fraying, a not infrequent occurrence but not determinable from the photographs. New collections are required before a complete description can be provided, yet the species is abundantly distinct in the characteristics of the endocarp alone.

2. **Physokentia rosea** H. E. Moore, *Principes* 10:90. 1966. (Figs. 1, 2D.)

Stem solitary, ca. 4 m. high, 10 cm. in diam. above roots, 7.5 cm. in diam. at crown, from a cone of stout, prickly, basally branched stilt roots ca. 1 m. long, green, leaf scars prominent.

Leaves ca. 9, stiffly spreading to ascending; crownshaft ca. 47.5 cm. long, thickened below the petiole, olive-green outside, rose-pink inside, with floccose, brown-centered, pale-margined scales where protected or brown-punctulate in age; petiole ca. 22.5 cm. long, densely and minutely lepidote at least when young with brown-centered, pale-margined, membranous or fimbriate, medifixed scales; rachis with scales similar to those of the petiole, ca. 1.22 m. long; pinnae ca. 35 on each side of the rachis at regular intervals, the margins strongly decurved in life, the prominent midnerve minutely lepidote or becoming brown-punctulate above, the midnerve, 4-5 secondary nerves, tertiary nerves, and margins all brown-punctulate below, the midnerve with larger, brown, membranous, basifixed to medifixed, irregularly linear scales to 5 mm. long on lower surface, basal pinnae ca. 27 cm. long, 9 mm. wide, central pinnae ca. 67 cm. long, 4 cm. wide, apical pinnae ca. 16 cm. long, 6 mm. wide.

Inflorescences glabrous, rose-red in bud, becoming green in fruit, as many as 6 below the crownshaft, often 2 at successive nodes separated from the next pair by several sterile nodes, horizontal, stiffly branched, the lower branches again branched; bracts rose-pink shading to white basally; peduncle 6-8.5 cm. long; rachis to 16.5 cm. long; lower branches divided into 4-6 simple or rarely furcate rachillae to 24 cm. long, upper branches furcate to simple, the ultimate rachillae to 19 cm. long, angled and somewhat flexuous to markedly flexuous apically; triads borne to about the middle of the rachilla or less with paired or solitary staminate flowers distally, the triads and staminate pairs subtended by an acute bract; bracteoles low, rounded, membranous, glabrous or with a few brownish hairs, not conspicuously barbate.

Staminate flowers 4-5 mm. long, briefly pedicellate with flat glabrous pedicels; sepals to 2 mm. long, deep red-black, with membranous, often ciliate margins; petals 4-5 mm. long, rose-red, pistillode about two-thirds as high as anthers in bud, briefly trifid at apex; pistillate flowers 5 mm. long in bud; sepals 3 mm. long, strongly imbricate, red-black, rounded, with membranous, often ciliate margins; petals deep vinous red, ca. 5 mm. long; pistil ovoid.

Fruit reddish-green, probably becoming blackish, globose, 1.9 cm. in diam. when fresh, drying ca. 1.6-1.7 cm. high, 1.4-1.6 cm. in diam.; endocarp light brown, ca. 1.3-1.5 cm. high, 1.2-1.4 cm. wide, 1.2-1.3 cm. thick, sharply 4-angled and keeled, with a partial ridge on each side of the abaxial (dor-

←

Dennisii from type; *F. P. insolita*, heavily sculptured form from *Whitmore 6079* [BH]; *G. P. insolita* from type. (a, lateral view; b, adaxial or ventral view; c, abaxial or dorsal view; d, top view; e, operculum; all $\times 1$.)

sal) keel, the operculum more or less angled; seed 1.2 cm. high, 1.1 cm. wide, 1.0 cm. thick when fresh, shaped like the endocarp; endosperm homogeneous, embryo basal.

Vernacular name: *tangandanu* (Sabatu dialect) fide Degener.

Specimens examined. FIJI ISLANDS: VITI LEVU; Province Ra (formerly Tholo North); Vuninatambua, Navai, 750–900 m. alt., *O. Degener 14792* (A, K); in forest, vicinity of Nandarivatu, 750–900 m. alt., Mar. 26, 1941, *O. Degener 14893* (A, K); ridge from Mt. Namama (east of Nandarivatu) toward Mt. Tomanivi (Mt. Victoria), 1050–1120 m. alt., 18 Aug. 1947, *A. C. Smith 5700* (A, K); vicinity of Nadarivatu, mossy cloud forest on upper slopes and ridges from Mt. Lomalangi beyond second peak in easterly direction, 2 May 1964, *H. E. Moore, Jr. & D. Koroiveibau 9363* (BH, holotype; SUVA isotype).

3. **Physokentia Thurstonii** (Beccari) Beccari in Martelli, *Atti Soc. Tosc. Sci. Nat. Pisa Mem.* **44**:154 [reprint 43]. 1934. (Figs. 1, 2B.)

Cyphosperma ? *Thurstonii* Beccari, *Webbia* **4**:272. 1914.

Goniosperma Thurstonii (Beccari) Burret, *Bishop Mus. Occ. Papers* **11**(4):12. 1935.

Goniosperma vitiense Burret, *Bishop Mus. Occ. Papers* **11**(4):11. 1935.

Stems solitary, to 7 m. high, 10 cm. in diam., bright green when young, dark green in age, with prominent leaf scars and with brown, prickly, sometimes branched stilt roots in an open cone to 2 m. high.

Leaves 6–9, ascending-spreading; crownshaft 45–55 cm. long, olive-green to dark green, with brown or gray-brown, floccose, medifixed, small scales forming a dense cover where protected or merely brown-punctulate with persistent scale centers where exposed, pink

inside; petiole 17.5–37.5 cm. long, rounded and densely covered with small scales having a brown center and pale, fimbriate, interlocking margins, or at length merely densely punctulate with persistent scale centers below, concave and glabrous above; rachis 1.25–1.7 m. long, densely covered when young with scales like those of the petiole or in age punctulate; pinnae 23–27 on each side of the rachis, regularly arranged in one plane, stiffly horizontal with strongly decurved margins in life, dark green above, lighter green below, glabrous above except for the brown-punctulate prominent midnerve and minute brown scales at the base, brown-punctulate below on all nerves, but the midnerve, 2–3 secondary nerves on each side, and the margins also with deciduous white floccose scales at first, and with persistent, large, irregularly linear, brown, membranous, basifixed or medifixed scales, basal pinnae narrow, 20–40 cm. long, 3–6 mm. wide, central pinnae 50–75 cm. long, 4–6 cm. wide, apical pinnae 20–40 cm. long, 1.8–2.2 (–8) cm. wide, these sometimes with several primary nerves.

Inflorescences 1–3 on an individual, in various stages of flower or fruit, horizontal with more or less pendulous whitish rachillae in flower but stiffish and green in fruit, provided with subpersistent, minute, substellate or lacerate scales at least on major axes, but the rachillae often glabrous; lower bract in bud ca. 17 cm. long, upper bract thin, white-floccose in bud, ca. 19 cm. long; peduncle 5–8 cm. long; rachis 22–35 cm. long with 12–14 branches; lower branches once-branched, the central and upper furcate to simple, the ultimate rachillae 9–20 cm. long, bearing triads more than half their length or sometimes the inflorescence entirely or essentially staminate with few or no pistillate flowers; triads and paired staminate

flowers subtended by acute bracts more or less reflexed, especially distally on the rachilla; bracteoles narrow, membranous, the upper margins and staminate pedicels brownish- or whitish-barbate.

Flowers white or with a pinkish cast: staminate flowers 5–6 mm. long; sepals ca. 2 mm. long, not nerved but with dark, entire, membranous, ciliolate margin when dry; petals ca. 5 mm. long, nerved or not nerved when dry and with a slight glaucous cast; pistillode angled-columnar, about two-thirds as high as stamens in bud: pistillate buds ca. 4.5 mm. high; sepals 3 mm. long, broadly imbricate, not nerved, with brown, membranous, entire, ciliolate margin when dry, in fruit ca. 3 mm. high, 6 mm. wide, and lobed; petals ca. 4 mm. high, with brown membranous margins ciliolate toward base, in fruit 6 mm. high, 7–8 mm. wide, lobed, more or less prominently nerved toward base.

Fruit subglobose, purplish-black at maturity, with excentrically apical stigmatic residue, ca. 2.3 cm. high, 2–2.1 cm. in diam. when dry; mesocarp fleshy, white, with few flat fibers and numerous pale sclerosomes; endocarp thick, dark, very sharply 4-angled with prominent adaxial (ventral) keel, abaxial (dorsal) and lateral crests, 2.1 cm. high, 1.8 cm. wide, 1.6 cm. thick, the surface smooth, operculum angled; seed shaped like endocarp, (14–) 17 mm. high, 15 mm. wide, (9–) 13 mm. thick, brown, with prominent raphe-branches horizontal from the adaxial keel and loosely anastomosing dorsally, endosperm homogeneous; embryo basal.

Vernacular name: *niuniu*.

Specimens examined. FIJI ISLANDS: VANUA LEVU; rain forests on slopes of Drayton Peak [Mount Mariko], on trail between Mbiugunu and Korosi, about 15 miles from Savu-Savu, 2000–2500 ft. alt., 1962, *D. W. Bierhorst F-134* (BH);

ridges and ravines on upper slopes of Mt. Mariko on trail from Bucalevu Village to summit, 2000–2800 ft. alt., 17 April 1964, *H. E. Moore, Jr. & D. Koroiveibau 9347* (BH, SUVA); Thakaundrove, Mount Mariko, alt. 600–866 m., 14 Nov. 1933, *A. C. Smith 417* (GH, isotype of *Goniosperma vitiense*). TAVEUNI; alt. 2300 ft., 17 April 1882, *Thurston s. n.* (K, type); by streamlet on steep slopes below crest of mountain on trail from Somosomo to crater lake, 23 April 1964, *H. E. Moore, Jr. & D. Koroiveibau 9353* (BH, SUVA).

The genus *Goniosperma* was erected by Burret to include two species, *G. vitiense* and *G. Thurstonii*, which are united here under *Physokentia*. The type of *P. Thurstonii* consists only of endocarps and seeds collected without definite locality on Taveuni, while the type of *Goniosperma vitiense* was a more ample collection, including foliage, flowers and fruit. I have collected *Physokentia Thurstonii* at what is probably the type locality and at the type locality for *Goniosperma vitiense* on Vanua Levu. As Burret suggested, there is no specific difference: in each locality *P. Thurstonii* is associated with two other clinostigmatoid palms—*Clinostigma exorrhiza* (H. Wendland) Beccari ex Martelli and *Taveunia trichospadix* Burret—in the rain forests of slopes and ridges at high elevations. Nor can *Goniosperma* stand as a genus apart from *Physokentia* when the present spread of species is considered.

4. ***Physokentia Whitmorei*** H. E. Moore, *sp. nov.* (Fig. 2C.)

Folia regulariter pinnata pinnis utrinque numerosis acutis uninerviis. Inflorescentia duplo-ramosa rachillis ad 33 cm. longis, bracteolis floris foeminei angustis, apice rotundatis. Fructus ater, globosus, 2.3 cm. altus, 2.0 cm. in diam., endocarpio 17 mm. alto, 15 mm. in

diam., crasso, acute 4-angulato.

Trunk solitary, to 6 m. high, with stilt roots to 1.5 m. high.

Leaves 5-6, suberect; sheaths green, tinged grey, forming a crownshaft 6-9 dm. high, covered, when young or where protected, with a dense, continuous mat of small, brown-centered, floccose-margined, peltate scales or becoming densely brown-punctulate with persistent scale-bases in age or where exposed; petiole ca. 26 cm. long, densely covered above and below with shining, irregularly and narrowly membranous-margined, brown, peltate scales; rachis with a dense cover of scales similar to those of the petiole or often with a broader, paler, lacerate-fimbriate margin; pinnae regularly arranged, the number on each side of the rachis not noted, the central ca. 57 cm. long, 5 cm. wide, narrowed basally to an insertion 1.5 cm. wide and to an acute apex, but this sometimes broken or frayed, glabrous above except the prominent, elevated, brown-punctulate midnerve and minute scattered punctulations on some lesser nerves, below densely and minutely brown-lepidote on the midnerve, on 3 rather prominent secondary nerves on each side, and on numerous tertiary nerves, the midnerve and secondary nerves also bearing prominent, dull brown, membranous, irregularly linear, medifixed or basifixed scales to ca. 3 mm. long near the base or nearly throughout their length, apical and subapical pinnae similar but smaller, (15-25 cm. long, 1.8-2 cm. wide) with usually 2 secondary nerves on each side, the lowermost pinnae ca. 32 cm. long, 1.5 cm. wide, long-attenuate, probably continuing into a rein or lora when first expanded.

Inflorescence ca. 5.5 dm. long from base to apex, glabrous; bracts apparently glabrous (from a very young inflorescence obviously from within a leaf-sheath and molded); peduncle 8 cm.

long, 1.4 cm. wide at apex; rachis 18 cm. long to last branch, bearing 9 subdistichously arranged branches including the terminal; lower few branches again subdistichously branched into ca. 6 simple or rarely furcate rachillae to 28 cm. long, the upper simple, to ca. 33 cm. long in fruit, all more or less angled or even flexuous at anthesis and terminating in a brief spinose tip; triads in the lower half or more of the rachillae, distally with paired or solitary staminate flowers, each triad subtended by a prominent acute bract 2 (-3) mm. long; bracteoles membranous, narrow, white-barbate on the upper margins as are the brief staminate pedicels.

Staminate flowers 4-5 mm. long, somewhat asymmetric, more or less rounded at the apex in bud; sepals indistinctly nerved when dry, broadly imbricate, rounded to acutish, ca. 2.5 mm. high, 3 mm. wide, the margins more or less ciliolate; petals nerved when dry, valvate, ca. 5 mm. long, 3-4 mm. wide; pistillode as long as the filaments, angled-columnar, 3-angled at apex: pistillate flowers in bud, 3-4 mm. long, the perianth in fruit of sepals 3.5-4 mm. long, 5-6 mm. wide and petals 6 mm. long, 9 mm. wide, both, and especially petals, rather strongly nerved.

Fruit olive maturing black, globose when still incompletely mature, with eccentrically apical stigmatic residue, 2.3 cm. high, 2 cm. in diam.; exocarp smooth; mesocarp thin with longitudinal fibers, not collapsing when dried; endocarp thick, 17 mm. high, 15 mm. wide and thick, 4-angled with beaked ridge on adaxial (hilar) side lower than rounded-angled apex, operculum rounded; seed not sufficiently developed to describe.

Vernacular name: *manusilae* in the Kwara'ae dialect.

Specimens examined. BRITISH SOLOMON ISLANDS PROTECTORATE:

SAN CRISTOBAL (EAST); 4 miles E. of Wainoni, headwaters of Huni R., ultrabasic outcrop, broad ridge top, 1600-1700 ft. altitude, 10 August 1965, *T. C. Whitmore R S S 6309* (BH, holotype; K, isotype).

Physokentia Whitmorei is the only species thus far known from the Solomon Islands that shows an immediate and clear resemblance to species from Fiji and the New Hebrides. The sharply angled endocarp, white-barbate bracteoles of the triads, and the pinnae are very similar to those of *P. Thurstonii*. Though the seeds had not developed sufficiently to provide information on endosperm, it may be anticipated that the endosperm will be homogeneous.

The epithet is but a faint tribute to the devotion which Dr. Whitmore has lavished on the flora of the Solomon Islands and to the unfailing assistance he has provided me during and after field work in the Solomons.

5. ***Physokentia Dennisii*** H. E. Moore, *sp. nov.* (Fig. 2E.)

Folia regulariter pinnata pinnis utrinque 22-25 acutis uninerviis. Inflorescentia triplo-ramosa rachillis ad 45 cm. longis, bracteolis floris foeminei angustis, subiter in apicem angustum productis. Fructus aurantiaco-ruber, subglobosus, 15 mm. altus, 10-11 mm. in diam., endocarpio 12 mm. alto, 10 mm. in diam., fragili, 4-angulato, carinis dorsalibus et lateralibus obtusis, seminis endospermio homoganeo.

Trunk solitary, to 10.5 m. high, with a dense mass of 100 or more stilt roots to 1.2 m. high, some roots branched, the upper portion of trunk light green, with short internodes.

Leaves spreading; crownshaft bright greyish-green, ca. 9 dm. long, considerably broader at base than at apex, covered when young or where protected with a dense indument of floccose

scales or densely brown-punctulate with persistent scale centers in age or where exposed; petiole elongate on juvenile plants but lacking or very short on mature trees (scarcely 2 cm. long); rachis ca. 1.8 m. long, densely covered above and below with minute, shining, brown, lacinate-fimbriate-margined, membranous, peltate scales or merely brown-punctulate where exposed or weathered; pinnae 22-25 on each side of the rachis, regularly arranged, the central ones ca. 78 cm. long, 7 cm. wide at middle, tapered basally to an insertion ca. 1 cm. wide; upper margin longer than the lower and straight, the lower narrowed toward the acute apex; both surfaces more or less densely lepidote or punctulate with minute, pale-membranous-margined, brown-centered, peltate scales or their persistent centers, midrib prominent and elevated on upper surface, with scattered floccose scales, the lower surface with prominent mid-nerve and 3-4 secondary nerves clothed with scattered, dull brown, irregularly linear, medifixed or basifixed, membranous scales 2-3 mm. long; apical and subapical pinnae shorter and narrower, 24-32 cm. long, 1.7-2.5 cm. wide, the tips often frayed and appearing praemorse; lower pinnae conspicuously narrowed and shortened toward base of rachis, the lowermost only ca. 15 cm. long, 5 mm. wide.

Inflorescence greenish-ivory, ca. 9 dm. long from base to apex, paniculately three-times branched, glabrous; bracts not seen; peduncle 15 cm. long, 2 cm. wide at apex; rachis ca. 26 cm. long to last branch, bearing ca. 17 branches, the lower branch ca. 45 cm. long, again twice-branched basally, simply branched apically into ca. 9 branches, the rachillae slender, elongate, to ca. 45 cm. long, 3 mm. in diam., upper branches progressively less branched to furcate or simple.

Flowers in triads to beyond the middle

of the rachillae, paired to solitary staminate distally, or some inflorescences largely or entirely staminate; triads subtended by a prominent rounded bract often deflexed in fruit, the bracteoles surrounding the pistillate flowers membranous, narrowly rounded and usually produced in a prominent narrow ligular process exceeding the bract, the bracteoles and pedicels glabrous or with sparse short brownish or whitish hairs, not conspicuously white-barbate; staminate flowers white, asymmetric, more or less rounded at the apex in bud, 4–5 mm. long; sepals ca. 2 mm. high, 2.5–3 mm. wide, more or less rounded with ciliolate margins, indistinctly nerved when dry, the outer often slightly keeled; petals ca. 4 mm. long, 2–2.5 mm. wide, asymmetric, rather distinctly nerved when dry; pistillode angled-columnar with angled apex, ca. two-thirds as long as the stamens in bud; pistillate flowers in bud ca. 4 mm. high, the perianth in fruit of 3 sepals 3–3.5 mm. high and often 3-lobed (entire and rounded in bud), of 3 petals ca. 6 mm. high.

Fruit subglobose, ripening orange-red, ca. 15 mm. high, 11 mm. wide, 10 mm. thick, (from preserved material) with excentrically apical stigmatic residue, drying wrinkled; exocarp smooth; mesocarp with a layer of sclerosomes immediately under the exocarp and few thin fibers in thin flesh; endocarp fragile, 4-angled, 12 mm. high, 10 mm. wide and thick, sharply keeled on the adaxial (hilar) side and operculate at the base, rounded-angled abaxially; seed not perfectly mature, shaped essentially as endocarp; endosperm homogeneous.

Vernacular name: *garagara* in the Kwara'ae dialect.

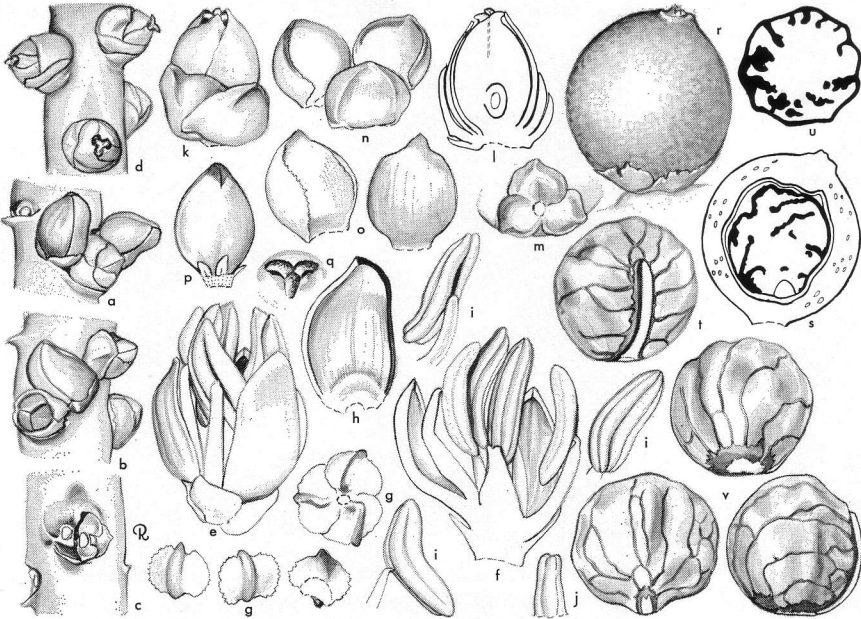
Specimens examined. BRITISH SOLOMON ISLANDS PROTECTORATE: GUADALCANAL (NORTH); headwaters of the Matiniko'o River, 11 April 1965, *G. F. C. Dennis s. n.* (BH, holotype);

headwaters of Tenaru River, path from Honiara to Betilonga Village, in forest over limestone, alt. ca. 1200 ft., 31 May 1964, *E. J. H. Corner & T. C. Whitmore B S I P 4391* (US, paratype).

Physokentia Dennisii is distinctive in several respects. The much ramified inflorescence with branches of three orders to 45 cm. long is unlike that of the remaining species, all of which have branches only to the second order except for rare instances of furcation in second order rachillae. The small fruits ripen orange-red (fide Corner and Whitmore) rather than black as in remaining species with homogeneous endosperm and the endocarp is much less sharply angled than in other species except *P. insolita*. Bracteoles surrounding the pistillate flowers are especially striking in their ligular apices. Although possessed of a fruit in the size range of *P. rosea* from Fiji, *P. Dennisii* does not seem especially related to that species, rather in its red fruit, endocarp with obtuse angles, and homogeneous endosperm it stands midway between *P. insolita* on the one hand, the remaining species on the other.

The epithet pays tribute to the persistent efforts of Mr. Geoffrey F. C. Dennis, Forest Department, Honiara, to obtain essential material of this and other species of palms, and more than that to the assistance so readily offered during and since the writer's brief field experience in the Solomons during 1964. The present species was then encountered sterile at its type locality when Mr. Dennis, Dr. and Mrs. Whitmore, and Mr. James Tedder, District Commissioner of the Central District, with his wife accompanied the writer on a Sunday excursion.

Inflorescence bracts are not described in detail. The following excerpt from a letter dated April 12, 1965—describing Mr. Dennis's attempt to carry back alone



3. *Physokentia insolita*: a, portion of rachilla with triad $\times 2$; b, abnormal triad of two pistillate flowers and one staminate flower $\times 2$; c, triad with flowers removed to show bract and bracteoles $\times 2$; d, portion of rachilla at pistillate anthesis $\times 2$; e, staminate flower $\times 4$; f, staminate flower in vertical section $\times 4$; g, staminate calyx, exterior view, and individual sepals $\times 4$; h, staminate petal, interior view $\times 4$; i, stamens $\times 4$; j, pistillode $\times 4$; k, pistillate flower $\times 4$; l, pistillate flower in vertical section $\times 4$; m, pistillate calyx $\times 4$; n, pistillate sepals $\times 4$; o, pistillate petals $\times 4$; p, pistil and staminodes in bud $\times 4$; q, stigmas $\times 8$; r, fruit $\times 2$; s, fruit in vertical section $\times 2$; t, endocarp showing adaxial keel $\times 2$; u, seed in cross-section $\times 2$; v, seed in three views $\times 2$. (From material of *Whitmore 4095* preserved in alcohol [BH].)

specimens of the palm from what I know to be an exhausting journey—provides more detail:

“I also collected a flower sheath, which unfortunately got lost in my struggle through the long grass on the ridges on my homeward trip, but from what I recall it was an ivory slightly green-tinted colour (as are the new flower panicles—flowers being white) 18 inches long, 3 1/2 inches wide, of a very flimsy soft texture, the base of it having a ragged edge where it has broken loose from the base of the crownshaft.”

Although only two collections from the vicinity of Honiara are explicitly cited, it appears likely that the species also occurs near Mt. Gallego, for the following Royal Society Expedition collection, though lacking fruit, agrees well in other details with the type and paratype: Monitor Creek, headwaters, 7 miles inland below Mt. Gallego, 2000 ft. alt., 6 July 1965, *T. C. Whitmore R S S 6050* (BH).

6. *Physokentia insolita* H. E. Moore, *sp. nov.* (Figs. 2F, G, 3, 4.)

Folia irregulariter pinnata pinnis utrinque 5–6 acutis 5–8–nervibus. In-



4. *Physokentia insolita*: a, mature plant; b, young plant with less dissected leaves and longer petioles; c, base of mature plant; d, infructescence; e, stilt roots; f, inflorescence at staminate anthesis. (Photographs of plants at type locality by T. C. Whitmore [BH].)

florescentia duplo-ramosa rachillis ad 40 cm. longis, bracteolis floris foeminei angustis, apice rotundatis. Fructus ruber, globosus, 11–12 mm. altus, 10–11 mm. in diam., endocarpio 10–12 mm. alto, 9–11 mm. in diam., fragili, carina dorsali obtusa, carinis lateralibus utrinque 2–3 indistinctis, seminis endospermio ruminato.

Stem solitary, slender, to 15 m. high, 17.5 cm. in diam., light brown or grey and smooth near the base with prominent leaf-scars and internodes 7.5–15 cm. long, green toward apex where internodes are shorter, with sometimes ribbed stilt roots to 15 dm. high, 2.5–5 cm. in diam., with spread of ca. 45 cm. at ground.

Leaves ca. 8, spreading at maturity; crownshaft 4.5–6 dm. long, fawn-colored from dense coat of pale brown floccose scales with pale centers where protected or olive-green and pale-punctulate where exposed, the old sheaths purple within; petiole slender 8–37.5 cm. long, 1.3–1.5 cm. wide at apex, densely dark-brown-lepidote or -punctulate on the rounded lower surface, similarly lepidote on the channelled upper surface, the scales membranous-margined; rachis 1.5–1.8 m. long (1.77 m. in type) with scales similar to those of the petiole; blade little or irregularly divided on each side into 2–3 very broad, many-nerved pinnae in younger plants or with 4–6 mostly broad pinnae on each side in mature individuals bearing flowers and fruits; pinnae (on one entire leaf of type) 5 per side, from base to apex with respectively 6, 6, 7, 5, 8 primary nerves or a total of 32 per side for the entire blade, (1.5–) 12–38 cm. wide at insertion, 43–108 cm. long on upper margin, 6.5–13 cm. wide at about middle, falcately narrowed to an acute apex, but this sometimes broken or frayed and appearing praemorse, secondary nerves 2–4 between each primary nerve, both surfaces and all nerves rather densely dark-lepidote with minute pale-margined scales, the primary nerves with prominent, red-brown, irregularly linear, membranous, medifixed or basifixed scales toward the base on the lower surface.

Inflorescences 1–8 on an individual plant, spreading, paniculately twice-branched, whitish at anthesis, to more than 6 dm. long and wide; lower peduncular bract thin, ca. 35 cm. long, briefly pointed, glabrous; peduncle 6–10 cm. long, 1.3–2.2 cm. wide at apex; rachis 9–22 cm. to last branch, bearing 9–10 branches, the lower of these once-branched, the upper furcate to simple and to ca. 40 cm. long, rachis and

branches with small, lacerate-fimbriate, whitish, dark-centered scales at least at anthesis; rachillae bearing triads nearly to the apex, these subtended by prominent rounded to usually acute bracts, bracteoles very narrow and inconspicuous, glabrous or, as also the staminate pedicels, minutely hairy but not prominently white-barbate.

Flowers cream-colored in bud: staminate flowers asymmetric, 5.5–7 mm. long when dry; sepals ca. 2 mm. long, narrow, acutish, somewhat keeled dorsally, ciliolate along the margins, not or very inconspicuously nerved when dry; petals ca. 5–6 mm. long, 2.5–3 mm. wide, rather conspicuously nerved when dry; pistillode conic when fresh, angled-columnar when dry, with angled apex, ca. one-third as high as stamens in bud: pistillate buds ca. 2.5–3 mm. high, the perianth in fruit with sepals 2.5 mm. long and often lobed (entire, rounded-acute and ciliolate along the margins in bud), petals 4 mm. high, 4.5 mm. wide, prominently ciliolate along the margins.

Fruit red at maturity, globose, with excentrically apical stigmatic residue, 11–13 mm. high, 10–13 mm. in diam.; mesocarp with numerous red sclerosomes in fleshy tissue and some flattened curved fibers; endocarp 10–12 mm. high, 10–11 mm. wide, 9–10 mm. thick with acute adaxial (hilar) keel, rounded abaxial (dorsal) keel, rounded apex, 2–3 indistinct rounded partial ridges and shallow to marked depressions on each side, the operculum rounded; seed ca. 8–9 mm. high, broad, and thick, brown, irregularly sculptured and rounded in conformity with the endocarp, raphe-branches ca. 5 per side from the ventral hilar keel, lateral and anastomosing dorsally toward base; endosperm ruminant; embryo basal.

Vernacular name: *manusilae* or sometimes *garagara* in Kwara'ae dialect.

Specimens examined. BRITISH SOLOMON ISLANDS PROTECTORATE: NEW GEORGIA GROUP, KOLOMBANGARA ISLAND; east coast, 1 1/2 miles inland, ca. 200 ft. alt., 16 April 1964, *T. C. Whitmore B S I P 4095* (BH, holotype: HON, US, isotypes); west coast, Merusu Cove, hillside, ca. 200 ft. alt., 14 Feb. 1963, *T. C. Whitmore B S I P 1438* (HON, LAE, US); inland from Iri iri Village (Merusu Cove), wet gully forest at 2500 ft. alt., 28 Sept. 1963, *T. C. Whitmore B S I P 2102* (HON, LAE, US). NEW GEORGIA (N.W.): near Jela, hillside, 250 ft. alt., 5 May 1964, *A. W. Coumeadow B S I P 3712* (HON, US); Hovoro, valley bottom, 500 ft. alt., 2 Sept. 1964, *Coumeadow's Collectors B S I P 3774* (HON, US). GUADALCANAL (N.W.): head of ridge E. of Hidden Valley, Mt. Gallego, alt. ca. 2000 ft. (but ranging from ca. 1700 ft. to ca. 3000 ft. on mountain into mist forest area), 17 Sept. 1966, *G. F. C. Dennis B S I P 4648* (US); Mt. Gallego, western ridge, 2500–3000 ft., 7 July 1965, *T. C. Whitmore R S S 6079* (BH, K).

Physokentia insolita (*insolitus*—unusual, strange) is, for the genus, an unusual species. When I first saw material of it at Honiara and later when I studied the type in Ithaca, I thought it to represent an undescribed genus. The combination of shape of staminate pistillode, sculptured endocarp and seed, red fruit, red sclerosomes in the mesocarp, and ruminant endosperm seemed not to fit with any other taxon in the clinostigmatoid alliance.

It was fortunate that publication was

withheld pending receipt and study of *Physokentia Dennisii*, for the last species is intermediate between *P. insolita* on the one hand and previously described species on the other. Lacking mature fruit, there seems nothing in the inflorescence or flowers to differentiate *P. insolita* generically and the foliage, though unusual in the broad pinnae and generally short petiole, is approached by that of *P. Dennisii*.

The material from low elevations on Kolombangara Island and New Georgia seems to agree well, though fruit is mostly immature. Dr. Whitmore writes: "common to abundant on West Kolombangara as a pretty undergrowth palm from ca. 500 ft. to ca. 1000 ft. alt.; it does not grow down to sea-level." Two collections from higher elevations on Guadalcanal are referred here with some question. The fruit is slightly larger (13 mm. high, 12–13 mm. in diam.) than in the type (11–12 mm. high, 10–11 mm. in diam.) and the endocarp is more prominently sculptured (Fig. 2F). Mature flowers have not been available and the discernible differences are not of a magnitude that lends conviction to separate description. More extensive collecting and field study may ultimately show associations of differences among plants of different islands or island groups or simply a continuum of variation. The presence of a *Physokentia* on Santa Ysabel noted previously (*Moore & Whitmore 9307*) and perhaps of this relationship suggests that we have yet much to learn about the genus in the Solomons.

Three New Palms from Venezuela

HAROLD E. MOORE, JR.

L. H. Bailey Hortorium, Cornell University, Ithaca, New York

Recent collections from the Chimantá Massif, Auyan-tepui and Cerro Sipapo in Venezuela represent undescribed species in the genera *Euterpe* and *Prestoea* as circumscribed by the writer (*Gentes Herbarum* 9:260-262. 1963). Complete descriptions are not yet available for all the species of these genera known from the tepuis of the Guianas and Venezuela, but the following have characteristics which, in ensemble, set them apart.

***Euterpe* (*Euterpeopsis*) *aurantiac* H.
E. Moore, *sp. nov.***

Caulis ad 12 m. altus, foliorum vaginis aurantiacis, petiolis brevibus, pinis utrinque 45, inflorescentiae bracteis aurantiacis, ramis dense brunneovelutinis, floribus masculis 4-4.5 mm. longis, pistillodio trifido, fructibus 12-13 mm. diam., albumine homogenero.

Tree to 12 m. high.

Leaves with bright orange sheaths ca. 8 dm. long and sparsely clothed with small, fimbriate-peltate, shining, dark-brown scales; petiole short, ca. 8 cm. long, densely clothed above and below with large, blackish, membranous, lacerate-twisted, basifixed scales to 3.5 mm. long over a thin waxy coat, both ultimately deciduous leaving the surface brown-punctulate; rachis similarly vestite at least basally, 1.75 m. long with ca. 45 pinnae on each side regularly arranged at intervals of 2.5 (mid) to 9 (lowest) cm., the lowermost pinnae ca. 52 cm. long, 3 mm. wide, lower pinnae 44 cm. long, 8 mm. wide, middle pinnae 68 cm. long, 3.8 cm. wide, upper pinnae 51 cm. long, 3.8 cm. wide, apical pinnae 28 cm. long, 8 mm. wide, all linear-attenuate to an acute or acuminate apex, glabrous above, densely clothed below

with minute, brown-centered, pale-margined, peltate scales and, on the midnerve, with prominent, elongate, castaneous, twisted, membranous, basifixed scales to 5 mm. long, secondary nerves 2 on each side of the midnerve.

Inflorescence infrafoliar, ca. 65 cm. long; bracts dorso-ventrally flattened, bright orange, subequal, inserted about 2 cm. apart, clothed with scattered, black, lacerate-peltate scales, the upper bract ca. 65 cm. long, apparently not much produced beyond the lower; peduncle short, ca. 10 cm. long, densely clothed with castaneous-centered, pale and fimbriate-margined, peltate scales over a thin waxy coat, becoming glabrate and brown-punctulate; rachis ca. 28 cm. long, densely tomentose with scales like those of the peduncle; rachillae numerous, ca. 97, to ca. 53 cm. long, densely velutinous with brown-centered, pale, fimbriate scales or densely pale-brown velutinous toward the apex.

Flowers inserted in distinct pits, the pistillate subtended by 2 glabrous, orange, shining bracteoles 1-1.5 mm. high: staminate flowers 4-4.5 mm. high, brownish (when dry, colored when fresh?), the sepals glabrous, somewhat keeled, more or less rounded apically, ca. 2 mm. high, dark-margined; petals asymmetrically rounded to a point but scarcely markedly acute; stamens 6, filaments stoutish, not inflexed at apex, slightly shorter than the narrowly ovate anthers; pistillode trifid, about half as long as the stamens and about equalling the stamen-filaments: pistillate flowers conic in bud, the broadly rounded sepals ca. 2.5 mm. high; petals ca. 4 mm. high and very briefly valvate at apex.

Fruit (from *Maguire & Politi 27733*)

globose, 12–13 mm. in diam., the surface minutely roughened when dry, subtended by sepals 2.5 mm. high, petals 5 mm. high; seed depressed-globose, 9 mm. in diam., 8 mm. high; endosperm homogeneous.

VENEZUELA. TERRITORIO AMAZONAS: Cerro Sipapo (Páraque), frequent in mixed montane forest, Cano Grande, 1 km. northwest of savanna camp, 1,500 m. alt., Dec. 28, 1948, *Maguire & Politi 28009* (NY, holotype); between savanna camp and Phelps camp, 1,400 m. alt., Dec. 17, 1948, *Maguire & Politi 27733* (NY, paratype in fruit).

The five species of *Euterpe* endemic to the tepuis—*E. aurantiaca*, *E. erubescens*, *E. montis-duidae*, *E. ptariana*, *E. roraimae*—are characterized by buff to ferruginous indument on the inflorescence branches in contrast to the white or pale yellow indument of most lowland species. Within this complex, *E. aurantiaca* differs from all species for which any color notations have been given in its bright orange leaf-sheaths and inflorescence bracts. The brown tomentum of the inflorescence, dense and large scales of the petioles, and colored bracteoles subtending the colored flowers are other features setting the species apart.

***Euterpe (Euteropsis) erubescens* H.**

E. Moore, *sp. nov.*

Caulis ad 12 m. altus, foliorum vaginis viridibus, petiolis ca. 40 cm. longis, pinnis regulariter ordinatis, inflorescentia ca. 43 cm. longa, ramis dense fusco-tomentosis, floribus masculis 5.5 mm. altis, rubris, pistillodio trifido, fructibus 12–13 mm. diam., albumine homoganeo.

Trunk slender, 5–12 m. high.

Leaves subcoriaceous, dark-green above, paler below; sheath glabrous but sparsely punctulate, 52 cm. long or more; petiole rounded and glabrous be-

low, deeply channelled and dark-subceraceous above, ca. 40 cm. long; rachis glabrous but marked with dark patches below, angled and dark-lepidote and perhaps dark-pilosulous above; pinnae regularly arranged at intervals of 1–5 cm., acuminate, the lowermost ca. 18 cm. long, 2 mm. wide, the remainder mostly 30–50 cm. long, 1.5–2.7 cm. wide, decreasing to 20 cm. long, 1.8 cm. wide near and 12.5 cm. long, 5 mm. wide at the apex, the midnerve prominent and keeled above as, to a much lesser extent, are a nerve on each side midway or closer to the margin, the midnerve brown-punctulate below, as are all the other nerves, and clothed near the base or nearly to the apex with dark brown, basifixed or rarely medifixed, membranous scales to 4 mm. long, the secondary and submarginal nerves impressed below, flanked by numerous nerves of tertiary and quaternary orders.

Inflorescence ca. 43 cm. long; peduncle dorso-ventrally compressed, becoming very densely red-brown-black appressed-puberulent or pilosulous toward and on the rachis and rachillae, 8 cm. long, 2.2 cm. wide at first bract, 11 mm. wide at first branch, with deciduous, pale, ceraceous scales at the base and between the two bract scars and scar of a third, probably incomplete, bract, these scars ca. 1 cm. apart, the lower 2 cm. from the base; rachis short, ca. 10 cm. long, with 28 branches, the lower branches 27 cm. long, 7 mm. wide at flattened and expanded base, the upper ones ca. 20 cm. long.

Staminate flowers 5.5 mm. high; sepals brick-red, 4 mm. long, lightly keeled; petals 5 mm. high, adnate to connate stamen-filaments ca. 1.5 mm. at base, filaments colored, ca. 2 mm. long, erect; anthers pale, erect, dorsifixed, 2 mm. long; pistillode of 3 subulate filaments about as long as stamen-

filaments: pistillate flowers subtended by 2 large bracteoles, these in fruit ca. 2 mm. high and glabrous apically, puberulent basally.

Fruit globose, 12–13 mm. in diam. but not completely mature, the exocarp dark and granular-roughened when dry (brownish-yellow in life fide Steyermark), the shining, glabrous, brown perianth appressed to the fruit, with sepals 3–3.5 mm. long, 4–6 mm. wide, petals 6 mm. long, 8 mm. wide; seed immature but with homogeneous endosperm.

VENEZUELA. ESTADO BOLIVAR: Chimantá Massif, Central Section; swampy ground above Summit Camp, 1,940 m. alt., Feb. 4, 1955, *J. A. Steyermark & J. J. Wurdack 434* (NY, holotype; VEN, isotype); Chimantá Massif, northwestern part of summit of Abácapa-tepui, above first line of sandstone bluffs, 2,000–2,125 m. alt., April 14, 1953, *J. A. Steyermark 75011* (NY, VEN); Auyan-tepui, common along stream, cumbre de la parte norte de la sección sur (división occidental del cerro), a lo largo del Río Churún al pie de "Second Wall" de arenisca, desde el campamento norte, 5 kms. hacia el noreste, 1,660 m. alt., May 12, 1964, *J. A. Steyermark 93738* (BH).

Vernacular name: *manaca*.

Uses: bud said to be edible.

Euterpe erubescens and *E. roraimae* differ from *E. aurantiaca*, *E. montisduidae*, and *E. ptariana* in the very dark indument of the mature inflorescence. The larger, staminate flowers with brick-red sepals more than half as long as the petals and the trifold pistillode distinguish *E. erubescens* from *E. roraimae* which was described as having staminate flowers 4 mm. long with sepals half as high as the petals and a columnar pistillode.

A specimen from the summit of Cerro de la Neblina, Río Yatua, Territorio

Amazonas, Venezuela, was collected in fruit on January 16, 1954 (*Maguire, Wurdack & Bunting 37319*). The material at hand is very similar to *E. erubescens* but differs in having a shorter petiole with a dense coat of longer, red-black, lacerate scales near the margin on the lower side, dense patches of similar scales at the apex of the leaf-sheath and delicate red-brown branched hairs on the body of the sheath. Hairs of the inflorescence are slightly shorter than those of *E. erubescens* with a tendency to be intermixed with paler hairs (though this is also evident on one inflorescence of the type collections). Complete material may someday provide the basis for a more satisfactory identification of this collection, but for the present it is noted as certainly very closely related to if not identical with *E. erubescens*.

The name *Euterpe erubescens* has already appeared in a report on the flora of Auyan-tepui (*Acta Botánica Venezolana* 2: 140. 1967) where, owing to delays in publication of this article, it is a *nomen nudum*.

Prestoea Steyermarkii* H. E. Moore, *sp. nov.

Caulis ad 8 m. altus, foliorum petiolis lepidotis pinnis regulariter ordinatis subtus lepidotis, inflorescentia ca. 1 m. longa, ramis scaberulis, floribus masculis 4 mm. longis, pistillodio trifido, fructibus globosis 8 mm. diam., albumine ruminato.

Trunk slender, 6–8 m. tall.

Leaves deep green; sheath with scattered, very thin, membranous, more or less lacerate-margined, brown, peltate scales; petiole elongate, about 70 cm. long, rounded, sparsely to densely beset below with pale, membranous, irregular, more or less lacerate, peltate scales often with spreading or appressed brown hairs, convex and glabrous above; pinnae regularly arranged, firmly mem-

branaceous, acuminate, glabrous above, prominently scaly below with very small, brown, membranous, lanceolate to peltate scales, the midnerve also with larger, more or less twisted, red-brown, membranous scales at least toward the base, the lowermost pinnae shorter and very narrow, 29 cm. long, 4 mm. wide, the lower pinnae 42 cm. long, 1.8 cm. wide, middle pinnae 53 cm. long, 2.5–2.9 cm. wide, upper pinnae 30 cm. long, 1.8 cm. wide, apical pinnae 20 cm. long, 8 mm. wide, the midnerve prominently keeled above, the margins pale and thickened, secondary and tertiary nerves prominent, pale, and about 5 on each side of the midnerve below with many fine quaternary nerves interspersed.

Inflorescence infrafoliar, nearly 1 m. long in bud; bracts markedly unequal, the lower ca. 35 cm. long, ancipitous, obliquely open at apex, the upper inserted ca. 8 cm. above the lower, terete and tapered to a flat point ca. 3 cm. long, both glabrous except for scattered minute deciduous peltate scales or persistent brown scale-bases; peduncle 2.6 dm. long, terete, glabrous to minutely brown-lepidote toward the rachis, this white in flower and fruit, ca. 33 cm. long, minutely scaberulous; rachillae about 45, minutely scaberulous, 22–31.5 cm. long, terminating in a sterile spinose tip.

Flowers whitish, the staminate 4 mm. long; sepals acute, keeled, 1–1.2 mm. long; petals 4 mm. long with apices more or less obliquely rounded to an acute but scarcely pointed tip; stamens

6, the filaments very briefly inflexed at the apex, about as long as the narrowly sagittate anthers with dark connective; pistillode trifold, about two-thirds as long as filaments; pistillate buds ca. 2.8 mm. high, glabrous; sepals broadly rounded; petals convolute-imbricate, briefly valvate at apex; staminodes 6, dentiform; pistil trigonous-columnar with 3 decurrent stigmas (in bud).

Fruit globose, green (immature) ca. 8 mm. in diam., the seeds incompletely developed but clearly with ruminant endosperm.

VENEZUELA. ESTADO BOLIVAR: Chimantá Massif, dwarf forest on semi-open shoulder of northwestern part of Abácapa-tepui, 1,400 m. alt., Apr. 19, 1953, *J. A. Steyermark* 75172 (NY, holotype; VEN, isotype); Cerro Venamo (parte Sur-Oeste) Cerca de los límites con la Guayana Inglesa, bosque alto húmedo montañoso, entre la base de la ladera principal escarpada de arenisca y el salto en el Río Venamo, 1,220–1,275 m. alt., Jan. 6–7, 1964, *J. A. Steyermark* & *E. Dunsterville* 92745 (BH).

Prestoea Steyermarkii is perhaps related to *P. tenuiramosa* from Roraima but the latter is described as having a glabrous petiole and a short columnar pistillode: *P. Steyermarkii* has prominent scales on the lower surface of the petiole and a deeply trifold pistillode. The second collection cited, *Steyermark et al.* 92745, lacks mature fruit but compares well with the type in other respects.

PALM BRIEFS

Request

Mr. DeArmand Hull of the Longwood Graduate Program of the University of Delaware and Longwood Gardens, under the direction of Dr. Russell J. Seibert and a special advisor, Dr. Harold E. Moore, Jr., has begun a study of the electrophoretic patterns of palm seed proteins among the subfamilies, in hopes of accumulating further reliable taxonomic evidence for the Palmae. Representatives of the nyroid, lepidocaryoid and phytelephoid subfamilies are at present not available in the United States. Mr. Hull would appreciate receiving fresh viable seed of the following genera of these subfamilies, accompanied by data concerning the age and origin of the material. This material would help make his study more complete.

He would also be very grateful for specimens of the plant for scientific purposes. If available, a section of the leaf, flowering spathe or cymba and inflorescence with flowers would suffice, especially if accompanied by a photograph. If all of the material is not available, seed and partial vouchers would still be appreciated. The genera needed are:

Nypa, *Calamus*, *Raphia*, *Eugeissona*,
Korthalsia, *Metroxylon*, *Mauritia*,
Pigajetta, *Salacca*, *Phytelephas*.

Material should be airmailed by April 1970, to Experimental Greenhouse, Longwood Gardens, Kennett Square, Pennsylvania 19348. Postage will be refunded if desired, or the donor may be placed on the Longwood ornamental plant exchange program. A list of the common and rare palms that will be available for exchange, and the necessary authorization for import will be sent upon request.

PALM LITERATURE

READ, ROBERT W. A study of *Pseudophoenix* (Palmae). *Genes Herbarum* 10(2): 169-213. 1968.

The genus *Pseudophoenix* differs sufficiently from other arecoid palms that it has been considered to represent a distinct family, Pseudophoenicaceae, by O. F. Cook or, by Dr. Read, a subfamily, the Pseudophoenicoideae, consisting of four species (see *Principes* 13: 77-79). The history of the genus, distribution and ecology, anatomy and morphology, cytology, seed viability and seedling morphology, behavior under cultivation, and taxonomy are considered in detail. The study is illustrated with photographs, drawings, and distribution maps. Copies of the entire fascicle of which this is a part may be purchased for \$2.50 from the L. H. Bailey Hortorium, 467 Mann Library, Ithaca, New York, 14850.

H. E. MOORE, JR.

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