

Chelyocarpus and its Allies Cryosophila and Itaya (Palmae)

HAROLD E. MOORE, JR.

L. H. Bailey Hortorium, Cornell University, Ithaca, New York 14850

Two handsome fan palms of the subfamily Coryphoideae have been growing for many years in the garden of the Museu Emilio Goeldi at Belém, Pará, Brazil, where they have been known as *Chelyocarpus ulei* and *Tessmanniophoenix chuco* or *Tessmanniodoxa chuco*. Seed of the latter was introduced into the United States by Mr. Stanley Kiem in 1961 and of *C. ulei* by the writer in 1967. There are, in addition, two other related palms in Colombia and Peru. The four together are of particular interest to the grower because of their ornamental potential and to the botanist because they have characteristics that place them among the most primitive of palms. There has, however, been some uncertainty as to the correct generic disposition of *Tessmanniodoxa chuco* and of an undescribed palm from Peru. Crucial to a solution of generic problems has been the identity of the palm described in 1847 by Martius as *Thrinax? chuco*. Recently specimens in flower and fruit from the general region from which *Thrinax chuco* was described have become available. The problem may now be resolved with some confidence and the Peruvian palm is described as a new genus, *Itaya*.

A Brief History of *Thrinax chuco*

Alcide Dessalines d'Orbigny, a French explorer and scientist, travelled widely in South America during the years 1826 to 1833. An account of these travels—*Voyage dans l'Amérique méridionale*—was published in seven volumes of text

and two of plates. Volume 7 part 3 of this work was an account of the palms collected by d'Orbigny prepared by C. F. P. von Martius. Known alternatively and more familiarly as *Palmetum Orbignianum*, this study of the palms appeared in several fascicles over a period from 1842 to 1847 except for one plate published earlier (see Stafleu, 1967). It included, among many others, a fan palm, *Thrinax? chuco*, collected in 1832 (see Urban, 1906) near a Brazilian fort, Principe da Beira, on the banks of the Guaporé or Iténes River which separates Bolivia and Brazil.

Martius' description appears to have been based on a drawing and actual material of leaf and fruit (*d'Orbigny no. 32*). There are fragments of a leaf in the Martius herbarium now at the Jardin Botanique National de Belgique, Bruxelles, Belgium, though three fruits mentioned by Martius have not been located there nor has material been found at Paris. The description of the material available is very detailed, but unfortunately neither inflorescence nor flowers were described and these are vital for a definitive generic placement of this palm as Martius noted. That it was not a *Thrinax* has been assumed for a long time, and it has been placed variously in *Trithrinax*, *Acanthorrhiza*, *Tessmanniophoenix*, and most recently in *Tessmanniodoxa*.

The transfers of *Thrinax chuco* to *Trithrinax* by Walpers in 1849 and to *Acanthorrhiza* by Drude in 1882 were made without further knowledge of the

palm as was Burret's assignment of it to *Tessmanniophoenix* in 1928. In 1934, however, Burret published photographs of *Chelyocarpus ulei* and *Tessmanniophoenix chuco* taken by Captain H. A. Johnstone in the botanic garden at the Museu Goeldi where they appear to have been brought as seed by Professor Huber from much the same region where Ule had collected *Chelyocarpus ulei*. Burret also published supplementary notes on flowers, fruits, and inflorescences of these plants from specimens provided by Captain Johnstone. Burret visited Brazil himself in 1937-38, when he saw living material at Belém. He thereafter decided that the genus *Tessmanniophoenix*, founded on *T. longibracteata*, was the same as *Chelyocarpus* so he provided a new name, *Tessmanniodoxa*, for *Tessmanniophoenix* or *Thrinax chuco* which he considered generically distinct by reason of the smooth rather than corky-tessellate surface of the mature fruit.

There the matter rested until 1960 when, with Ing. Adolfo Salazar C. and Dr. Earl E. Smith, I collected two fan palms in Peru. An attempt to identify these palms initiated a reexamination of

the whole problem and attempts to obtain complete material of *Thrinax chuco* from its type locality. Dr. Ghilleen T. Prance and his colleagues have recently collected ample specimens in flower and fruit of a palm that agrees in every detail with Martius' description of *Thrinax chuco* from known locations on the Rio Madeira downriver from its junction with the Guaporé on which Principe da Beira lies. There seems little doubt now that the cultivated material is correctly identified with *Thrinax chuco* but comparisons with *Chelyocarpus ulei* and with another palm from Colombia that Burret also placed in *Tessmanniodoxa* suggest that all belong to *Chelyocarpus*, which in turn is amply distinct from the Peruvian palm here called *Itaya*.

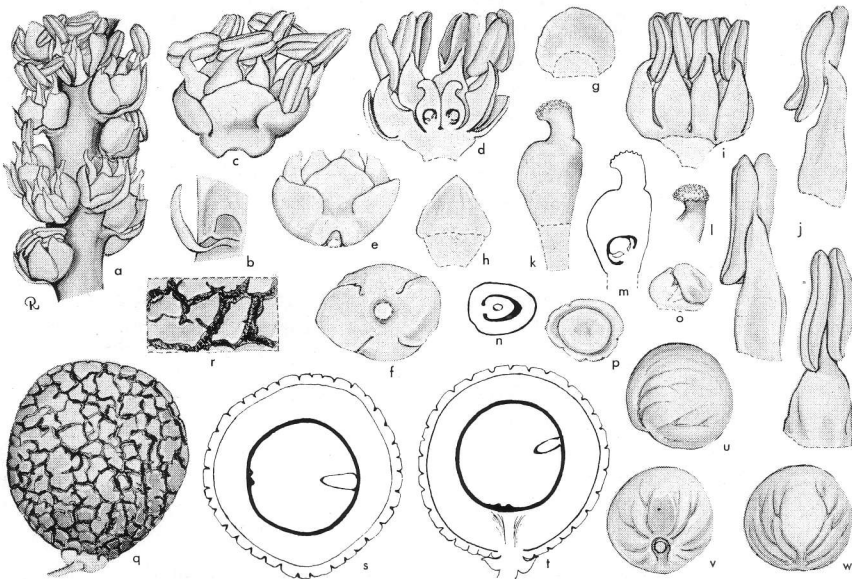
These genera, with *Cryosophila*, form an alliance characterized by a distinctive leaf-blade. Their relationships to other apocarpous genera of the coryphoid palms (Coryphoideae) and the principal differences between them may be brought out in a partial synoptic key and in descriptions and comments to follow.

1. Carpels 3-1, distinct (apocarpous genera).

2. Perianth uniseriate, lobed; primary inflorescence branches subtended by persistent tubular bracts sheathing the bases, a prophyll usually present on the peduncular base of at least the lower branches; carpel 1. _____ *Coccothrinax, Thrinax, Zombia*
2. Perianth biseriate, the sepals and petals clearly distinguishable in separate whorls; subtending bracts various but a prophyll seldom present on the peduncular base of inflorescence branches (but see *Chelyocarpus chuco*); carpels 1-3.
3. Carpels approximate apically, with styles as wide as or wider than ovary, the gynoeceum essentially top-shaped, stigmas short and incurved, erect, or recurved; stamen-filaments or staminodes short and adnate to the petals, anthers included. _____ *Liberbaileya, Maxburretia, Rhapsis*
3. Carpels with styles conspicuously narrower than the ovary, the gynoeceum never top-shaped; stamen-filaments distinct or connate but not markedly adnate to the petals, anthers usually exerted.
4. Flowers with an elongate pseudopedicellate base equalling or exceeding the petals, these reflexed at anthesis; flowers near the base of the rachillae perfect, those near the apex staminate; leaves regularly divided into 1-ribbed acute segments, a short palman (undivided portion) present; carpel 1. _____ *Schippia*
4. Flowers lacking a pseudopedicellate base, the petals erect or spreading but not reflexed at anthesis; flowers essentially uniform in an inflorescence; leaves variously divided.

5. Leaves regularly divided part way to the base into 1-ribbed or more rarely 2-3-ribbed segments with acute or briefly bifid or briefly toothed apices throughout; stamens always 6. *Chamaerops*, *Rhapidophyllum*, *Trachycarpus*, *Trithrinax*
 5. Leaves divided at the center beyond the middle or nearly to the base into 2 halves, each half divided laterally into more or less cuneate, 2-several-ribbed segments, these again shallowly to deeply divided into acute or briefly bifid 1-ribbed segments; stamens 6-24.
 6. Stamens 6, the flat filaments connate half their length or more; styles elongate, exserted; root-spines present on the trunk. *Cryosophila*
 6. Stamens 6 or more, the filaments distinct or united briefly at the base for less than half their length; styles not exserted; root-spines not present on trunk.
 7. Petals 2, 3, or 4, distinct, imbricate; sepals 2, 3, or 4, distinct or briefly connate; stamens (5-) 6 or (7-) 8; carpels (1-) 2 or 3 (4-); embryo lateral; petioles not split basally in the leaf-sheath; sheath remaining closed. *Chelyocarpus*
 7. Petals 3, connate half their length; sepals 3, connate basally; stamens 18-24; carpel 1; embryo subbasal; petiole split basally in the leaf-sheath; sheath splitting opposite the petiole. *Itaya*
1. Carpels 3, connate by their styles or the gynoecium entirely syncarpous (non-apocarpous genera).

Chelyocarpus



1. *Chelyocarpus ulei*. a, portion of rachilla $\times 2$; b, bracteole and floral scar $\times 4$; c, flower $\times 4$; d, flower in vertical section $\times 4$; e, f, perianth in lateral and bottom views $\times 4$; g, sepal $\times 4$; h, petal $\times 4$; i, flower, perianth, removed $\times 4$; j, stamens in three views $\times 8$; k, pistil $\times 4$; l, stigma $\times 4$; m, pistil in vertical section $\times 4$; n, ovary in cross-section $\times 4$; o, p, ovule in lateral and top views $\times 8$; q, fruit $\times 1$; r, surface of fruit $\times 2$; s, fruit in cross-section $\times 1$; t, fruit in vertical section $\times 1$; u, v, w, seed in lateral, antirapheal, and rapheal views $\times 1$. a-p from material of Moore & Salazar 9494, q-w from material of Moore 9548, both preserved in liquid.

Chelyocarpus Dammer, Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem 7: 395. 15 Jan. 1920.

Type: *C. ulei* Dammer

Tessmanniophoenix Burret, *op. cit.* 10: 397. 1 Dec. 1928.

Lectotype: *T. longibracteata* Burret, (*vide* Burret, *op. cit.* 15: 337. 1941).

Tessmanniodoxa Burret, *op. cit.* 15: 336. 30 Mar. 1941.

Lectotype: *T. chuco* (Martius) Burret (*vide* Moore, *Gentes Herbarum* 9: 273. 1963).

Solitary, unarmed, hermaphroditic palms of moderate size, the trunk naked except for fibrous residual sheaths below the crown.

Leaves numerous in a spreading crown, induplicate palmate, flabelliform; sheath fibrous, densely appressed-villous when young, not splitting opposite the petiole, with prominent fibrous ligule on each side of petiole at apex, this disintegrating into loose fibers in age; petiole elongate, unarmed, not splitting basally in sheath, rounded below and channelled above basally becoming biconvex and rhombic in section with obtuse margins distally, terminating adaxially in a small, deltoid, elevated hastula plicately grooved dorsally, and in a narrow deltoid margin abaxially; rachis not developed; blade flat, thin, divided centrally well beyond the middle or nearly to the base, each half divided into paired or irregularly grouped 1-ribbed segments (*C. chuco*), or divided to the base into elongate-cuneate many-ribbed segments, these again divided into several acute or very briefly bifid 1-ribbed segments.

Inflorescences several, interfoliar, pendulous; peduncle flattened, bearing a prophyll and at intervals 2 (-3) tomentose sterile bracts with tubular bases

and cochleariform blades; rachis flattened, with several recurved, once-branched, flattened primary branches basally adnate to the rachis, each subtended by a prominent fertile bract similar to those on the peduncle but progressively smaller and at least the lower branches bearing a membranous prophyll (*C. chuco*), or bearing only simple rachillae, or the lower rachillae sometimes fasciate or subfasciculate on short branches but the fertile bracts, except sometimes for an open one subtending the whole rachis, small and not like those on the peduncle; rachillae usually adnate for some distance above an acute, sometimes elongate subtending bract.

Flowers perfect, at least in *C. ulei* strongly scented, borne singly in a spiral along the rachillae, each sessile or on a very short pedicel subtended by a small to prominent acute bract; sepals 2 or 3 and distinct or briefly connate basally, or 4, distinct, and slightly imbricate; petals 2, 3, or 4, distinct, imbricate; stamens 5, 6, 7, 8, or 9, one opposite each sepal, remainder opposite petals, the filaments erect, distinct, fleshy, thick and broad below and more or less abruptly narrowed to a subulate tip, anthers dorsifixed at the middle, laterally dehiscent by longitudinal slits, exerted at anthesis, bifid at apex and base; carpels 3 or 2, rarely 1 or 4, only one usually developing into a fruit, style short, somewhat recurved, stigma papillate, ovule hemianatropous, attached adaxially at the base, an aril present and basally fused to the locular wall.

Fruit globose with excentrically apical stigmatic residue; epicarp smooth or coarsely corky-tessellate; mesocarp thick, dry; endocarp membranous: seed not adherent to the pericarp, globose; hilum basal, round; raphe slightly impressed the length of the seed and with ascending branches; endosperm homogeneous; em-

bryo below or above the middle opposite the raphe; germination remote-tubular; seedling with one scale leaf and bifid eophyll.

Distribution and ecology: three species of Amazonian Bolivia, Brazil, Peru, and of western Colombia, at low elevations in areas of high rainfall.

Chromosome complement: $n=18$ (cf. Read & Moore, 1967).

Anatomical features: central vascular bundles of petiole with a single phloem strand (Parthasarathy, 1968). For foliar and floral anatomy see Uhl, 1972a & b.

Chelyocarpus was initially set apart because of the corky-tessellate surface of the fruit of the type-species which so resembled a turtle's carapace as to suggest the generic name. Dammer commented on the dimerous or two-parted perianth of *C. ulei* but lacking flowers thought his material perhaps atypical. More complete collections, however, have shown that the perianth is normally dimerous in the species. Although the tessellate fruit is unusual it is not unique in palms. Dransfield (1970) has noted the occurrence of corky-warted fruits in three undescribed species of *Licuala*, a genus otherwise with smooth fruits, and similar fruit surfaces have evolved independently in several genera. A difference in fruit alone does not seem of sufficient importance to outweigh striking resemblances to two other species which Burret assigned first to *Tessmanniophoenix* and then to *Tessmanniodoxa*. Companion studies of floral anatomy and leaf anatomy (Uhl, 1972a & b) bolster the resemblances.

All three species have similar habit; the leaf-blade is deeply divided centrally, then variously divided and segmented laterally, while the densely appressed-villous sheath does not split opposite the petiole nor does the petiole split basally in the sheath; central vascular bundles of the petiole have single phloem strands;

inflorescences are similar in nature of bracts and flattened axes with much adnation, though one is more branched than the others; flowers follow a basic pattern though with some interesting variation—the normal dimerous and tetramerous (four-parted) state of two species is unique among the palms so far as I am aware; fruits and seeds are similar except for the tessellate fruit coat of *C. ulei*. I have, therefore, transferred both species of *Tessmanniodoxa* to *Chelyocarpus*.

Chelyocarpus chuco differs from the remaining species in a series of characteristics listed in the key to species. It might be argued that *Tessmanniodoxa*, restricted to its lectotype-species (*T. chuco*), deserves subgeneric or even generic rank. I consider it merely to represent the basic pattern from which *C. dianeurus* and *C. ulei* diverge in having a less complex inflorescence, flowers readily derived from a trimerous state by multiplication of parts or by reduction, and leaves with an indument of trichomes and deep lateral lobing. It is particularly interesting to note that these species correlate with three of nine refugia—Madeira-Tapajós (7), East Peruvian (6), Chocó (1)—postulated by Haffer (1969) as regions where rainforest persisted during drier epochs of the Pleistocene.

When one assesses the characteristics of *Chelyocarpus*, it becomes evident that it must be considered among the most primitive of palm genera, sharing this honor with *Trithrinax*, also South American but apparently representing a separate cluster of interrelated genera. *Chelyocarpus chuco*, as also *Trithrinax*, comes close to what might in some ways be considered a palm prototype so far as inflorescence, flowers, and fruit are concerned—trimerous perianth whorls, hexamerous androecium, trimerous gynoecium, and continuous growth in the development of fruit (see Murray, 1971).

Within *Chelyocarpus* there is apparent simplification of the inflorescence and there are modifications of the flower which suggest directions of evolution toward connation and reduction in the perianth, elaboration of the androecium, and reduction of the gynoecium found in the related genus *Itaya* and in the more specialized *Thrinax* alliance.

Primitive though it may be, *Chelyocarpus* seems clearly to have close affinities with two genera of more specialized nature—*Cryosophila* and *Itaya*. The deep central division of the leaf and lateral lobing are unusual among apocarpous genera and there are striking resemblances in the inflorescence, in flowers, and in fruit. *Cryosophila* exhibits floral specialization probably related to pollination while retaining a hexamerous androecium and trimerous gynoecium. *Itaya* is most advanced of the three in floral structure and in having two phloem strands in central vascular bundles of the petiole. Preliminary studies of the late metaxylem in the stems of *Chelyocarpus*, *Cryosophila*, and *Itaya*

show the presence of simple perforation plates and often a characteristic ligule in vessels of *Itaya* as opposed to the more generalized compound perforation plates (scalariform) in *Chelyocarpus* and in *Cryosophila albida* a mixture of vessels having either scalariform perforation plates with 1–5 (often only 1–2) bars or simple perforation plates and no ligules (Larry Klotz, personal communication).

Before leaving this small group, some notes on the division of the leaf may complement observations made by Dransfield (1970) on unusual leaf-division in *Licuala* and *Rhapis*. In *Chelyocarpus* and allies, the leaf-blade is split deeply or nearly to the base along one side of the continuing nerve presumed to represent the midnerve of the central pinna of an induplicate leaf. Division is thereby nearly equal, for each of the central lobes will have half a segment at its inner margin but one has a marginal nerve while the other lacks marginal thickening.

Key to Species

1. Perianth trimerous with 3 sepals and 3 petals; stamens 6; carpels 3; fruit not corky-tessellate, the seed with embryo above the middle; inflorescence with several recurved once-branched primary branches, each subtended by a prominent bract and at least the lower branches bearing a membranous prophyll on the peduncular portion; leaf-blade green below, divided nearly to the base at center but the lateral divisions not deeply divided (Fig. 12Ba). Eastern Bolivia, western Brazil. *C. chuco*
1. Perianth dimerous or tetramerous with 2 or 4 sepals and 2 or 4 petals; stamens 5–9; carpels usually 2; fruit and seed various; inflorescences with a prophyll and usually 2 prominent sterile bracts below the terminal rachis, this sometimes subtended by an open fourth bract, lacking prominently bracteate primary branches bearing prophylls, the rachillae all simple or the basal ones fasciate or subfasciculate on short branches; leaf-blades silvery below, divided centrally to below the middle or nearly to the base, then divided to the base laterally into elongate-cuneate many-ribbed segments, these again divided into 1-ribbed segments (Fig. 12Aa, 13Ba).
2. Perianth tetramerous with 4 distinct sepals and 4 petals; bracts below the flowers much shorter than the perianth; fruit with smooth epicarp, the seed with embryo below the middle; inflorescence rachis and rachillae glabrous; leaf divided to within 15–18 (or rarely 3–5?) cm. of the base at center. Western Colombia. *C. dianeurus*
2. Perianth dimerous with 2 usually distinct or rarely briefly connate sepals and 2 petals; bracts below the flowers equalling or exceeding the perianth; fruit corky-tessellate, the seed with embryo above the middle; inflorescence rachis and rachillae floccose-tomentose at least at anthesis; leaf divided to within 1–2 cm. of the base at center. Western Brazil, eastern Peru. *C. ulei*



2. *Chelyocarpus chuco* cultivated at Museu Goeldi, Belém, Brazil. Note the pale infructescence on plant at upper right. Photo by S. Kiem.



3. Fruits of *Chelyocarpus chuco*. Photo by S. Kiem.

Chelyocarpus chuco (Martius) H. E.

Moore, *tr. nov.* (Fig. 2-3, 12B).

Thrinax? chuco Martius, *Palmetum Orbignianum* 45, t. VIII, fig. 1 & T. XXV B, 1847.

Type: *d'Orbigny* 32 (BR).

Triptrinax chuco (Martius) Walpers, *Annales Botanices Systematicae* 1: 1005. 1849.

Acanthorrhiza chuco (Martius) Drude in Martius, *Flora Brasiliensis* 3(2): 554. 1 Mai 1882; Beccari, *Webbia* 2: 241. 1907.

Tessmanniophoenix chuco (Martius) Burret, *Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem* 10: 400. 1 Dec. 1928.

Tessmanniodoxa chuco (Martius) Burret, *op. cit.* 15: 337. 30 Mar. 1941. Trunk to 5 m. high or more, slender.

Leaves 10-22 in a crown; sheath more than 3 dm. long, pale (golden?) appressed-villous; petiole elongate, to ca. 1.8 m. long (*teste* Martius), ca. 2 cm.

wide basally, 1 cm. wide apically, with brown furfuraceous scales at first, becoming glabrate; hastula deltoid or truncate-deltoid, 1.5-2.5 cm. long, 2-3 cm. wide at base; blade thin, green, to 1.05 m. long at center, 1.8 m. across, divided centrally to within 1.5-2 cm. of the base, divided laterally one-fourth to nearly three-fourths to the base into 15-24 lanceolate 1-ribbed segments on each side, these mostly grouped in pairs toward the margins or irregularly toward the center, the ultimate segments to 50 cm. long, 2.5-6 cm. wide, each with a midrib, 2-3 lateral secondary and several finer tertiary nerves on each side more prominent below than above, flexuous cross-veinlets prominent on both surfaces when dry, proximal segments often conspicuously narrowed and "shouldered" toward the acute or very briefly bifid apex, lower surface of blade green but paler than upper surface, very densely beset with minute, shining, translucent dots.

Inflorescences 3-4 (*teste* Martius), to more than 5.5 dm. long; sterile bracts 2 (or more?), densely light brown floccose-lepidote outside, glabrous within, ca. 21 cm. long; branches 5-7, each

subtended by a fertile bract similar to the peduncular bracts but progressively smaller, the lowermost branches bearing a membranous prophyll to 12 cm. long, upper branches with incomplete prophylls or prophyll lacking, main axis and branches more or less flattened, branches mostly curved with flattened base to ca. 18 cm. long, 1.3 cm. wide in fruit, fertile portion to ca. 20 cm. long; rachillae to 8 cm. long, subtended by narrowly triangular, membranous, tomentum-tipped bracts to 15–17 mm. long on lowermost branches, shorter above, shortly adnate above the bract and with a short sterile base.

Flowers sessile or briefly pedicellate, borne singly in a spiral on the rachillae, bracts short; perianth 2–2.5 mm. long, creamy white, erect at anthesis; sepals 3, connate for ca. 0.5 mm., 2.0–2.5 mm. long, lobes deltoid; petals 3, about as long as the sepals, distinct, imbricate; stamens 6, filaments broad and thick basally, subulate above, anthers exerted and spreading from the narrow mouth of the perianth; carpels 3.

Fruit globose or depressed-globose, with persistent thickened perianth, 1.6–2.0 cm. wide, 1.6–1.8 cm. high; epicarp not tessellate; mesocarp rather thin; endocarp membranous; seed brown, depressed-globose, ca. 1.6 m. wide, 1.4 cm. high; embryo above the middle.

Vernacular names: *Carnaubinha* fide Prance *et al.*; *chuco* in Itonama, *hue-chichaho* in Baures, *iriai* in Cayuvava, *sava* in Itênès, *choinan* in Pacaguara, fide d'Orbigny.

Distribution and ecology: Bolivia and Brazil along banks of rivers, larger in forests than along the banks (fide d'Orbigny), flowering November (Prance *et al.*) to January (d'Orbigny), fruiting April (d'Orbigny) to July (Prance *et al.*).

Specimens examined:

BOLIVIA. STATE OF PANDO: west bank

of Río Madeira opposite Abunã in forest on terra firme, 9 July 1968, G. T. Prance, E. Forero, L. F. Coelho, J. F. Ramos & L. G. Farias 5708 (BH). BRAZIL. Region of Forte Príncipe da Beira, Rio Guaporé, 1832, d'Orbigny 32 (Hb. Mart, BR, holotype). TERRITORY OF RONDÔNIA: basin of Río Madeira; east bank of Río Madeira between Abunã and Penha Colorado, varzea forest, 20 Nov. 1968, G. T. Prance, W. A. Rodrigues, J. F. Ramos & L. G. Farias 8717 (BH). CULTIVATED. Botanical Garden, Museu Emilio Goeldi, Belém, Pará, Brazil: 8 Nov. 1946, L. H. Bailey 324 (BH); photographs only, 1961, Stanley Kiem s. n. (BH); 1 June 1963, Museu Goeldi 349. R-8 (BH); 1966, Cavalcante s. n. (BH); 20 Mar. 1967, H. E. Moore, Jr. 9549 (BH).

Chelyocarpus chuco stands somewhat by itself in the genus as noted earlier. The presence of a prophyll on some primary branches is unusual in the alliance, for such have not been observed in *Cryosophila* nor in *Itaya*. The less deeply lobed leaf with its green under-surface further sets the species apart from others in *Chelyocarpus*, from *Itaya*, and from most in *Cryosophila*.

Chelyocarpus dianeurus (Burret) H. E. Moore, *tr. nov.* (Fig. 4, 5, 13B).

Tessmanniophoenix dianeura Burret, Notizblatt des Botanischen Garten und Museums zu Berlin-Dahlem 11: 499. 11 Jul. 1932; Dugand, Revista de la Academia Colombiana de Ciencias 8:387. 1951.

Type: Archer 2199 (US).

Tessmanniodoxa dianeura (Burret) Burret, Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem 15: 337. 30 Mar. 1941. Trunk gray, to ca. 5 m. high or more, 6–9 cm. in diam.

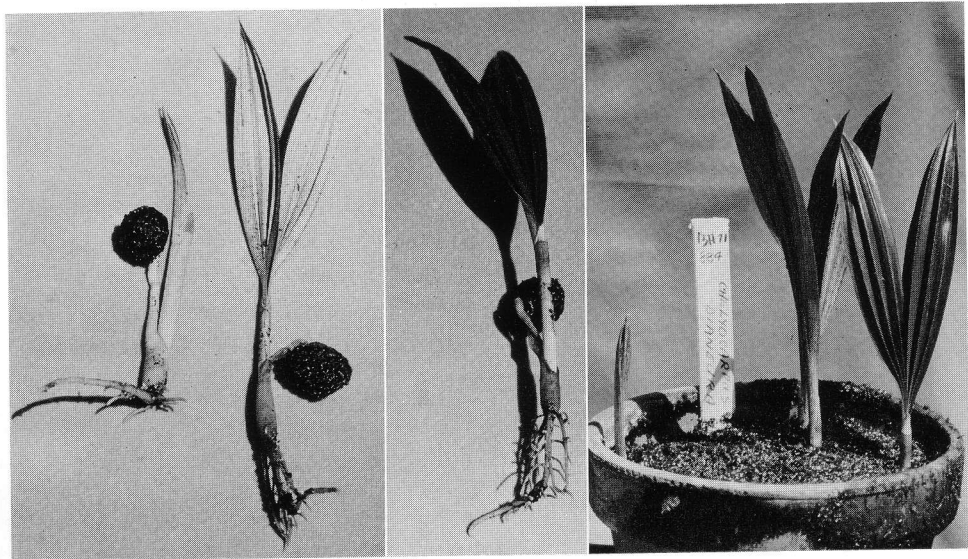
Leaves ca. 10 or more; sheaths to ca. 3 dm. long, brown-fibrous-margined, the inner ones densely golden appressed-villous; petiole as long as the blade or longer, 1–1.3 m. long, ca. 1.5 cm. wide at base and apex, brown furfuraceous-



4. *Chelyocarpus dianeurus* leaf, the central segments brought together in order to hold the blade (Moore, Parthasarathy & Orjuela 9458). Photo by M. V. Parthasarathy.

lepidote becoming glabrate; hastula deltoid with incurved margins, ca. 2 cm. high, 2 cm. wide; blade green and shining above, silvery below, 0.65–1.12 m. long, to 1.2 m. across, divided centrally to within 15–18 (or 3–5 fide Dugand) cm. of the base, divided laterally to or nearly to the base into 5–7 elongate-cuneate many-ribbed segments 1.2 m. long, 7–25 cm. wide, each again divided into 3–6 acute 1-ribbed segments 8–24 cm. long, 2–4.5 cm. wide, these with the midrib prominent below, the midrib, a lateral nerve on each side, and numerous oblique cross-veinlets evident above, lower surface covered with a continuous layer of thin white membranous scales, these rubbing off on contact.

Inflorescences several among the leaves, to ca. 8 dm. long; peduncle ca. 5 dm. long, flattened at base, brown-tomentose when protected, bearing a prophyll inserted ca. 21 cm. above the base and 2 sterile bracts at intervals of ca. 14 and 10 cm. respectively, these



5. Seedlings of *Chelyocarpus dianeurus* to show remote-tubular germination, single scale leaf, and bifid eophyll. From Moore & Gutiérrez 9999 cultivated at Cornell University.

(fide Burret) to 25 cm. long, oblong-lanceolate, densely dull gray-white-tomentose outside; rachis ca. 35 cm. long with ca. 50 simple rachillae, the lowest to 16 cm. long, upper shorter, each subtended by a small fertile bract.

Flowers sessile or on a low tubercle, subtended by a short bract; perianth 2.5 mm. high; sepals 4, ovate or nearly semiorbicular, slightly imbricate, rounded at apex; petals 4, longer than the sepals, ovate-oblong or oblong, rounded; stamens 8 (-9), filaments flattened, broad basally, narrowed above, nearly filiform at the anthers, these oblong; carpels 2 or rarely 1.

Fruit greenish or probably yellowish or whitish at full maturity, globose or subglobose, 1.8-2.0 cm. wide, 1.7-2.0 cm. high; epicarp not tessellate; mesocarp whitish, ca. 1.5-2 mm. thick when fresh; seed depressed-globose, ca. 1.6 cm. wide, 1.3 cm. high, the seed coat thickened and slightly intruded on either side of the hilum; embryo in lower third; germination remote-tubular with 1 scale leaf and bifid eophyll.

Vernacular name: *noli* fide Archer, but this name is elsewhere applied to *Elaeis oleifera* fide Dugand; *quitasol* but this name also used for *Mauritia* (cf. Dugand) and probably other fan palms.

Distribution and ecology: western Colombia at elevations near sea level as an undergrowth palm in low rainforest, usually on slopes.

Uses: according to Archer, local Amerindians make pillows from the indument of sheath and petiole base.

Specimens examined:

COLOMBIA. DEPT. CHOCÓ: headwaters of the Río Tutunendo, east of Quibdó, May, 1931, *W. A. Archer 2199* (US, holotype). DEPT. VALLE: Buenaventura, 23 May 1926, *O. F. Cook 132* (US); 26 May 1926, *O. F. Cook 146* (US); 29 May 1926, *O. F. Cook 158* (US); forests in concession of Cartón Colombia, Baja Calima region, north of Buenaventura,

0-50 m. alt., 10 Feb. 1967, *H. E. Moore, Jr., M. V. Parthasarathy & Pablo Orjuela 9458* (BH, CALI); forested slopes in Cartón Colombia concession, near Río San Joaquín, Baja Calima region, north of Buenaventura, alt. 0-50 m., 24 Nov. 1971, *H. E. Moore, Jr. & M. Gutiérrez 9999* (BH, CALI). Another collection cited by Dugand has not been seen—Dept. Valle: Río Calima, La Trojita, 5-50 m. alt., 19 Feb.-10 Mar. 1944, *J. Cuatrecasas 16702* (COL).

Fresh flowers of other species of *Chelyocarpus* have been available for study but for *C. dianeurus* only those of the type have been seen. These are blackened and leave much to be desired in the way of analysis. Fruits collected in late November, 1971, and distributed through the seed bank of The Palm Society were greenish and perhaps had not achieved their fully mature color but seeds began to germinate at Cornell University in late March, 1972.

Chelyocarpus dianeurus and *C. ulei* are very similar in aspect but are clearly different in flower and fruit. The normally tetramerous flowers readily distinguish *C. dianeurus* from all other palms.

Chelyocarpus ulei Dammer, Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem 7: 395. 15 Jan. 1920; Burret, *op. cit.* 10: 395. 1 Dec. 1928, *op. cit.* 12: 151. 31 Dec. 1934; Macbride, Field Museum of Natural History, Botanical Series 13: 331. 1960. (Fig. 1, 6-12A). Type: *Ule 5885* (B).

Tessmanniophoenix longibracteata Burret, Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem 10: 398. 1 Dec. 1928; *op. cit.* 11: 315. 30 Mar. 1932; Macbride, Field Museum of Natural History, Botanical Series 13: 332. 1960.

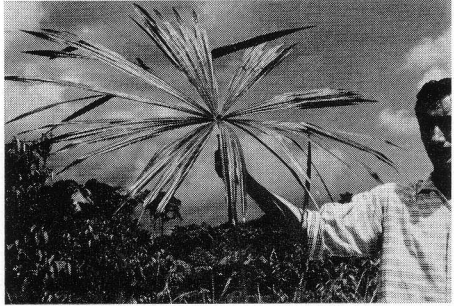
Type: *Weberbauer 6765* (B, destroyed, F, lectotype).



6. *Chelyocarpus ulei* with inflorescence in forest at Aucayacu, Peru (Moore & Salazar 9494).

Trunk gray, to ca. 9 m. high, 7.5 cm. in diam., more or less prominently ringed with obscure scars.

Leaves 10–15; sheath ca. 4.5 dm. long, densely pale-brown appressed-villous; petiole to 1.35 m. long, 1.5 cm. wide, brown furfuraceous-lepidote becoming glabrate; hastula deltoid with incurved margins, 1–2 cm. long, 1.5 cm. wide; blade green above, silvery below, 0.65–1.2 m. long, 1.3–1.4 m. wide, divided centrally to within 1–3 cm. of the base, laterally divided into 5–7 (–8) elongate-cuneate many-ribbed segments 0.35–1.2 m. long, 6.8–35 cm. wide, each again divided into 3–8 acute or very briefly bifid 1-ribbed segments 8–21 cm. long, 2.5–5.8 cm. wide, the segments with midrib, 3 lateral secondary nerves and many tertiary nerves on each side prominent below, flexuous cross-veinlets numerous and prominent above, lower



7. Leaf of *Chelyocarpus ulei* held by Ing. Salazar near Aguaytía, Peru (Moore, Salazar & Smith 8379).

surface with a continuous layer of pale membranous scales.

Inflorescences pendulous, pale yellow at anthesis, to 1.13 m. long; peduncle flattened, brown-tomentose or becoming glabrate, bearing an ancipitous, brown-tomentose-margined prophyll to 3 dm. long inserted ca. 8 cm. above the base, 2 brown-tomentose sterile bracts ca. 3 dm. long and 2.8 dm. long inserted ca. 1.8 dm. and 1.3 dm. higher respectively, and a fourth open sterile bract ca. 1.5 dm. long at base of rachis; rachis to 4.6 dm. long, flattened, pale-brown floccose-tomentose at anthesis; rachillae floccose-tomentose, slender, numerous, to ca. 1.9 dm. long, each subtended by a very narrowly triangular membranous fertile bract, the lowest to ca. 8.5 cm. long, rachillae variously adnate to rachis above when simple or the lower ones subfasciculate or fasciate on very short branches.

Flowers pale yellow or creamy turning black, scented of fishmeal or burning rubber, 4–5 mm. long, each subtended by a linear bract usually as long as or longer than the flower; sepals 2, ca. 3 mm. long; petals 2, distinct, ca. 2.5 mm. long; stamens 5–8 often 7, most filaments broad and thick basally, tapered to the exerted anthers; carpels 2, ca. 1.5 mm. long, included.



8. Inflorescence of *Chelyocarpus ulei* with prophyll and two sterile bracts (Moore & Salazar 9494).



9. Another inflorescence of *Chelyocarpus ulei* from the same tree as Fig. 8 but flowers at full anthesis.

Fruit globose, ca. 2.5 cm. in diam. when fresh, 1.8–2.1 cm. in diam. when dry, brown, corky-tessellate; mesocarp dry, whitish, ca. 5 mm. thick; seed globose, ca. 13 mm. high, 14 mm. wide; embryo above the middle.

Vernacular names: *uchpapanga* fide Burret (1928).

Distribution and ecology: eastern Peru, western Brazil, in rainforest at 200–550 m. alt.

Chromosome complement: $n=18$ (Read & Moore, 1967).

Specimens examined:

BRASIL, near Belém, Rio Juruá Miry, Sept. 1901, *Ule* 5885 (B). PERU. DEPT. LORETO: Prov. Coronel Portillo; on wooded slopes 6–8 kms. beyond Aguatía on road to San Alejandro (Tingo Maria-Pucallpa highway), alt. ca. 300 m., 29 Apr. 1960, *H. E. Moore, Jr., Adolfo Salazar C. & Earl E. Smith* 8379 (BH, USM). DEPT. HUANUCO: Río Pozuzo, 200–300 m., 1909–1914, *A. Weberbauer* 6765

(B, holotype of *Tessmanniophoenix longibracteata*, destroyed, F, lectotype). Prov. Leoncio Prado; Distr. Crespo Castillo, bosque humedo tropical, Aucayacu, alt. ca. 500 m., 10 Mar. and 6 May 1964, *E. Vasquez A. s. n.* (BH); 5 Sept. 1967, *A. Salazar C.* 401 (BH); Campamento de UTCF, Aucayacu, 1 Mar. 1967, *H. E. Moore, Jr. & A. Salazar C.* 9494 (BH, USM). CULTIVATED. Botanic Garden, Museu Emilio Goeldi, Belém, Pará, Brazil: 22 Aug. 1912, *J. Huber* 12179 (BH, photo); 8 Nov. 1946, *L. H. Bailey* 326 (BH); 1 June 1963, *Museu Goeldi* 329.0–6 (BH); 20 Mar. 1967, *H. E. Moore, Jr.* 9548 (BH).

The type of *Chelyocarpus ulei*, first associated with *Acanthorrhiza chuco* (Dammer, 1907), had a leaf smaller than usual for the genus. It may have been taken from a juvenile plant (the petiole was described as 5–7 mm. wide and 3 mm. thick—I have seen none less than 1.5 cm. wide) but appears to have been destroyed. Two inflorescences and fruits from the type, however, are still extant



10. A fruit cluster of *Chelyocarpus ulei* from cultivation at Museu Goeldi, Belém, Brazil. Note the tessellate fruit from which the genus gets its name (Moore 9548).

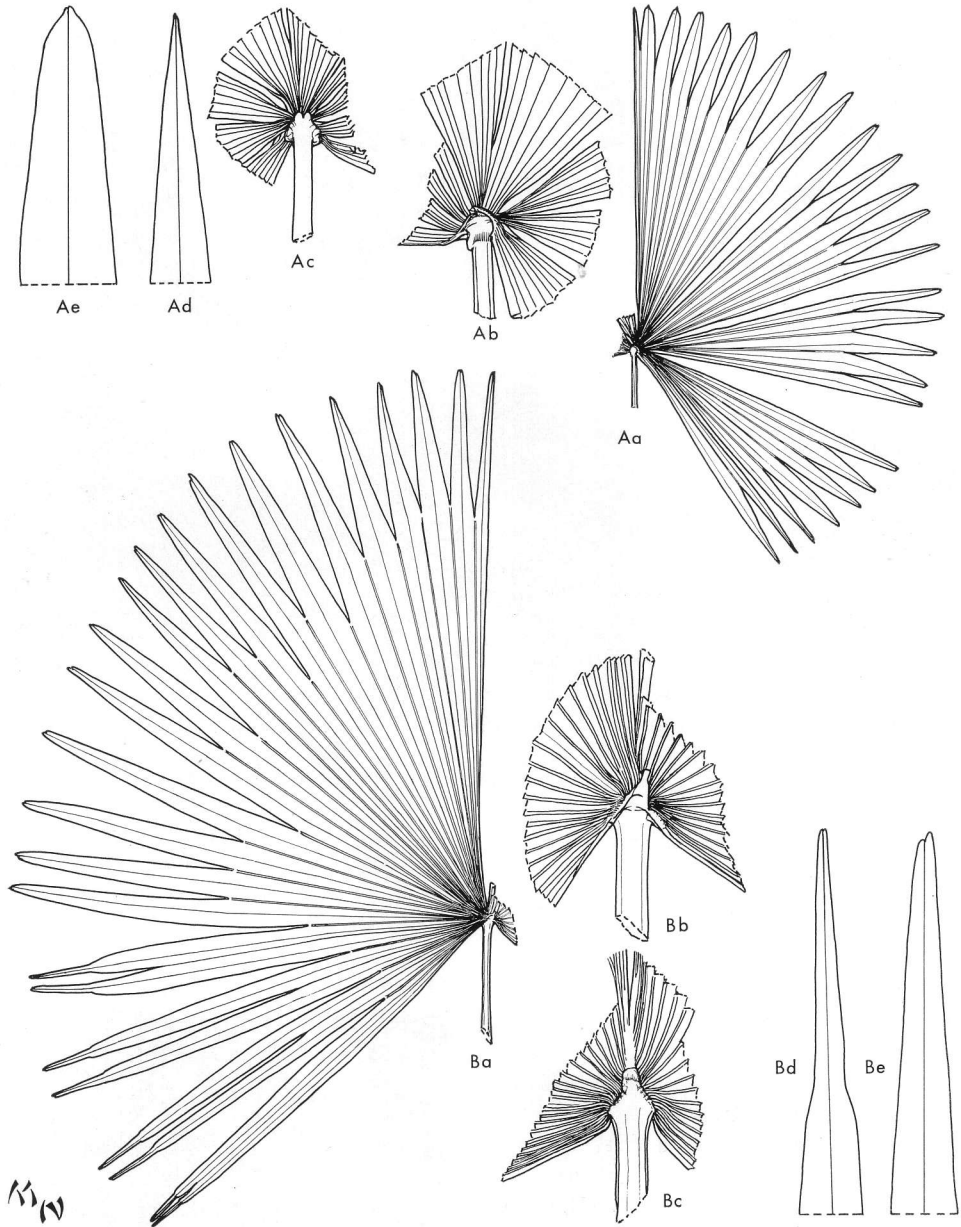
at Berlin and through the kindness of Prof. Dr. Eva Potzta were located and forwarded on loan. I have compared these with other materials cited here and find no difference. The fruits match recent materials from Peru and the tomentum and prominent stubs of bracts below the floral scars of the type are similar to those on Peruvian materials of comparable condition.

Tessmanniophoenix was first distinguished from *Chelyocarpus* because of its supposedly smooth fruit (Burret, 1928, 1934), but Burret later (1941) associated its lectotype, *T. longibracteata* from Peru, with *Chelyocarpus*. He neither transferred *T. longibracteata* as a species nor clearly indicated its identity with *C. ulei*. The implicit association with the last can now be made explicit

and because the holotype of *T. longibracteata*, once at Berlin, has been destroyed, I have designated an isotype at the Field Museum of Natural History as lectotype.

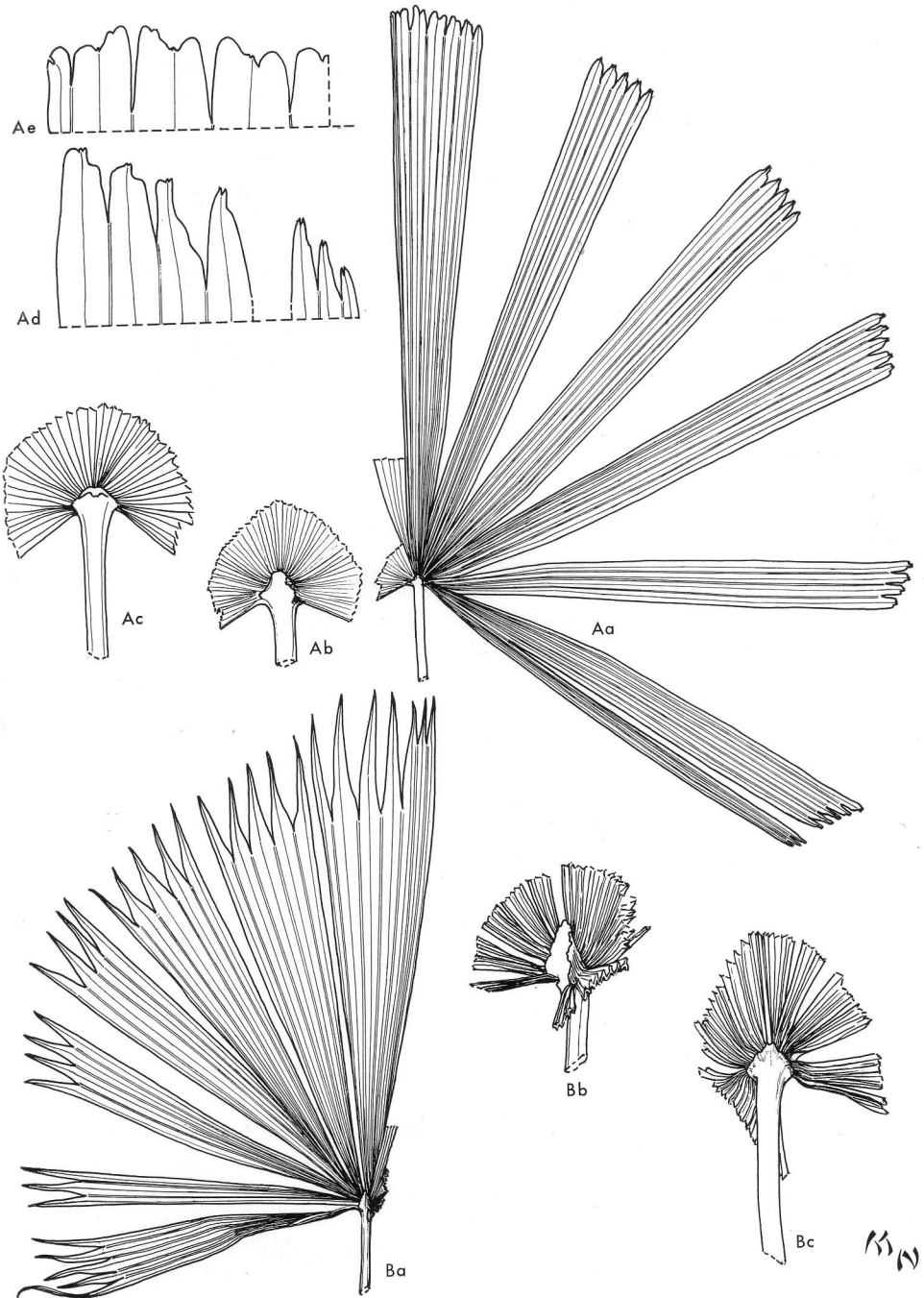


11. A young plant of *Chelyocarpus ulei* about five years old cultivated at Cornell University from seed of Moore 9548.



12. Leaves of *Chelyocarpus*. A, *C. ulei*: Aa, blade with one half cut away $\times 1/15$; Ab, hastula $\times 1/3$; Ac, dorsal crest $\times 1/3$; Ad, Ae, tips of segments $\times 1/3$. From Moore 9548 (BH). B, *C. chuco*: Ba, blade with one half cut away $\times 1/15$; Bb, hastula $\times 1/3$; Bc, dorsal crest $\times 1/3$; Bd, Be, tips of segments $\times 1/3$. From Moore 9549 (BH).

13. Leaves of *Chelyocarpus* and *Itaya*. A, *Itaya amicomum*: Aa, blade with one half cut away $\times 1/15$; Ab, hastula $\times 1/3$; Ac, dorsal crest $\times 1/3$; Ad, tips of segments at base of leaf $\times 1/3$; Ae, tips of



segments at center of leaf $\times 1/3$. From Moore, Salazar & Gutiérrez 9509 (BH). B, *Chelyocarpus dianeurus*: Ba, blade with one half cut away $\times 1/15$; Bb, hastula $\times 1/3$; Bc, dorsal crest $\times 1/3$. From Moore & Gutiérrez 9999 (BH).

Plants of *Chelyocarpus ulei* cultivated at the Museu Goeldi may, in fact, have come from a Peruvian source rather than from Brazil. I have seen a photograph of a specimen (*Huber 12179*) made at the garden there in 1912 and labelled with the manuscript name "*Acanthorrhiza ucalina*" which seems to be *C. ulei*.

Chelyocarpus ulei is apparently unique among palms in its usually dimerous perianth. Exceptional flowers do occur, as Burret noted, with five or six perianth parts. Stamens may also vary as may carpels. The normal pattern, however, is one of a stamen opposite each sepal, two or three opposite each petal. The development of the corky-tessellate fruit coat has not been worked out but it probably follows much the pattern for *Johannesteijsmannia* studied by Dransfield (1970). The prominent bracts subtending the flowers are also distinctive.

DOUBTFUL SPECIES

Chelyocarpus wallisii Burret, Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem 10: 396. 1 Dec. 1928.
T.: *Wallis* s. n. (B, seeds only, destroyed).

Acanthorrhiza wallisii H. Wendland ex Regel, Gartenflora 28: 163, t. 977, fig. 2 1872 ('*Acanthorrhiza*') *nomen nudum*; Drude in Martius, Flora Brasiliensis 3(2): 554. 1 Mai 1882 *nomen nudum*; Beccari, Webbia 2: 242. 1907 *nomen nudum*.

Tessmanniophoenix wallisii Burret, Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem 10: 397. 1928 *nomen provisorium*.

This species was based on five seeds once in the herbarium at Berlin and thought to have been collected by Wallis

in Colombia or Ecuador. Burret associated these seeds with a palm figured in very stylized fashion without description or diagnostic details in 1872 under the name *Acanthorrhiza wallisii*, which must be taken as a *nomen nudum*. The later description of the seeds, though sufficient to validate the name *Chelyocarpus wallisii*, is not sufficient to associate the name clearly with any species of the genus and the seeds themselves were lost during World War II. The name should therefore be ignored now and in the future.

Cryosophila

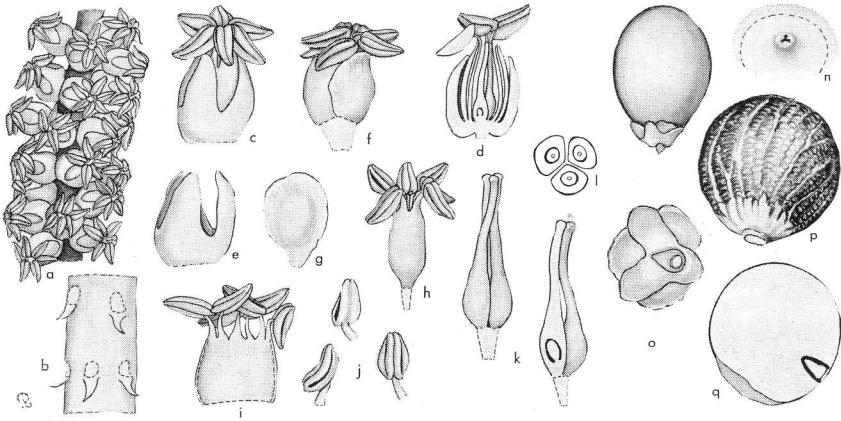
Cryosophila Blume, Rumphia 2: 53. 1838-39 ('1836'). (Fig. 14).
Type: *Corypha nana* Humboldt, Bonpland & Kunth.

Acanthorrhiza H. Wendland, Gartenflora 18: 241. July. 1869.
Type: *A. aculeata* (Liebmann) H. Wendland.

Solitary, hermaphroditic palms of moderate size, the trunk armed with often branched root-spines, slender, prickly stilt roots sometimes developed.

Leaves numerous in a spreading crown, induplicate palmate, flabelliform; sheath fibrous, densely floccose-tomentose, splitting opposite the petiole and persisting as fibrous margins on the bases of petioles and at length fraying into slender elongate fibers at the apex; petiole elongate, unarmed, rounded below, channelled above and with margins sharp throughout their length, terminating adaxially in a small, deltoid, elevated hastula dorsally plicately grooved, and abaxially in a narrow margin; rachis not developed; blade flat, thin, divided centrally to or nearly to the base (except in *C. williamsii*?), each half deeply divided into elongate-cuneate many-ribbed segments, these

Cryosophila



14. *Cryosophila argentea* (a-l) and *C. nana* (m-q). a, portion of rachilla $\times 2$; b, portion of rachilla showing floral scars and bracteoles $\times 4$; c, flower $\times 4$; d, flower in vertical section $\times 4$; e, calyx $\times 4$; f, flower, calyx removed $\times 4$; g, petal $\times 4$; h, androecium $\times 4$; i, androecium expanded, interior view $\times 4$; j, anthers in three views $\times 4$; k, gynoeceum, external view (left) and in vertical section (right) $\times 8$; l, carpels in cross-section $\times 8$; m, fruit $\times 1$; n, apex of fruit $\times 8$; o, base of fruit $\times 4$; p, seed $\times 2$; q, seed in vertical section $\times 2$. a-l from material of *Read 689* preserved in liquid, m-q from dried material of *McVaugh 900*.

again divided into 2 or more acute or briefly bifid 1-ribbed segments.

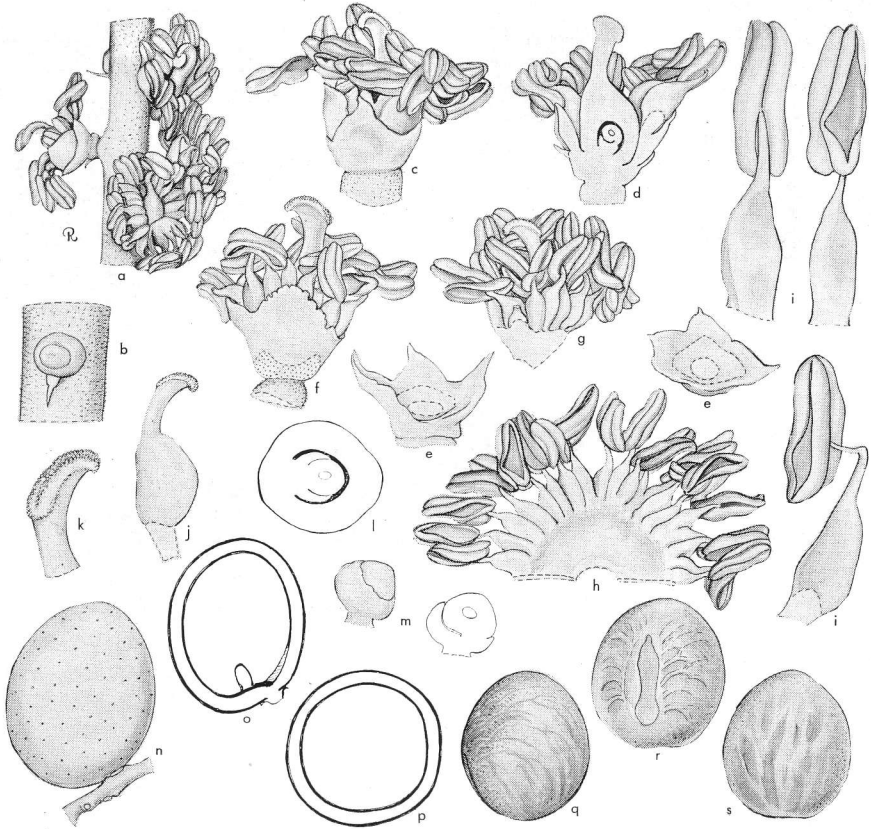
Inflorescences interfoliar, arcuate or pendulous; peduncle bearing a prophyll near the base and at intervals 4 (or more?) tomentose sterile bracts with tubular base and cochleariform blade; rachis somewhat angled, with several to many recurved, once-branched primary branches, only the lower or all (in *C. guagara*) subtended by prominent fertile bracts like those of the peduncle but progressively smaller, or the upper ones with reduced bracts only, primary branches usually with obvious, not or only slightly adnate, peduncular base and rachis, but rarely (*C. cookii*) the peduncle and rachis not evident and rachillae fastigiately grouped along the rachis; rachillae little or not adnate above an acute subtending bract.

Flowers perfect, borne singly in a spiral along the rachillae on brief pedicels each subtended by a small, acute bract;

sepals 3, narrowly ovate to deltoid, briefly connate basally; petals 3, imbricate, rounded at apex, scarcely longer than sepals; stamens 6, filaments flat, connate basally in a tube one-half their length or more, then distinct and strap-shaped or subulate, anthers exerted and spreading at an angle of 90° , dorsifixed near the base, briefly bifid at base and apex, dehiscent laterally by longitudinal slits; carpels 3, distinct, only one usually developing into a fruit, styles elongate, exerted, stigma scarcely expanded, ovule campylotropous with a small aril on the funicle, inserted adaxially at the base.

Fruit white at maturity, with terminal stigmatic residue; epicarp smooth; mesocarp somewhat fleshy; endocarp membranous; seed globose, not adherent to the endocarp, with round basal hilum, raphe-branches impressed, ascending and anastomosing from the base; endosperm homogeneous with slight intrusion of

Itaya



15. *Itaya amicornum*. a, portion of rachilla $\times 2$; b, pedicel and bract $\times 4$; c, flower $\times 4$; d, flower in vertical section $\times 4$; e, calyx $\times 4$; f, flower, calyx removed $\times 4$; g, flower, perianth removed $\times 4$; h, androecium expanded, interior view $\times 4$; i, stamens in three views $\times 8$; j, pistil $\times 4$; k, stigma $\times 8$; l, ovary in cross-section $\times 8$; m, ovule in lateral view and vertical section $\times 8$; n, fruit $\times 1$; o, fruit in vertical section $\times 1$; p, fruit in cross-section $\times 1$; q, r, seed in lateral, rapheal, and antirapheal views $\times 1$. a-m from material of Moore, Salazar & Gutiérrez 9509, n-s from material of Gutiérrez 1940, both preserved in liquid.

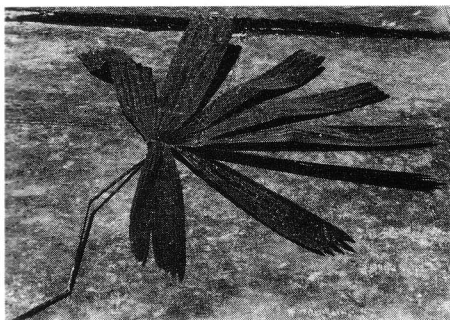
seed coat adaxially at the base, embryo lateral at or below the middle.

Distribution and ecology: eight or fewer species of western Mexico to northern Colombia at moderate to low elevations in dry woods (*C. nana*) to rainforest.

Anatomical features: central vascular bundles of petiole with a single phloem strand (Parthasarathy, 1968). See Tomlinson (1961) and Uhl (1972b)

for vegetative anatomy, and Uhl (1972a) for floral anatomy.

The species of *Cryosophila* are eight or fewer and in need of detailed study in the field. Most herbarium material is completely inadequate for drawing distinctions among species such as have been drawn among those of *Chelyocarpus*, though admittedly the genus is more uniform. A generic description is included here to complete the trio



16. A leaf of *Itaya amicornum* removed from plant press for photography after folding (Moore, Salazar & Smith 8447).



17. An inflorescence of *Itaya amicornum*. Note split petiole base immediately at left of tape measure and bracts of another inflorescence at left. The pinnate leaf in the background is from a *Scheelea* (Moore, Salazar & Gutiérrez 9509).

composing the *Chelyocarpus* alliance. Habit, leaf, inflorescence, flowers, and fruit have been illustrated photographically by Allen (1953) and Bartlett (1935). The root-spines on the trunk are unique among palms and the androecium is distinctive. A possibly specialized mode of pollination is suggested by the arrangement of anthers at anthesis. In general, *Cryosophila* seems to be more advanced than *Chelyocarpus*, less so than *Itaya*.

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

Palma solitaria hermaphrodita foliis induplicatis flabelliformibus ad 3/4 bipartitis lateraliter in 4-7 segmenta elongato-cuneata partitis. Inflorescentiae interfoliatae bracteis sterilibus 5 ramis 6-7. Flores bisexuales sepalis 3 et petalis 3 ad medium connatis, staminibus 18-24, carpello 1. Fructus stigmatibus terminalibus, seminis endospermio homogoneo embryo prope basin sito.

Solitary, unarmed, hermaphroditic palms of moderate size, the trunks with smooth cortex (drying roughened), naked except for fibrous residual sheaths below the crown.

Leaves numerous in a spreading crown, induplicately palmate, flabelliform; sheaths short, split opposite the petiole

and persisting as fibrous margins on the bases of the petioles and at length fraying into slender elongate fibers at the apex; petioles elongate, unarmed, the bases prominently split, more or less long-persistent in a latticework effect below the crown, rounded below and channelled above, basally becoming bi-convex and rhomboid in section distally with obtuse margins, terminating adaxially in a small, deltoid, elevated hastula basally plicately grooved, and abaxially in a narrow deltoid margin; rachis not developed; blade flat, thin, three-fourths orbicular in outline, the segments circumscribing an arc of about 270°, divided about three-fourths to the base at the middle, each half again deeply divided into several (4-7) elongate-cuneate, 4-7-ribbed segments, these very shallowly divided apically into briefly bifid 1-ribbed segments.

Inflorescences several, interfoliar, elongate, arcuate; peduncle terete, bearing a bicarinate abaxially split prophyll and ca. 5 chartaceous, persistent, and at length marcescent sterile bracts with tubular bases and inflated acute apices split on one side; primary branches

6-7, each subtended by a persistent and at length marcescent fertile bract similar to the sterile bracts but progressively smaller and the uppermost scarcely tubular at the base, branches more or less flattened, adnate to the rachis often nearly to the succeeding bract, the lower branches again twice- to once-branched, the upper ones once-branched into slender slightly sinuous rachillae, each rachilla subtended by a linear acute bract.

Flowers perfect, borne singly in a spiral along the rachillae, each on a very short pedicel subtended by a small acute bract; sepals 3, connate in an acutely 3-lobed cupular calyx; petals 3, connate about half their length in a 3-lobed corolla, the lobes rounded and erect at anthesis, probably valvate in bud, stamens 18-24, one or two opposite each sepal, remainder opposite petals, filaments connate basally in a fleshy tube less than half their length, slightly adnate to corolla basally, fleshy and more or less subulate above, anthers oblong in outline, dorsifixed at the middle, versatile, laterally dehiscent by longitudinal slits, exerted at anthesis, bifid at apex and base, carpel 1, excentrically ovoid, narrowed to a slender curved style and oblique papillose stigma, ovule hemianatropous, attached adaxially at the base, the short funicle bearing a prominent oblique aril.

Fruit oblong-ovoid or subglobose with excentrically apical stigmatic residue; epicarp minutely granular-roughened and irregularly beset with minute perforations; exocarp ca. 0.5 mm. thick with sclerosomes; mesocarp ca. 1 mm. thick, white, dry, with anastomosing fibers; endocarp not discrete: seed oblong-ovoid; hilum ellipsoid, subbasal, raphe-branches ascending-spreading; endosperm homogeneous; embryo excentrically basal; germination not known; seedling with undivided, elliptic eophylls.

Type: *Itaya amicorum* H. E. Moore.
 Distribution: Peru, in seasonal rain-forest at low elevations.
 Chromosome complement: unknown.
 Anatomical features:

Central vascular bundles of the petiole with two phloem strands; late metaxylem elements with simple perforation plates and often a characteristic ligule (Larry Klotz, personal communication).

Foliar and floral anatomy—see Uhl, 1972a & b.

Itaya amicorum H. E. Moore, *sp. nov.*
 (Fig. 13A, 15-17).

Caulis ad 5 m. altus foliis 12-20 ad 1.25 m. longis 2 m. latis. Inflorescentia ad 1.25 m. longa. Flores 3 mm. alti. Fructus 2.4 cm. longus.

Trunk to 5 m. high, 9 cm. in diam., gray.

Leaves ca. 12-20, spreading from ascending petioles; sheath ca. 5 dm. long, densely light-brown floccose-tomentose; petiole ca. 2.6 m. long above sheath, brown-furfuraceous basally, minutely deciduous-floccose distally, 1.3-1.4 cm. wide, 7 mm. thick at apex; hastula ca. 1 cm. high, 1.5 cm. wide; blades to 1.25 m. long at middle, 2 m. wide, segments 4-7 on each side, to 1.25 m. long, 9-20 cm. wide at apex, again divided 1-7 cm. deep into segments 0.5-3 cm. wide and bifid to 3-10 mm., upper surface glossy when dry with numerous prominent cross-veinlets, lower surface densely appressed white-tomentose, the principal nerves conspicuously elevated, tomentose or glabrescent, secondary nerves few, not elevated, cross-veinlets evident.

Inflorescence to 1.25 m. long or more, creamy white with brownish bracts at anthesis; peduncle to 2.3 cm. wide near base; prophyll (on a smaller inflorescence) ca. 14 cm. or more long, 2.5 cm. wide, peduncular bracts to ca. 6 dm.

long, 5 cm. wide, split ca. 10 cm. from apex, upper bracts ca. 10 cm. long, all densely pale-brown floccose-tomentose at first, outside fibers longitudinal and dense, inner fibers obliquely transverse, the bracts at length fraying into masses of longitudinal fibers; lower branches to 5 dm. long, pale puberulous, rachillae to 12 cm. or more long, puberulous.

Flowers ca. 3 mm. high when dry, sepals 1.5–2 mm. high, petals ca. 2 mm. high, stamens and style exserted.

Fruit (from *Gutiérrez R. 194*) said to be whitish when ripe, 2.4 cm. long, 2.2 cm. in diam. when fresh but perhaps not completely mature; seed 1.8 mm. high, 1.5–1.6 mm. wide and broad.

Vernacular name: *falso bombonaje*, *sacha bombonaje* (fide *Gutiérrez R.*)

Specimens examined:

PERU. DEPT. LORETO: Prov. Maynas; in forest on trail to Omaguas beyond landing on Río Itaya at Varadero de Omaguas, 13 May 1960, *H. E. Moore, Jr., Adolfo Salazar C. & Earl E. Smith 8447* (BH, USM); Río Itaya, Fundo Ciudadilla, alt. 150 m., 17 Feb. 1965, *Abelardo Gutiérrez Ruíz 194 AGR* (BH); Río Itaya, on Varadero de Omaguas from Fundo Ciudadilla, about 2 1/2 hours by 40 H. P. speedboat from Iquitos, 150 m. alt., 5 Mar. 1967, *H. E. Moore, Jr., A. Salazar C. & A. Gutiérrez R. 9509* (BH, holotype, USM, isotype).

I have taken the name for this genus from the river near which it grows and the epithet from the spirit of the program under which I first encountered it and for my associates in Peru.

Itaya appears to be most closely related to *Chelyocarpus* and *Cryosophila* with which it has been contrasted in the key. It is, however, more specialized than either in the connation and adnation of sepals and petals, in its numerous stamens, in its uncarpellate gynoecium, and in the presence of two phloem strands in central vascular bundles of the petiole. The split in the petiole base

has been commented upon for *Thrinax* by Read (1967). It is an immediately recognizable field difference but one which often cannot be discerned from herbarium material which usually lacks leaf bases. In this feature, *Chelyocarpus* and *Cryosophila* are to *Itaya* as *Coccothrinax* and *Zombia* are to *Thrinax*.

Four fruits near maturity were obtained and forwarded for study by Ing. Gutiérrez R. to whom special thanks are due. They have an epicarp which is marked by numerous apparently natural openings but which is never fractured as in *Chelyocarpus ulei*.

Itaya amicum is thus far known only from the type locality. It is a promising horticultural subject on account of its large and handsome leaves much resembling those of some *Licuala* species, its moderate stature, and its creamy-white inflorescences and flowers. As yet, the species has not been introduced into cultivation.

ACKNOWLEDGMENTS

I first encountered *Chelyocarpus ulei* and *Itaya amicum* during the course of a reconnaissance survey of palms in eastern Peru with Ing. Adolfo Salazar C., then with the Programa Co-operativa para el Desarrollo Forestal del Perú, and Dr. Earl E. Smith, then Forestry Adviser, Agricultural Division, United States Operation Mission to Peru, International Cooperation Administration. The reconnaissance was sponsored by the Agriculture Division, USOM/PERU, ICA. A second field encounter with these two genera in 1967 and subsequent work has been supported largely by National Science Foundation grants GB-3528, GB-7758, and GB-20348X. I am indebted to the John Simon Guggenheim Memorial Foundation for the privilege of studying the type of *Thrinax chuco* in 1955. I am also indebted to Dr. A. Lowalree at Bruxelles, to Dr. Alicia Lourteig at Paris, and

Dr. Eva Potzta at Berlin for their assistance in searching for types.

Ing. Flavio Bazan, then Director General of the Servicio Forestal y de Caza of the Ministerio de Agricultura for Peru, and my project companions organized a memorable field experience in 1960. Ing. Bazan and Ing. Salazar, now Dean of the Facultad de Ciencias Forestales, Universidad Agraria, La Molina, Peru, and personnel of the Servicio Forestal greatly facilitated field work in 1967. My indebtedness to my Peruvian friends is expressed in a small way in the epithet used in *Itaya*.

LITERATURE CITED

- ALLEN, P. 1953. Two new fan palms from Central America. *Ceiba* 3: 173-178, fig. 1-5.
- BARTLETT, H. H. 1935. Various Palmae Corypheaee of Central America and Mexico. Carnegie Institution of Washington Publication 461: 27-41, plate 1-12.
- BURRET, M. 1928. Die Palmengattungen *Chelyocarpus* Dammer und *Tessmanniophoenix* Burret nov. gen. *Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem* 10: 394-401.
- . 1932. Palmae neogaeae II. *op. cit.* 11: 499-501.
- . 1934. Palmae neogaeae VII. *op. cit.* 12: 151-159.
- . 1941. Die Palmengattung *Tessmanniodoxa* gen. nov. *op. cit.* 15: 336-338.
- DAMMER, U. 1907. Palmae. In Ule, E., Beiträge zur Flora der Hylaea nach den Sammlung von Ule's Amazonas Expedition. Verhandlungen des Botanischen Vereins der Provinz Brandenburg 48: 118-129.
- . 1920. *Chelyocarpus* Dammer nov. gen. *Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem* 7: 388-395.
- DRANSFIELD, J. 1970. Studies in the Malayan palms *Eugeissona* and *Johannesteijsmannia*. Ph.D. Thesis, Cambridge University, Cambridge, England, i-xvii, 1-242.
- HAFFER, J. 1969. Speciation in Amazonian forest birds. *Science* 165: 131-137.
- MURRAY, S. G. 1971. The developmental anatomy of certain palm fruits. Ph. D. Thesis, Cornell University, Ithaca, New York, i-vi, 1-193.
- PARTHASARATHY, M. V. 1968. Observations on metaphloem in the vegetative parts of palms. *American Journal of Botany* 55: 1140-1168.
- READ, R. W. 1965. Chromosome numbers in the Coryphoideae. *Cytologia* 30: 385-391.
- . 1967. A study of *Thrinax* in Jamaica, Ph.D. Thesis, University of the West Indies, Mona Kingston, Jamaica, 1-228.
- & MOORE, H. E. JR. 1967. More chromosome counts by mail. *Principes* 11: 77.
- STAFLEU, F. A. 1967. Taxonomic literature. *Regnum Vegetabile* 52: 1-556.
- TOMLINSON, P. B. 1961. Anatomy of the Monocotyledons [Ed. C. R. Metcalfe] II. Palmae 269-271.
- UHL, N. W. 1972a. Floral anatomy of *Chelyocarpus*, *Cryosophila*, and *Itaya* (Palmae). *Principes* 16: 89-100.
- . 1972b. Leaf anatomy in the *Chelyocarpus* alliance. *Principes* 16: 101-110.
- URBAN, I. 1906. Vitae itineraque collectorum botanicorum. In Martius, C. F. P., *Flora Brasiliensis* 1 (1): 72-74.