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ASTROCARYUM (PALMAE) IN AMAZONIA A PRELIMINARY TREATMENT

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Abstract

In the Amazon, *Astrocaryum* includes 24 species of which five belong to the subgenus *Pleiogynanthus* and 19 to the subgenus *Monogynanthus* - three in the section *Munbaca* and 16 in the section *Ayri*. A key to these 24 species is presented followed by description based on new data, and notes on their distribution, ecology, and uses. Six new species are described.

Key words: Astrocaryum, *Palmae*, *Amazonia*, *Systematics*.

ASTROCARYUM (PALMAE) EN LA AMAZONIA. TRATAMIENTO PRELIMINAR

Resumen

Astrocaryum consta de 24 especies amazónicas, 5 de las cuales pertenecen al subgénero *Pleiogynanthus* y 19 al subgénero *Monogynanthus* (3 a la sección *Munbaca*, 16 a la sección *Ayri*). Se presenta una clave para diferenciar las especies, y para cada una, su descripción con nuevos datos, así como notas sobre la distribución geográfica, la ecología, y los usos. Se describen seis especies nuevas.

Palabras claves: Astrocaryum, *Palmae*, *Amazonia*, *sistemática*.

*ASTROCARYUM (PAL*MAE) EN AMAZONIE. TRAITEMENT PRÉLIMINAIRE

Resumé

Le genre *Astrocaryum* est composé de 24 espèces amazoniennes : cinq appartiennent au sous-genre *Pleiogynanthus* et 19 au sous-genre *Monogynanthus* (3 à la section *Munbaca* et 16 à la section *Ayri*). Une clé d'identification est proposée, ainsi que la description de chaque espèce, complétée par de nouvelles observations et suivie de notes sur la distribution géographique, l'écologie et les utilisations. Six espèces nouvelles sont décrites.

Mots clés : *Astrocaryum*, Palmae, Amazonie, systématique.

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INTRODUCTION

Astrocaryum is a well-defined genus (Uhl & Dransfield, 1987). Everyone who knows something about palms can identify it without confusion, because of its large flattened spines and its blade which is white beneath. Nevertheless there is great confusion at the specific level, which we attempt to clarify in this paper. We present a key to the species, descriptions based on new observations, data on distribution, ecology, uses, and the most common vernacular names. Our objective has been to provide a practical tool which will facilitate the identification of Amazonian species.

PRESENTATION OF THE GENUS

Astrocaryum (Palmae, Arecoideae, Cocoeae, Bactridinae), with 24 native species in the Amazon basin, is the third most diversified genus in the area after *Geonoma* and *Bactris* with about 30 and 50 species, respectively. It is also the most diversified Amazonian genus with regard to life forms (Kahn & Granville, 1992) including (1) tall, large, single-stemmed, (2) tall, slender, single or multistemmed, (3) medium-sized with large leaves, single or multistemmed, or subacaulescent (i.e. with a short stem in old trees), (4) small, multistemmed palms, and (5) palms with subterranean stem and large leaves. Only three of the well known palm habits are not represented: the scandent, the small acaulescent, and the small, single-stemmed palms (Table 1).

Astrocaryum is pleonanthic and monoecious. The inflorescence is interfoliar, 1-branched with many rachillae which bear many staminate flowers on the distal part and one or a few pistillate flowers at the base. The pistillate flowers are inserted directly on rachis in several species. The leaves are pinnate. The blade is green on the adaxial side, covered with a usually whitish, sometimes golden indumentum on the abaxial side, and it is spiny at the edges. The eophyll is entire and bifid in most species.

Burret (1934) divided *Astrocaryum* into two subgenera: The subgenus *Pleiogynanthus* was defined by the presence of several pistillate flowers at the base of the rachillae, by a fruit with a smooth pericarp, and by leaves with the pinnae oriented in several directions (except for the Colombian *Astrocaryum malybo*, which does not occur in the Amazon basin). The subgenus *Monogynanthus* was defined by the presence of only one pistillate flower at the base of the rachillae, by a fruit with setose or spiny pericarp, and by leaves with pinnae regularly arranged in one plane (except for *Astrocaryum alatum*, a Costa Rican species).

The latter subgenus includes two sections: *Munbaca* and *Ayri*. The section *Munbaca* is characterized by a fruit with a dehiscent pericarp which is torn and opened like a yellow flower at maturity. The stem bears spines arranged in rings. Inflorescence is erect or pendulous. The sheaths of the dead leaves are not persistent on the stem. The section *Ayri* is characterized by a fruit with the pericarp not dehiscent at maturity and covered with spines or setae. Some species have spines on the stem but these are never arranged in complete rings. The inflorescence is always erect. Sheaths of dead leaves are persistent on the upper part of the stem or over its whole length.

Five Amazonian species belong to *Pleiogynanthus* and 19 to *Monogynanthus*. In this latter subgenus, the section *Munbaca* includes three very distinct species, and the section *Ayri* is composed of four groups of related species, totalling 16 species (Table 1).

	Life forms
Subgenus *Pleiogynanthus*	
1. *Astrocaryum acaule*	Subter.
2. *Astrocaryum aculeatum*	T.l.st.
3. *Astrocaryum chambira*	T.l.st.
4. *Astrocaryum jauari*	T.sl.mt.
5. *Astrocaryum vulgare*	T.sl.mt.
Subgenus *Monogynanthus*	
Section *Munbaca*	
6. *Astrocaryum gynacanthum*	S.mt.
7. *Astrocaryum paramaca*	Subter.
8. *Astrocaryum rodriguesii*	T.sl.st.
Section *Ayri*	
Group 1	
9. *Astrocaryum farinosum*	Subac.st.
10. *Astrocaryum sciophilum*	M.st.
11. *Astrocaryum sociale*	Subter.
Group 2	
12. *Astrocaryum ferrugineum*	M.st.
13. *Astrocaryum ciliatum*	Subac.st.
14. *Astrocaryum scopatum*	Subac.mt.
15. *Astrocaryum carnosum*	Subac.mt.
16. *Astrocaryum javarense*	Subac.st.
17. *Astrocaryum huicungo*	Subac.mt.
Group 3	
18. *Astrocaryum macrocalyx*	M.st.
19. *Astrocaryum urostachys*	M.mt.
20. *Astrocaryum perangustatum*	M.st.
21. *Astrocaryum gratum*	M.st.
Group 4	
22. *Astrocaryum chonta*	M.st.
23. *Astrocaryum murumuru*	M.mt.
24. *Astrocaryum ulei*	Subac.st

T: tall; l: large; sl: slender; M: medium-sized; S: small; st: single-stemmed; mt: multistemmed; Subter: subterranean-stemmed with large leaves; Subac: subacaulescent with large leaves.

Table 1 - *Astrocaryum* in Amazonia.

NOTES ON METHODS

The descriptions of species are based on series of specimens as far as it was possible to find enough material.

From collections made by the authors, 1-10 leaves were measured per individual in the field. The extreme values of the series are given in the description of the species.

For each inflorescence, ten staminate flowers and 20-30 pistillate flowers were measured after re-hydration; extreme mean values are presented with standard deviations when several inflorescences were sampled. When only few flowers were measured, the extreme values are given. So, in a description including series of specimens, the reader should not be surprised to find, for instance, the lower value as a mean with standard deviation corresponding to an inflorescence with many flowers measured, and the higher as two extreme values corresponding to another inflorescence with a few flowers measured. When the extreme value consists of two means with similar standard deviation, this is presented once. At least ten fruits were measured per infructescence when there was enough material; extreme values are given in the description.

Most common vernacular names used in Bolivia (B), Brazil (Br), Colombia (C), Ecuador (E), Guyana (G), French Guiana (FG), Peru (P), Surinam (S), and Venezuela (V), are presented after the description of each species and are listed in alphabetical order in table 2.

All flower descriptions and drawings have been made from re-hydrated material. This is also true for the keys using characters of pistillate flowers.

akuyuro palm (G) - *Astrocaryum aculeatum*
amana (S) - *Astrocaryum aculeatum*
awarra (FG, G) - *Astrocaryum vulgare*
awarra liba (FG, G, S) - *Astrocaryum jauari*
boegroemaka (S) - *Astrocaryum sciophilum*
chambira (C, E, P) - *Astrocaryum chambira*
chonta (B) - *Astrocaryum chonta, Astrocaryum gratum*
chonta (P) - *Astrocaryum perangustatum*
chonta de macallo (B) - *Astrocaryum gratum*
chonta loro (B) - *Astrocaryum ulei*
chonta negra (B) - *Astrocaryum gratum*
chontilla (B) - *Astrocaryum aculeatum, Astrocaryum vulgare*
chuchana (C) - *Astrocaryum macrocalyx*
chuchana (E) - *Astrocaryum urostachys*
coco (C) - *Astrocaryum ciliatum*
coco (E) - *Astrocaryum chambira*
coco peludo (C) - *Astrocaryum ciliatum*
coqueiro javari (Br) - *Astrocaryum jauari*
counana (FG) - *Astrocaryum paramaca*
cumare (C) - *Astrocaryum chambira, Astrocaryum vulgare*
cumare (V) - *Astrocaryum aculeatum, Astrocaryum vulgare*
cumare de guara (C) - *Astrocaryum ciliatum*
cuyuru palm (G) - *Astrocaryum aculeatum*
guara (C) - *Astrocaryum jauari*
huicungo (P) - *Astrocaryum carnosum, Astrocaryum chonta, Astrocaryum gratum, Astrocaryum huicungo, Astrocaryum javarense, Astrocaryum macrocalyx, Astrocaryum scopatum*

huiririrma (E, P) - *Astrocaryum jauari*
jauari (Br, FG) - *Astrocaryum jauari*
koenana (S) - *Astrocaryum paramaca*
marajá assu (Br) - *Astrocaryum gynacanthum*
mourou mourou (FG) - *Astrocaryum murumuru, Astrocaryum rodriguesii, Astrocaryum sciophilum*
munbaca (Br) - *Astrocaryum gynacanthum*
murumuru (Br) - *Astrocaryum chonta, Astrocaryum macrocalyx, Astrocaryum murumuru*
murumuru da terra firme (Br) - *Astrocaryum ferrugineum, Astrocaryum javarense, Astrocaryum rodriguesii, Astrocaryum sociale*
murumuru-iry (Br) - *Astrocaryum farinosum*
pakiramaka (S) - *Astrocaryum gynacanthum*
palha (Br) - *Astrocaryum sociale*
paramaka (S) - *Astrocaryum paramaca*
pingomaka (S) - *Astrocaryum sciophilum*
sawarai (G) - *Astrocaryum jauari*
soela-awarra (S) - *Astrocaryum jauari*
toekoemau (S) - *Astrocaryum aculeatum*
tucum assu (Br) - *Astrocaryum aculeatum*
tucum bravo (Br) - *Astrocaryum aculeatum, Astrocaryum vulgare*
tucum da serra (Br) - *Astrocaryum aculeatum*
tucum do matto (Br) - *Astrocaryum aculeatum*
tucum purupuru (Br) - *Astrocaryum aculeatum*
tucumã (Br) - *Astrocaryum aculeatum, Astrocaryum vulgare*
tucumã arara (Br) - *Astrocaryum aculeatum*
tucumã piranga (Br) - *Astrocaryum aculeatum*
tucumã piririca (Br) - *Astrocaryum aculeatum*
tucumã uassu rana (Br) - *Astrocaryum aculeatum*
tucumã-í (Br) - *Astrocaryum acaule*
tucumã-í da terra firme (Br) - *Astrocaryum acaule*
tucumã-í da várzea (Br) - *Astrocaryum acaule*
tucumou (G) - *Astrocaryum aculeatum*
warau (S) - *Astrocaryum aculeatum*
yavaide (V) - *Astrocaryum aculeatum*
yauari, yavari (C) - *Astrocaryum jauari*

B: Bolivia; Br: Brazil; C: Colombia; E: Ecuador; G: Guyana; FG: French Guiana; P: Peru; S: Surinam; V: Venezuela.

Table 2 - Most common vernacular names of *Astrocaryum* species used in Amazonia.

IDENTIFICATION OF AMAZONIAN SPECIES

Key to subgenera and sections:

1. a - Leaves ragged with pinnae oriented in several directions from rachis. Several pistillate flowers at the base of rachillae. [**I. Pleiogynanthus**]

Tall, large, single, or slender, multistemmed, or subterranean-stemmed palms. Aerial stem armed with complete rings of spines. Sheaths of dead leaves not persistent beneath the crown. Inflorescence and infructescence erect. Pericarp smooth not dehiscent at maturity.

1. b - Leaves with pinnae regularly distributed in one plane. One pistillate flower at the base of rachillae. [2]

2. a - Fruit oblong to elongato-obovate; pericarp smooth or setose in the upper third, dehiscent, open like a yellow flower at maturity. If no aerial stem, inflorescence and infructescence erect, pistillate flower with a short, spiny pedicel. If aerial stem, inflorescence and infructescence pendulous, pistillate flower with a short, spiny pedicel or inserted directly on rachis. [II. **Monogynanthus** section **Munbaca**]

Tall, slender, single-stemmed, or small, multistemmed, or subterranean-stemmed palms. Aerial stem armed with complete rings of spines. Sheath of dead leaves not persistent on the stem beneath the crown.

2. b - Fruit turbinate, depressed basally to obovate; pericarp setose to spiny, not dehiscent at maturity. Inflorescence and infructescence erect. Pistillate flower inserted directly on rachis, or on a short unarmed pedicel. [III. **Monogynanthus** section **Ayri**]

Medium-sized, single or multistemmed, subacaulescent, or subterranean-stemmed palms. Aerial stem usually not spiny, sometimes with a few groups of spines not forming complete rings. Sheaths of dead leaves persistent beneath the crown or covering the whole stem.

I. Pleiogynanthus

Key to species:

1. a - Inflorescence with rachis usually more than 30 cm long; more than 90 rachillae, each more than 25 cm long; palm with aerial stem. [2]

1. b - Inflorescence with rachis usually less than 20 cm long; less than 70 rachillae, each less than 15 cm long; palm with subterranean stem. [**1. Astrocaryum acaule**]

2. a - Staminodial ring less than 1/2 as long as corolla in pistillate flower and in perianth at fruit maturity [3]

2. b - Staminodial ring more than 2/3 as long as corolla in pistillate flower and in perianth at fruit maturity [4]

3. a - Pistillate flower with corolla cup- to cask-shaped, clearly shorter than calyx; ripe fruit 4.5-6 cm long, 3.5-4.5 cm wide; single-stemmed palm. [**2. Astrocaryum aculeatum**]

3. b - Pistillate flower with corolla ovato-urceolate, as long as calyx; ripe fruit less than 4 cm long and 3 cm wide; multistemmed palm. [**5. Astrocaryum vulgare**]

4. a - Stamens 6; corolla limb of pistillate flower turned inwards girdling the style; ripe fruit 5-7 cm long, 4.5-5 cm wide; DBH more than 25 cm; single-stemmed palm. [**3. Astrocaryum chambira**]

4. b - Stamens 9-12; corolla limb of pistillate flower not turned inwards, not girdling the style; ripe fruit less than 4.5 cm long and 3 cm wide; DBH less than 25 cm; multistemmed palm, or one stem with suckers at base. [**4. Astrocaryum jauari**]

II. Monogynanthus section **Munbaca**

Key to species:

1. a - Inflorescence and infructescence pendulous; aerial stem present. [2]

1. b - Inflorescence and infructescence erect; aerial stem absent. [**7. Astrocaryum paramaca**]

2. a - DBH more than 12 cm, stem with more than 10 cm wide rings of spines; single-stemmed palm; median pinnae more than 1m long and 6 cm wide; pistillate flower on a spiny, 2-3 cm long pedicel; calyx obclavate to urceolate, 3-dentate, more than 10 mm long; perianth in fruit armed with slightly flexuous spines. [**8. Astrocaryum rodriguesii**]

2. b - DBH less than 7 cm, stem with 1-2 cm wide rings of spines; multistemmed palm; median pinnae less than 1m long and 5 cm wide; pistillate flower inserted directly on rachis; calyx cup-shaped, 1-3 mm long; perianth in fruit armed with flattened, very flexuous spines. [**6. Astrocaryum gynacanthum**]

III. Monogynanthus section **Ayri**

Key to groups:

1. a - Median pinnae several-ribbed, plicate; apical pinnae multi-pointed (several pinnae connate together). Spines on petiole regularly arranged in linear, horizontal or oblique parallel rows. Peduncular bract spiny, erect at fruit maturity. Proximal part of rachillae hirsute (this character is unknown in *Astrocaryum farinosum*). [**group 1**]

1. b - Median pinnae one-ribbed, not plicate, apical pinnae one or multi-pointed; or median pinnae with 1-2 parallel ribs on each side of the midrib near the margins, not plicate, apical pinnae one-pointed in adult palm. Spines on petiole often in groups, usually not arranged in regularly spaced linear rows. Peduncular bract almost glabrous or covered in a fur-like tomentum in the lower part, spiny only in the upper half, pendulous along the peduncle after anthesis. Proximal part of rachillae glabrous. [2]

2. a - Calyx in pistillate flower tubular, elongato-urceolate, or cask-shaped, or obclavate, hirsute with dense, flexuous, 2-4 mm long setae. [**group 2**]

2. b - Calyx in pistillate flower cup-shaped, ovoid to pear-shaped, or urceolate, glabrous or with a few small setae, or elongato-ovoid to pear-shaped and glabrate (in this case corolla limb turned inwards girdling the base of stigmas, see Fig. 47; never the case in group 2). [3]

3. a - Calyx in pistillate flower longer than corolla, uceolate, ovoid or elongato-ovoid to pear-shaped. [**group 3**]

3. b - Calyx in pistillate flower shorter than corolla (see the flower at the base of the rachis) and cup-shaped. [**group 4**]

Group 1

Key to species:

1. a - Calyx shorter than corolla in pistillate flower; inflorescence up to 2 m long; rostrum of fruit wide basally; petiole rusty-red-tomentose basally; subacaulescent palm. [**9. Astrocaryum farinosum**]

1. b - Calyx longer than corolla in pistillate flower; inflorescence usually shorter than 1.5 m; rostrum of the fruit not very wide basally; petiole green; aerial or subterranean-stemmed palms. [2]

2. a - Fruit with strong spines, 5-12 mm long; inflorescence usually longer than 1 m; spines clearly arranged in oblique, parallel rows on lateral side of petiole; leaf usually more than 5 m long with more than 70 pinnae per side, median pinnae more than 0.9 m long and 4 cm wide; palm with aerial stem, up to 10 m high. [**10. Astrocaryum sciophilum**]

2. b - Fruit with 1-2 mm long spines; inflorescence less than 0.7 m long; spines not arranged in oblique, parallel rows on lateral sides of petiole, but ± regularly verticillate on both lateral sides and on abaxial side of petiole where they are usually longer; leaf usually less than 5 m long with less than 70 pinnae per side, median pinnae less than 0.9 m long and 4 cm wide; palm with subterranean stem [**11. Astrocaryum sociale**]

Group 2

Key to species:

1. a - Abaxial side of blade pilose with brown to rusty-red hairs. [**12. Astrocaryum ferrugineum**]

1. b - Abaxial side of blade not pilose [2]

2. a - Median pinnae with 1-2 parallel ribs on each side of the midrib near the margins; limb of corolla armed with dense spines in pistillate flower, entire, crenulate, remarkably ciliate in fruit. [**13. Astrocaryum ciliatum**]

2. b - Median pinnae one-ribbed; limb of corolla more or less ciliate, never armed with dense spines in pistillate flower, not densely ciliate, not crenulate, usually crenate to dentate, lobed or laciniate in fruit. [3]

3. a - Calyx of pistillate flower cask-shaped, wide, as long as corolla; pistillate flowers not crowded on rachis; rachillae with staminate flower thick. [**14. Astrocaryum scopatum**]

3. b - Calyx in pistillate flower tubular to cup-shaped; pistillate flowers crowded on rachis. [4]

4. a - Calyx in pistillate flower tubular, pleated at top, usually slightly longer than corolla; staminodial ring membranous, dentate, sometimes setose at margin, less than 1/3 as long as corolla; pericarp with spines of irregular size. [**15. Astrocaryum carnosum**]

4. b - Calyx in pistillate flower not clearly pleated at top, usually shorter than corolla; staminodial ring adnate, more than 1/3 as long as corolla; pericarp with setae or spines of regular size. [5]

5. a - Mesocarp not fleshy at maturity; margin of staminodial ring crenate in fruit; single-stemmed palm. [**16. Astrocaryum javarense**]

5. b - Mesocarp fleshy at maturity; margin of staminodial ring slightly crenulate in fruit; multistemmed palm. [**17. Astrocaryum huicungo**]

Group 3

Key to species:

1. a - Corolla in pistillate flower with the limb turned inwards girdling the base of stigmas; staminodial ring more than 1/3 as long as corolla; calyx ovoid, elongato-ovoid to pear-shaped, glabrous or glabrate, with limb turned inwards closely overlapping corolla. [2]
1. b - Corolla in pistillate flower with the limb not turned inwards, not girdling the base of stigmas; staminodial ring high or low in corolla; calyx ovoid, urceolate to cylindrical, glabrous or with sparse, minute setae, with limb not closely overlapping corolla. [3]
2. a - Calyx in pistillate flower glabrous, shorter than 14 mm; fruit with 3-4 mm long setae, corolla less than 20 mm at maturity; single-stemmed palm. [**18. Astrocaryum macrocalyx**]
2. b - Calyx in pistillate flower glabrate (some setae are always present), longer than 15 mm; fruit with 5-6 mm long setae, corolla longer than 23 mm at maturity; multistemmed palm. [**19. Astrocaryum urostachys**]
3. a - Calyx in pistillate flower oblong to cylindrical, glabrous; staminodial ring more than 1/3 as long as corolla, entire, or as long as corolla and laciniate; fruit very narrow at base, pericarp covered with shiny black spines, mesocarp fleshy and thin, pedicel 1-(2) cm long; blade golden and satiny beneath, median pinnae 9-11 cm wide. [**20. Astrocaryum perangustatum**]
3. b - Calyx in pistillate flower ovoid to pear-shaped, with a few minute setae; staminodial ring less than 1/3 as long as corolla or reduced to 6 teeth; fruit not very narrowed basally, pericarp sparsely black-setose, mesocarp fleshy and thick, pedicel up to 3.5 cm long; blade whitish beneath, median pinnae 5-7 cm wide. [**21. Astrocaryum gratum**]

Group 4

Key to species

1. a - Staminodial ring less than 1/3 as long as corolla in flower, membranous, entire or laciniate; single-stemmed palm. [**22. Astrocaryum chonta**]
1. b - Staminodial ring more than 1/3 as long as corolla in flower, entire [2]
2. a - Corolla in pistillate flower tubular or urceolate with limb turned outwards; calyx 1/3 to 4/5 as long as corolla; multistemmed palm. [**23. Astrocaryum murumuru**]
2. b - Corolla in pistillate flower oblong to cask-shaped; calyx less than 1/3 as long as corolla; subacaulescent palm. [**24. Astrocaryum ulei**]

DESCRIPTION OF AMAZONIAN SPECIES

1. Astrocaryum acaule Martius, Hist. Nat. Palm. 2: 78, t. 24, 63, fig. 5, 1824. (Fig. 1, 2).

Type specimen: Martius s.n., Amazonas, Brazil (M) - not seen.

Astrocaryum giganteum Barbosa Rodrigues, pro syn. (in part?), Contr. Jard. Bot. Rio de Janeiro 3: 82, t. 10C, 1902. Type specimen not designated, Pará, Brazil.

Astrocaryum luetzelburgii Burret, pro syn., Notizbl. Bot. Gart. u Mus. Berlin X: 1021, 1930. Type specimen: Luetzelburg 23045, Brazil (seen at BH).

Astrocaryum huebneri Burret, pro syn., Fedde Rep. 35, 128, 1934. Type specimen: Huebner 8, Brazil (seen at BH).

A *subterranean-stemmed* palm. *Leaves* 5-8; *sheath* 60 cm long (from ground), fibrous at margins, with black, flattened spines, up to 14 cm long and 0.7 cm wide basally; *petiole* 240-300 cm long, covered with a red-brown indumentum, spiny; *rachis* 280-360 cm long, abaxial side armed with spines in groups of 2-4; *pinnae* 80-85 per side, in groups of 2-5 oriented in several directions from the rachis; *basal pinnae* 37-60 cm long, 0.7-2.2 cm wide; *median pinnae* 69-86 cm long, 3.2-3.4 cm wide; *apical pinnae* 1 or 5-6 connate per side, 29-35 cm long, 2.2-13 cm wide. *Inflorescence* erect; *prophyll* 50-60 cm long, 3-3.5 cm wide, adaxial side brown, furfuraceous red near margins, abaxial side convex, densely setose, brown to red, edges crenate; *peduncular bract* inserted 85-90 cm from the base, 70-80 cm long, more or less acuminate, furfuraceous red-brown, armed with many or few, terete, black, 2-6 cm long spines, and sometimes many smaller spines between these; *peduncle* 100-110 cm long, section oval, 1.4 x 1.8 cm, with black spines, up to 2.5 cm long, between bract insertion and rachis, and smaller brown spines towards the base; *rachis* 12-15 cm long; *rachillae* less than 60, whitish above, furfuraceous, brown to purplish below. *Staminate flower* with *sepals* connate basally, 0.9 ± 0.1 mm long; *petals* connate in the lower third, 4.0 ± 0.3 mm long, recurved at anthesis; *stamens* 6; *anthers* 1. 6 ± 0.1 mm long; *filament* 3.1 ± 0.3 mm long; *pistillode* small, trifid. *Pistillate flower* ovoid, 8 mm long, 5-6 mm wide; *calyx* 6.2 ± 0.3 mm long, 3-dentate, ciliate at margin, whitish-tomentose, with scattered, 0.2 mm long spines; *corolla* urceolate as long as calyx, 3-dentate, whitish-tomentose, with sparse, small spines in the upper part, ciliate at margin; *staminodial ring* entire, wavy, 1.0 ± 0.2 mm long; *pistil* with sparse whitish scales, 5.6-6.2 mm long, 3 mm wide; *stigmas* 3, 2 mm long. *Fruit* obovoid, often slightly asymmetrical, 3.5-4.5 cm long with a 0.5 cm long rostrum, 2.4-2.8 cm wide; *pericarp* smooth; *mesocarp* thin; *perianth* with *corolla* 6-10 mm long, crenate to deeply lobed, *staminodial ring* 2-4 mm long, *calyx* 4-7 mm long, 4-5 lobed.

Fig. 1 - *Astrocaryum acaule* fruiting in a forest on poorly-drained soils near Manaus, Brazil.

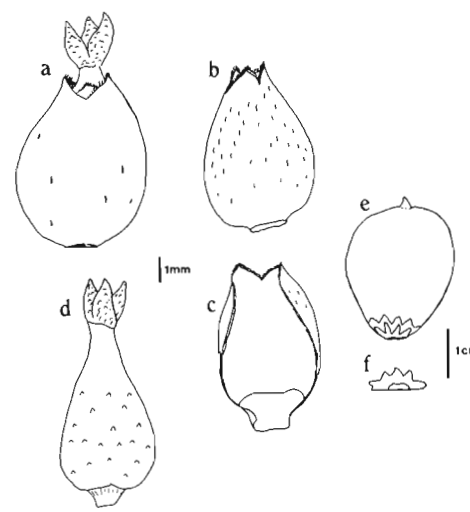

Fig. 2 - *Astrocaryum acaule* - a. pistillate flower; b. corolla; c. staminodial ring in corolla; d. pistil; e. fruit; f. perianth in fruit with staminodial ring shorter than corolla. (Material used: Castro 595, Kahn & Moussa 3221)

Specimens observed:

BRAZIL - *Castro 595* (P), 3 Dec 1983, ZF2, 45 km N of Manaus. *Coelho s.n.* (INPA), 6 Nov 1956, Manaus. *Henderson 687* (BH, K), 12 Dec 1986, Amazonas, Tarumã River near Manaus. *Henderson et al. 260* (INPA), 19 Apr 1985, 8°55'S, 61°15'W, Município Humaitá, BR 230, km 120 from Humaitá. *Henderson et al. 296* (INPA, NY), 24 Apr 1985, 7°40'S, 61°10'W, Município Novo Aripuna, BR 230, km 234 from Humaitá. *Huebner 8* (BH), 27 Aug 1928, Amazonas, Manaus, Cachoerinha. *Huebner 17* (BH), Manaus. *Janssen 421* (INPA), 7°31'S, 63°20'W, Município Humaitá, igarapé Alumínio. *Kahn & Moussa 3218, 3220* (USM), *3221* (P), 10-11 Dec 1991, ZF2, 45 km N of Manaus. *Kuhlmann 1831* (RB), 29 Jun 1924, Urupá, Tapajoz, Pará. *Luetzelburg 23045* (BH), Uaupés River, Jutica. *Moore et al. 9527* (BH, INPA), 14 Mar 1967, Amazonas, vicinity of Manaus, Tarumã River. *Nee 34884* (K), 14 Apr 1987 Rondônia, Porto Velho. *Prance et al. 20568* (INPA), 15 Mar 1974, margin of Igapó Açu at crossing with BR 319, Manaus-Porto Velho road. *Rodrigues 317* (INPA), 6 Dec 1956, Urubú River, Lindóia. *Rodrigues s.n.* (INPA), 25 Dec 1958, Roraima. *Spruce 47* (K), yr 1854. *Ule 137* (BH), Madera River. COLOMBIA - *Balick & Vargas 1197* (BH), 5 Aug 1978, Topochera, Las Gaviotas, Vichida. VENEZUELA - *Colchester 2422* (K), 4 May 1976, Amazonas, Cacún. *Putz 174* (BH), 28 Jun 1978, San Carlos de Rio Negro, Amazonas.

Distribution: In the central northern parts of the Amazon basin.

Ecology: In forests on waterlogged, white sandy soils in high density (Kahn & Castro, 1985).

Uses: The fruits of *Astrocaryum acaule* would be used as bait for fishing (Barbosa Rodrigues, 1903: 69).

Vernacular names: tucumã-í, tucumã-í da terra firme, tucumã-í da várzea (Br).

Notes: *Astrocaryum huebneri* and *Astrocaryum giganteum* are considered synonyms of *Astrocaryum acaule* because there are no clear differences in fruits (there are no flowers in collection). According to Barbosa Rodrigues' description, *Astrocaryum giganteum* differs by the corolla of the pistillate flower which is longer than the calyx. This difference is not significant because the author described aborted flowers from an old inflorescence as indicated by the absence of staminate flowers in a protogynous genus. Moreover, populations of *Astrocaryum acaule* in central Amazonia show a great variability: leaf size, leaf number in crown, and fruit number on spadix range widely in relation to light, sandy texture and hydromorphy of soils. From its description and illustration (the type specimen was not designated), *Astrocaryum giganteum* seems to refer to a mixture of *Astrocaryum acaule* and *Astrocaryum jauari*.

2. Astrocaryum aculeatum Meyer, Prim. Fl. Essq.: 266, 1818. (Fig. 3-7).

Type specimen: Rodschied s.n., Essequibo, British Guiana (?) - not seen.

Astrocaryum tucuma Martius, pro syn., Hist. Nat. Palm. 2: 77, t. 65, fig. 2, 1824. Type specimen: Martius s.n., Amazonas, Brazil (M) - not seen.

Astrocaryum aureum Grisebach, pro syn., Flora Brit. West India. 521, 1864. Type specimen: Rye s.n., Trinidad (seen at K)

Astrocaryum caudescens Barbosa Rodrigues, pro syn., Enum. Palm. Nov. 22, 1875. Type specimen not designated, TrombetasRiver, Brazil.

Astrocaryum princeps Barbosa Rodrigues, pro syn., Enum. Palm. Nov. 22, 1875. Type specimen not designated, Amazonas and Pará, Brazil.

Astrocaryum manoense Barbosa Rodrigues, pro syn., Vellosia 2: 105, t. 1, 1891. Type specimen not designated, Rio Negro, Manaus, Brazil.

Astrocaryum princeps Barbosa Rodrigues var. *aurantiacum* Barbosa Rodrigues, pro syn., Vellosia 1: 49, 1898. Type specimen not designated.

Astrocaryum princeps Barbosa Rodrigues var. *sulphureum* Barbosa Rodrigues, pro syn., Vellosia 1: 48, 1898. Type specimen not designated.

Astrocaryum princeps Barbosa Rodrigues var. *vitellinum* Barbosa Rodrigues, pro syn., Vellosia 1: 48, 1898. Type specimen not designated.

Astrocaryum princeps Barbosa Rodrigues var. *flavum* Barbosa Rodrigues, pro syn., Vellosia 1: 50, 1898. Type specimen not designated.

Astrocaryum macrocarpum Huber, pro syn., Bull. Herb. Boiss. ser. 2, 6: 271, t. 13, 1906. Type specimen: Huber s.n., Acre, Brazil (MG?) - not seen.

An *arborescent, single-stemmed* palm. *Stem* up to 25 m high, 30 cm in diameter, densely armed with black, up to 25 cm long spines. *Leaves* 8-14; *sheath* and *petiole* 160-270 cm long, strongly armed with black, slightly flattened spines; *rachis* 260-330 cm long; *pinnae* 100-120 per side, oriented in several directions; *basal pinnae* 150 cm long, 3 cm wide; *median pinnae* 100 cm long, 5 cm wide; *apical pinnae* 60 cm long, 2 cm wide. *Inflorescence* erect; *prophyll* brown-setose; *peduncular bract* inserted 60 cm from the base, 135-200 cm long, 20-22 cm wide when opened, armed with dense, black, up to 8 cm long spines; *peduncle* 90-100 cm long, section oval, 3 x 5 cm basally; *rachis* 68-70 cm; *rachillae* many, 25-40 cm long, distal part bearing staminate flowers covered with yellowish hairs. *Staminate flower* with *sepals* small, 0.9-1 mm long; *petals* 4-5 mm long, recurved at anthesis; *stamens* 6; *pistillode* small, trifid. *Pistillate flower* 15 mm long, 8 mm wide; *calyx* obclavate to urceolate, 3-dentate, 11.4 ± 0.9 mm long, with scattered, 0.2-0.4 mm long spines; *corolla* cup- to cask-shaped, 3-denticulate, 7.4 ± 0.8 mm long, green with sparse, brown, 0.2 mm long spines, margin ciliate; *staminodial ring* entire, 3.4 ± 0.6 mm. *Pistil* oblong, 7-11 mm long, 5 mm wide; *style* conoidal, 1-4 mm long; *stigmas* 3, 4 mm long. *Fruit* subglobose to ellipsoid, 4.5-6 cm long including a 0.6-1 cm long rostrum, 3.5-4.5 cm wide; *pericarp* yellowish, 1-1.5 mm thick; *mesocarp* fleshy, orange, 4 mm thick; *perianth* with *corolla* cup-shaped, crenate, 8-12 mm long, *staminodial ring* 4-6 mm long, *calyx* 3-lobed, 9-13 mm long.

Specimens observed:

BRAZIL - *Anderson 196* (INPA), 23 Sep 1975, Amazonas, Wiahanahu River, basin of Demeni River. *Edwards 2581* (K), 17 Mar 1987, Federal Territory of Roraima, ecological reserve of Maracá. *Balick et al. 922* (BH), 12 Nov 1977, Pará, Santarém-Cuyaba highway, BR 163, km 887 from Santarém. *Huebner 98* (BH), Manaus. *Kahn & Moussa 3216* (P), 10 Dec 1991, km 22 Manaus-Boa Vista road. *Moore et al. 9541* (INPA), 16 Mar 1967, km 7 Manaus-Itacoatiara road. *Nee 34831* (K), 13 Apr 1987, 10°56'S, 69°09'W, Rondônia, Município Guaiara Mirim. GUYANA - *Omawale & Persaud 126* (NY), 20 Jul 1970, Kairuni, east bank of Demerara. VENEZUELA - *Lister 168* (K), 31 Jan 1976, Amazonas, Mosquito stream on Marieta stream.

Distribution: In the eastern and central northern parts of the Amazon basin; abundant in the city of Manaus and in its outskirts where it is likely to have been introduced (Kahn & Granville, 1992).

Fig. 3 -*Astrocaryum aculeatum* - crown.

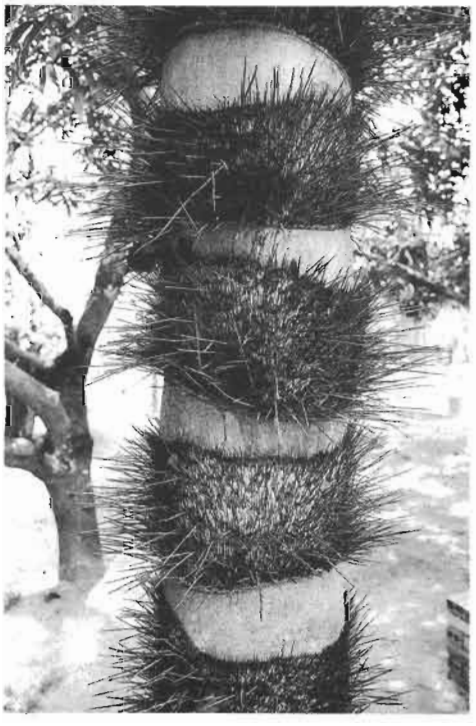

Fig. 4 -*Astrocaryum aculeatum* - spines on the stem.

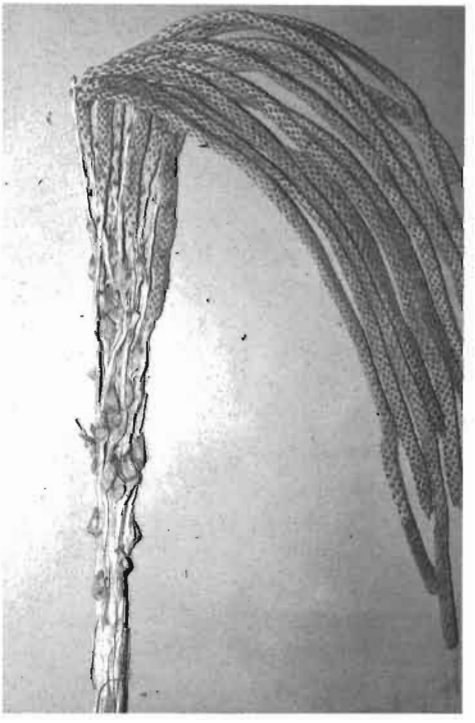

Fig. 5 - *Astrocaryum aculeatum* - inflorescence.

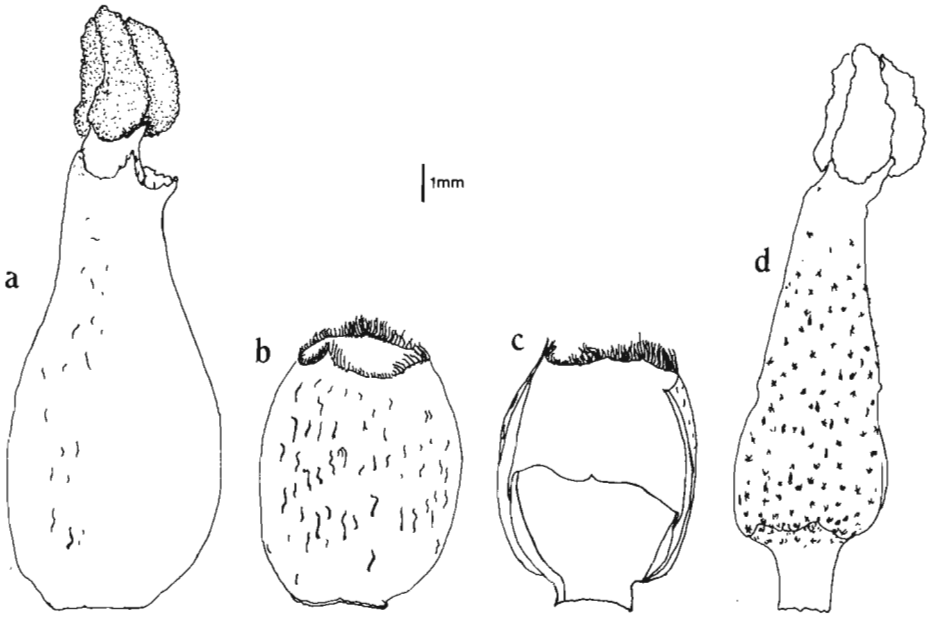

Fig. 6 - *Astrocaryum aculeatum* - a. pistillate flower; b. corolla; c. staminodial ring in corolla; d. pistil. (Material used: Kahn & Moussa 3216)

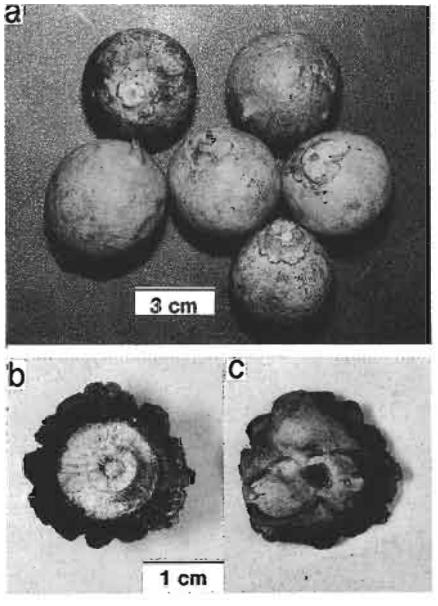

Fig. 7 - *Astrocaryum aculeatum* - a. fruits; b, c. perianth in fruit: staminodial ring shorter than corolla (b), calyx 3-lobed (c).

Ecology: In terra firme forests in low density; abundant in deforested areas.

Uses: The mesocarp of *Astrocaryum aculeatum* is eaten and fruits are sold in the streets and markets of Manaus. The pericarp is used to smoke-cure rubber (Pinheiro & Balick, 1987).

Vernacular names : akuyuro palm (G), amana (S), cumare (V), cuyuru palm (G), chontilla (B), toekoemau (S), tucum assu (Br), tucum bravo (Br), tucum da serra (Br), tucum do matto (Br), tucum purupuru (Br), tucumã (Br, V), tucumã arara (Br), tucumã piranga (Br), tucumã piririca (Br), tucumã uassu rana (Br), tucumou (G), warau (S), yavaide (V).

3. Astrocaryum chambira Burret, Fedde Rep. 35: 122, 1934. (Figs. 8-12)

Type specimen: Tessmann 5709, Iquitos, Peru (B) - not seen.

> *Astrocaryum vulgare* auct. non Martius: Wallace, Palm trees of the Amazon: 105, t. 40, 1853.
>
> *Astrocaryum aculeatum* auct. non Meyer: Galeano, Tropenbos-Colombia, vol. 1: 46, fig. 6, 1991.

A *large, single-stemmed* palm. *Stem* up to 30 m high, 25-40 cm in diameter, armed with flattened, black, up to 20 cm long spines. *Leaves* 9-16; *sheath* and *petiole* up to 3.8 m long, abaxial side glaucous, densely armed with black, 10 cm long spines; *rachis* 2.8-4.5 m long, densely armed on adaxial side with flattened, grayish to brown, 3-5 cm long spines, these longer, up to 7 cm, and less dense on abaxial side; *pinnae* 120-175 per side, oriented in several directions from the rachis, small spines on edges and on midrib prominent above; *basal pinnae* 51-150 cm long, 0.7-2.6 cm wide; *median pinnae* 119-173 cm long, 3-6 cm wide; *apical pinnae* 22-48 cm long, 0.7-5 cm wide. *Inflorescence* and *infructescence* erect; *prophyll* 0.8-1.2 m long, 17-22 cm wide, strongly flattened with margins rugged, abaxial side densely covered with small, dark, less than 2 cm long spines; *peduncular bract* up to 2.3 m long, 12-20 cm in diameter, inserted 12-30 cm from the rachis, armed with dense, small spines; *peduncle* 1.1-2.0 m long, section oval up to 12 cm wide; *rachis* 106-171 cm long; *rachillae* 130-320, 50 cm long, proximal part 18-22 cm long, with (1)-2-3-(4-5) triads, each with 1 sessile pistillate flower and 2 staminate flowers with 1-2 mm long pedicels, the upper triad often reduced to 2 staminate flowers, distal part 20-28 cm long, 0.6-0.7 cm in diameter, flavo-tomentose, with staminate flowers purplish, 1/3 immersed, densely arranged. *Staminate flower* with *sepals* connate basally 2.0 ± 0.2 mm long; *petals* oblong, connate basally, brown to purple, 6.1 ± 0.3 mm long; *stamens* 6; *anthers* linear, 3.7 ± 0.1 mm long; *filament* pink, 2.6 ± 0.5 mm long; *pistillode* trifid, ca. 1 mm long. *Pistillate flower* cylindrical, 12-22 mm long including stigmas, 10-12 mm in diameter; *calyx* urceolate to cylindrical, briefly narrowed into a 2 mm wide mouth, glabrous, unarmed, 15.6 ± 1.0 mm long, 3-dentate; *corolla* round to turbinate, 10.3 ± 0.6 mm long, 9.4 ± 0.5 mm wide, with sparse 0.3-0.5 mm long setae, margin ciliate, the limb turned inwards girdling the base of the style; *staminodial ring* 9.4 ± 0.5 mm long, turned inwards like corolla limb; *pistil* oblong, 9-10 mm long, 5.5-6.6 mm wide, purplish; *style* clearly distinct, 5.1 ± 0.7 mm long, slightly curved, slightly tapered from 1.5 to 1.2 mm in diameter; *stigmas* 3, 4-6 mm long. *Fruit* obovate to subglobose, rostrate, 6-7 cm long, 4.5-5 cm in diameter; *pericarp* yellow at maturity; *mesocarp* fibrous; *endocarp* obovate, acute basally; *perianth* with *corolla* cup-shaped, deeply obconoidal, 12-14 mm long, minutely crenulate, *staminodial ring* as long as corolla, *calyx* crenate, 5-7 mm long.

Fig. 8 - *Astrocaryum chambira* - crown.

Fig. 9 - *Astrocaryum chambira* - details of rachillae.

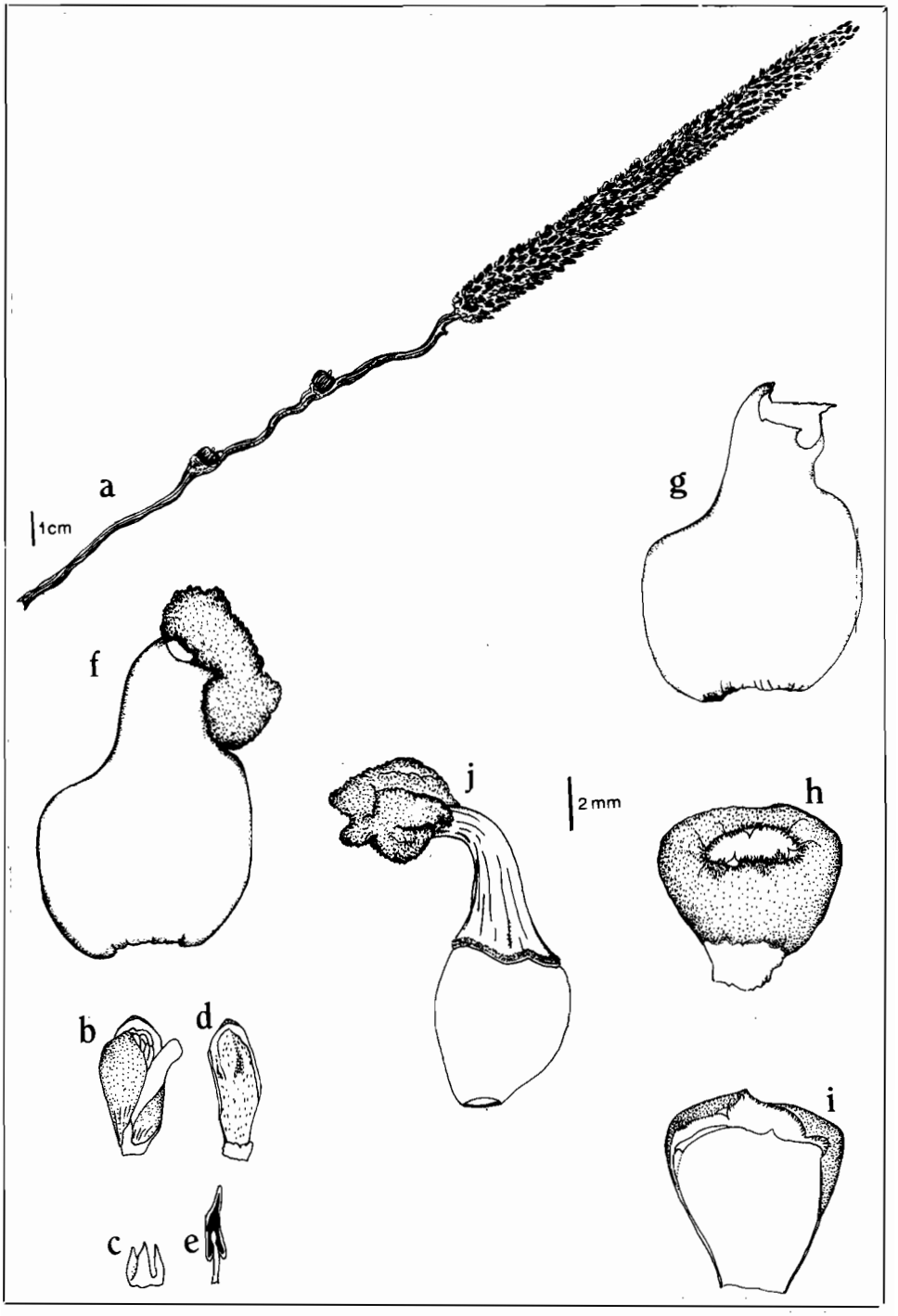

Fig. 10 - *Astrocaryum chambira* - a. rachilla; b. staminate flower; c. calyx; d. petal; e. stamen; f. pistillate flower; g. calyx; h. corolla; i. staminodial ring in corolla; j. pistil. (b-j with same scale. Material used: Kahn *et al.* 2447)

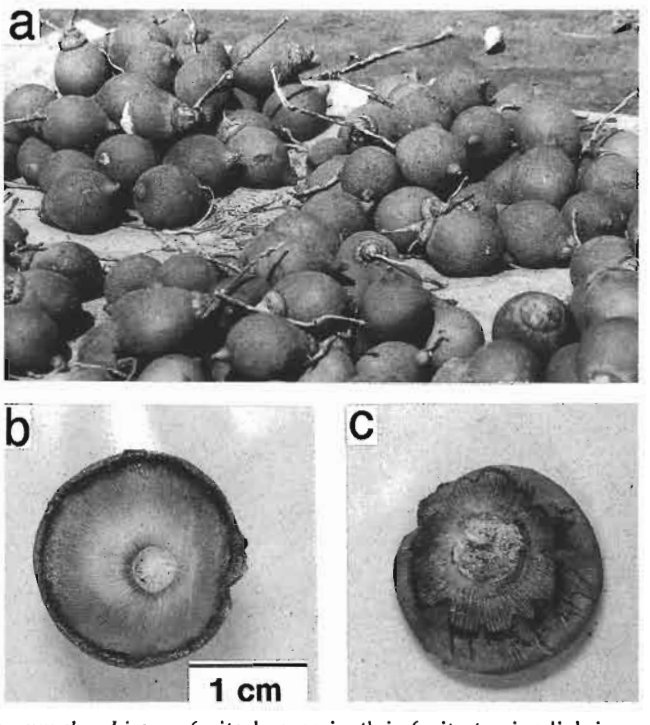

Fig. 11 - *Astrocaryum chambira* - a. fruits; b, c. perianth in fruit: staminodial ring as long as corolla (b), calyx cup-shaped and crenate (c).

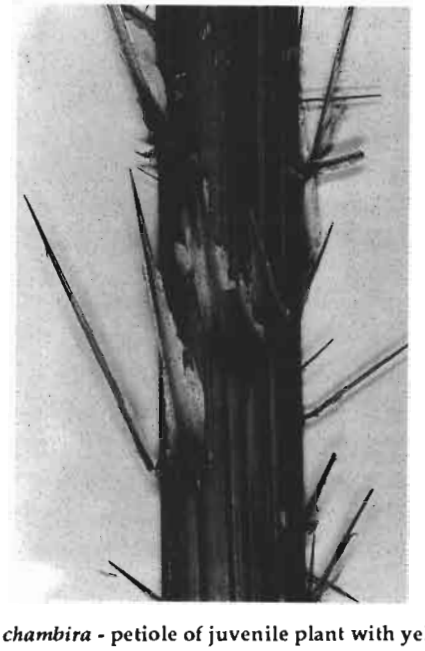

Fig. 12 - *Astrocaryum chambira* - petiole of juvenile plant with yellowish-winged spines.

Specimens observed:

BRAZIL - *Henderson et al. 887* (K), 14 Jan 1989, 4°20'S, 70°20'W, Amazonas, Município Benjamin Constant, frontier between Brazil and Peru. *Henderson 1136* (K), 15 Oct 1986, 7°25'S, 73°38'W, Acre, Município Nancio Lima, Moa River. *Huebner 155* (BH), no data. ECUADOR - *Balslev 4812* (K, NY), 23 Jan 1984, 00°02'S, 76°11'W, 300 m, Napo, Cuyabeno. *Balslev & Boom 4386* (AAU, K, NY), 26 Aug. 1983, 00°15'S, 76°53'W, 300 m, Napo, S of San Miguel River at El Conejo. *Balslev et al. 60694* (K), 28 Jul 1985; *Mori & Luteyn 14684* (AAU, NY), 20 Jun 1982; *SEF 8529* (NY), 30 May-21 Jun 1982: 00°32'S, 76°23'W, 300 m, Napo, Añangu. PERU - *Berlin 527* (BH), 13 Dec 1972, 210-240 m, Amazonas, N of Huampani stream. *Gentry 31752* (AMAZ), 25 Feb 1981, Mishana, Nanay River halfway between Iquitos and Santa María de Nanay. *Kahn et al. 2447* (K, P, USM), Oct 1989; *Mejia 105* (AMAZ), 10 Mar 1982: Jenaro Herrera. *Moore et al. 8416* (BH, USM), 11 May 1960, km 4-5 before San Juan, road from Iquitos to Quistococha. *Plowman et al. 6945* (K, USM), 20 Apr 1977, 3°05'S, 71°55'W, Ampiyacu River, Pucaurquillo and vicinity. *Torres 107* (AMAZ, USM), 15 Oct 1965, Mishuyaco, 12 km NW of Iquitos, road to Quistococha.

Distribution: In the western parts of the Amazon basin.

Ecology: In terra firme forests in very low density; dense populations of this species occur in deforested areas; also found on periodically flooded alluvial soils.

Uses: The endosperm of *Astrocaryum chambira* is drunk or eaten in the same way as the coconut. The epidermis of the pinnae of young leaves is used for fiber (Wheeler, 1970; Schultes, 1977) which serves to make hammocks, and bags called «shicras» in Peru (Mejía, 1988).

Vernacular names : chambira (C, E, P); coco (E); cumare (C).

Notes: Galeano (1991) suggests that *Astrocaryum chambira* and *Astrocaryum aculeatum* may be the same species. Our studies, however, show that the former clearly differs from the latter by the following characters: pistillate flower usually larger, cylindrical not conoidal, corolla limb turned inwards girdling the style, corolla in fruit deep, obconoidal with staminodial ring as long as corolla, calyx crenate, not 3-lobed (Fig. 11 vs 7); fruit with a bigger rostrum; mesocarp thin and fibrous, not fleshy; staminate flowers larger and purplish. Due to their floral characters these species cannot be confused. Acaulescent juveniles of *Astrocaryum chambira* are characterized by the yellowish-winged spines on the petiole (Fig. 12). Spines of *Astrocaryum aculeatum* are not winged. *Astrocaryum chambira* is a larger palm; the stem turns grayish in old individuals, while it usually remains dark in *Astrocaryum aculeatum*. Both species have ragged leaves; this character is more accentuated in *Astrocaryum aculeatum* (Fig. 8 vs 3). Except for the yellowish-winged spines of juvenile forms, the differences are not so clear in vegetative as in floral parts.

4. Astrocaryum jauari Martius, Hist. Nat. Palm. 2: 76, t. 52, 65, fig. 1, 1824. (Fig. 13, 14).

Type specimen: Martius s.n., Pará, Brazil (M) - not seen.

> *Astrocaryum giganteum* Barbosa Rodrigues, pro syn. (in part?), Contr. Jard. Bot. Rio de Janeiro 3: 82, t. 10C, 1902. Type specimen not designated, Pará, Brazil.
>
> *Astrocaryum guara* Burret, pro syn., Notizbl. 11: 15, 1930. Type specimen: Woronow & Juzepcuk 6307, Orteguaza River, Colombia (B, destroyed).

A usually *multistemmed, rhizomatous* palm. *Stem* up to 20 m high and 20 cm in diameter, with rings of up to 10 cm long spines. *Leaves* 8-15; *sheath* and *petiole* 2.3 m long, armed with black, flattened, up to 6 cm long spines; *rachis* up to 4.1 m long, armed with small spines; *pinnae* up to 165 per side, oriented in diverse directions from the rachis; *basal pinnae* 50-140 cm long, 1-4.3 cm wide; *median pinnae* 90-140 cm long, 2.4-4.4 cm wide; *apical pinnae* 15-40 cm long, 0.9-4 cm wide. *Inflorescence* erect; *prophyll* 60 cm long with brown setae and shiny black spines, 0.5-5 cm long; *peduncular bract* spiny, up to 1.1 m long; *peduncle* up to 1 m long, sparsely armed with 1-4 cm long spines; rachis 40 cm long; *rachillae* more than 100, each with 3-8 pistillate flowers at base. *Staminate flowers* with brown bracts, 4 mm long, ciliate at margins; stamens 9-(12); pistillode small. *Pistillate flower* globose, 7 mm long; *calyx* and *corolla* subequal, globose to urceolate, setose; staminodial ring almost as long as corolla; *pistil* globose, *stigmas* 3, 4-5 mm long. *Fruit* ovoid, 3-4 cm long, 2.5-3 cm wide, shortly rostrate; *pericarp* yellow to orange; *perianth* with *corolla* cup-shaped to campanulate, crenulate 6-10 mm long, *staminodial ring* slightly shorter than corolla, crenulate to crenate, 5-9 mm long, *calyx* irregularly lobed, 4-8 mm long.

Specimens observed:

BRAZIL - *Henderson & Lima 605* (BH, K), 15 Jul 1986, 3°24'N, 61°26'W, Roraima, Município Alto Alegre, Maracá ecological station. *Jobert 644* (P), yrs 1877-1878, northern Brazil, Putumayo River. *Kahn 610* (P), Oct 1981, Anavilhanas, Rio Negro. *Prance et al. 20198* (INPA), north bank of Rio Negro, 20 km above Tarumã River. *Ramos & Paula 1610* (INPA), 16 Oct 1984, Tocantins River, Tucuruí. *Schwacke 226* (RB), 14 Oct 1877, Alto Amazonas, Icá River. COLOMBIA - *García-Barriga 14007* (NY), 1-15 Dec 1951, 250 m, Amazonas Vaupés, Apaparis River between Kananarí and Patoa Rivers. *Schultes 3869* (BH), 22-28 May 1942, 150 m, Caraparaná River between Las Bocas and El Encanto. ECUADOR - *Balslev et al. 4313* (K, NY), 22 May 1983, 00°02'S, 76°13'W, 230 m, Napo, Cuyabeno, Laguna Cocodrilococha. *Balslev 4817* (AAU, K, NY), 23 Jan 1984, 00°00'S, 76°11'W, 300 m, Napo, Cuyabeno. GUYANA - *Smith 3036* (P), 12 Feb 1938, basin of Kuyuwini River, Essequibo tributary. PERU - *Gentry 19113* (AMAZ, NY), Nanay River across from Santa Clara. *Mejia 66* (USM), Aug 1982; *Millán 70, 71, 75, 76, 77, 78, 79* (USM), 7-9 Mar 1991: 4°55'S, 73°45'W, Loreto, Requena, Jenaro Herrera. *Moore et al. 8442* (USM), 12 May 1960, Nanay River opposite Mapa. *Tessmann 5210* (NY), Jun 1925, 110 m, Loreto, Maynas, Soledad. *Vásquez 7403* (AMAZ), 18 Apr 1986, 3°50'S, 74°10'W; 150 m, Loreto, Maynas, cocha Soledad.

Distribution: Throughout the basin; reported from French Guiana only on Maroni River (Kahn & Granville, 1992).

Ecology: Riparian species, on banks of large or small, black or whitewater rivers, or lakes, in places which are flooded several months each year.

Uses: The fruits of *Astrocaryum jauari* are used as bait for fishing (Wallace, 1853), and the leaflets for basketry and fiber. The mesocarp contains an edible oil and the endosperm contains 21 % fat (Pinheiro & Balick, 1987). Some attempts are made in Brazil to exploit the species for palm heart canning. The stem is rot-resistant and serves as building material in Peru (Mejía, 1988). Its distribution, which is limited to the periodically flooded river banks, as well as the many spines on the stem, reduce its potential as an economic plant. However, Borgtoft Pedersen & Balslev (1990) propose this species as a potential component of agroforestry systems.

Vernacular names : awarra liba (FG, G, S), coqueiro javari (Br), guara (C), huiririrma (E, P), jauari (Br, FG), sawarai (G), soela-awarra (S), yauari, yavari (C).

Fig. 13 - *Astrocaryum jauari* - a tall, multistemmed, riparian species.

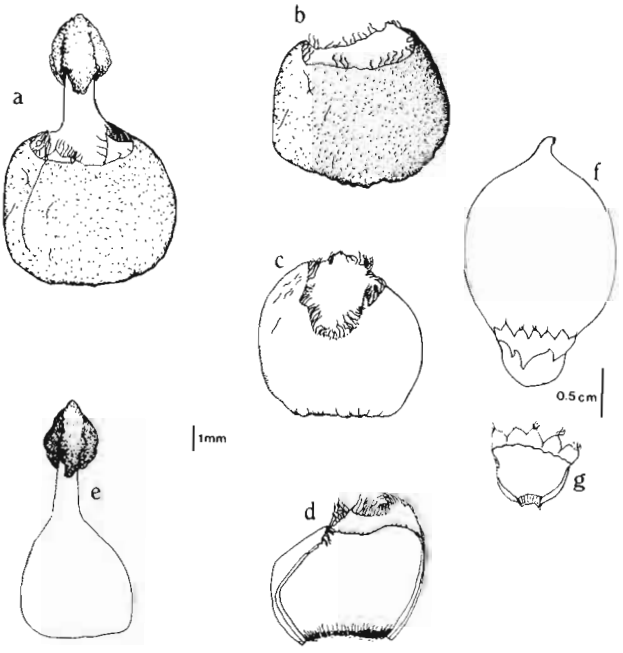

Fig. 14 - *Astrocaryum jauari* - a. pistillate flower; b. calyx; c. corolla; d. staminodial ring in corolla; e. pistil; f. fruit; g. perianth in fruit: corolla with staminodial ring. (Material used: Kahn 610)

5. Astrocaryum vulgare Martius, Hist. Nat. Palm. 2: 74, t. 62-63, 1824. (Fig. 15-16).

Type specimen (isotype): Martius s.n., Brazil (seen at P).

Astrocaryum awarra de Vriese, pro syn., Jaarb. Kon. Ned. Mij. Aanm. Tuinb. 12, 1848. Type specimen: Splitgerber 60, Suriname (L) - not seen.

Astrocaryum guianense Splitgerber ex Martius, pro syn., Hist. Nat. Palm. 3: 323, 1853. Type specimen: Splitgerber 60, Suriname (L) - not seen.

Astrocaryum tucumoides Drude, pro syn., Mart. Fl. Bras. 3: 381, t. 81, 1881. Type specimen: Glaziou 8060, Amazonas, Brazil (seen at P).

Astrocaryum segregatum Drude, pro syn., Mart. Fl. Bras. 3: 382, 1881. Type specimen: Sagot 593, French Guiana (seen at K, P).

Astrocaryum tucuma auct. non Martius: Wallace, Palm trees of the Amazon: 107, t. 41, t. 2, fig. 5, 1853.

Astrocaryum aculeatum auct. non Meyer: Bailey, Gentes Herbarum 8: 149, Fig. 54, 55, 56, 1919.

A *tall* to *medium-sized, multistemmed* palm. *Stem* up to 20 m high, 15-20 cm in diameter, with rings of black, up to 15 cm long spines. *Leaves* 8-16; *sheath* and *petiole* 2 m long, armed with flattened, black spines; *rachis* 2.5-4 m long, spines sparser towards the apex; *pinnae* 77-102 per side, more or less aggregated in groups and oriented in diverse directions from the rachis; *median pinnae* 90-110 cm long, 3-4 cm wide; *apical pinnae* 25-30 cm long, 2-3 cm wide. *Inflorescence* erect; *prophyll* 1 m long, brown-puberulous, with a few spines; *peduncular bract* up to 2 m long, acuminate, armed with black, up to 4 cm long spines; *peduncle* up to 1.5 m long, oval in cross-section, 5 cm wide at base; *rachis* more than 30 cm long; *rachillae* more than 100, each ca. 25 cm long. *Staminate flower* 4 mm long; *stamens* 6; *pistillode* small. *Pistillate flower* 12 mm long; *calyx* ovato-urceolate, as high as *corolla*, this ciliate at margin, 10 mm long; *staminodial ring* 2 mm long; *pistil* ovoid; *style* 3mm long. *Fruit* globose to ovoid, 3.5-4.5 cm long, 2.5-3.5 cm in diameter, shortly rostrate; *pericarp* orange-red at maturity; *mesocarp* fleshy; *perianth* with *corolla* crenate to dentate, 8-10 mm long, *staminodial ring* 3-4 mm long, *calyx* irregularly lobed, 7-8 mm long.

Specimens observed:

BRAZIL - *Bailey 338* (BH), 26 Nov 1946, near Belém, Pará. *Coelho & Alfredo s.n.* (INPA), 15 Mar 1983, Município Obidos, Pará. *Daly et al. D277* (NY), 26 Sep 1980, Maranhão State. *Dawson 15220* (BH), 4 Jun 1956, 13°45'S, 48°50'W, E of Formoso. *Glaziou 8060* (K, P), 28 Nov 1875, Botanical Garden of Rio de Janeiro, origin from Amazonas. *Kahn 536* (INPA), 1 Jun 1981, Santa Rosa, S of Tururuí, in the lower Tocantins River valley. *Martius s.n.* (P), Pará. GUYANA - *Harrison & Persaud 1116* (K), 13 Jun 1958, Waranama ranch, Berbice River. FRENCH GUIANA - *Broadway 644* (K, NY), 8 Jul 1921, Montabo, vicinity of Cayenne. *Granville et al. 10004* (CAY, P, USM), 4 Sep 1987, 2°36'N, 54°00'W, upper Marouini River basin. *Sagot 593* (BM, K, P), yr 1858, Mana. SURINAM - *Moore & Palmtak 10357* (BH), 15 Jul 1977, west bank of Sarama River between Groningen and Paramaribo.

Distribution: In the eastern parts of the Amazon basin.

Ecology: In low forests on sandy soils; particularly abundant in the coastal savannahs of the Guianas.

Uses: The mesocarp of *Astrocaryum vulgare* is rich in provitamin A (Cavalcante, 1974). It provides a fat, mashed pulp which is used to prepare the very popular French Guianan «bouillon d'awarra», traditionally eaten at Easter. Fiber is occasionally extracted from the leaflets (Schultes, 1977), and from the petiole when macerated in water (Pinheiro & Balick, 1987). Palikur Amerindians prepare a decoction of the roots which is said to have an effect against furunculosis, and use oil extracted from the seed to cure boils and toothache (Grenand *et al.*, 1987).

Vernacular names : awarra (FG, G); chontilla (B); cumare (C, V); tucumã (Br), tucum bravo (Br).

Notes: Wessels Boer (1965) suggests that *Astrocaryum vulgare* and *Astrocaryum aculeatum* may be the same species. However, it does not really argue on the topic. *Astrocaryum vulgare* differs from the latter in that (1) the corolla is ovato-urceolate, not cup- to cask-shaped, as long as the calyx, not shorter, (2) the ripe fruit is smaller with an orange to red pericarp and a thicker mesocarp, and(3) the habit is multistemmed .

Fig. 15 - *Astrocaryum vulgare*, in the field in French Guyana.

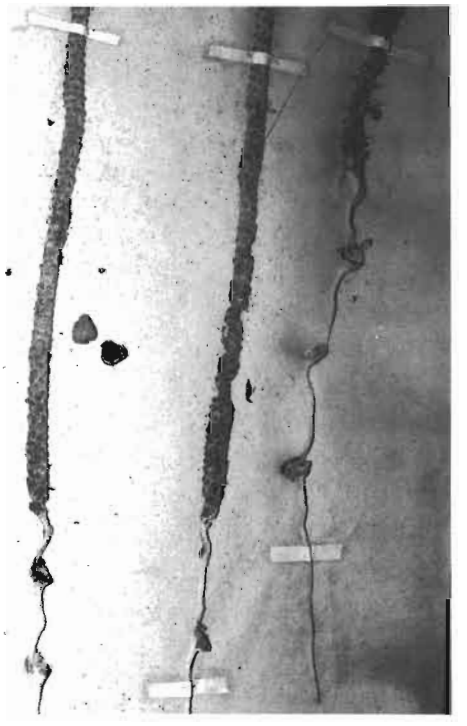

Fig. 16 - Isotype of *Astrocaryum vulgare*, (Martius s.n., P).

6. Astrocaryum gynacanthum Martius, Hist. Nat. Palm. 2: 73, t. 60-61, 1824. (Fig. 17-19).

Type specimen (isotype): Martius s.n., Manaus, Brazil (seen at P).

Astrocaryum munbaca Martius, pro syn., Hist. Nat. Palm. 2: 74, 1824. Type specimen not designated.

Astrocaryum minus Trail, pro syn., Journ. Bot. 15: 78, 1877. Type specimen: Trail 1071 (CCXIII), Brazil (seen at K, P).

Astrocaryum rodriguesii Trail var. *minus* (Trail) Barbosa Rodrigues, pro syn., Prot. App.: 28, 1879. Type specimen not designated.

Astrocaryum minus Trail var. *terra-firmae* Drude, pro syn., Mart. Fl. Bras. 3: 374, 1881. Type specimen: Wallis s.n., Amazonas, Brazil (K?) - not seen at K.

Astrocaryum gymnopus Burret, pro syn., Notizbl. Bot. Gart. u Mus. Berlin X: 1020, 1930. Type specimen: Luetzelburg 22927, Orinoco, Venezuela (M) - not seen.

Astrocaryum vulgare auct. non Martius: Warburg Pflanzenw. 3: 409, fig. 220A, 1922.

A *small, multistemmed* palm. *Stem* 1-10 m high, 6-7 cm in diameter, armed with rings of flattened, black, up to 15 cm long spines; sheaths of dead leaves not persistent under the crown. *Leaves* 8-12; *sheath* fibrous at margins, 10-30 cm long, armed with flattened, black, 2-4 cm long spines, *petiole* 40-80 cm long, with longer, up to 10 cm long spines; *rachis* up to 2.3 m long, with scattered spines; *pinnae* 26-41 per side, regularly arranged in one plane, plicate, obliquely acuminate, sparsely minutely setose beneath; *basal pinnae* 18-54 cm long, 0.3-2.2 cm wide; *median pinnae* 39-68 cm long, 2.8-4.4 cm wide; *apical pinnae* 19-49 cm long, 3.3-13 cm wide. *Inflorescence* pendulous before opening of peduncular bract; *prophyll* flattened, 40-50 cm long; *peduncular bract* 50-70 cm long, inserted at the middle of the peduncle, densely brown-setose before opening, with many flattened, flexuous, black, 1 cm long spines, some of them whitish basally; *peduncle* up to 90 cm long, with flexuous, brown-tomentose, dark brown, 10-15 mm long spines, dense between rachis and bract insertion; *rachis* up to 25 cm long; *rachillae* many, proximal part 15 mm long covered with light brown, 3 mm long setae, distal part bearing staminate flowers 2.5-4 cm long, densely pilose with slender hairs, one pistillate flower at base inserted on rachis. *Staminate flower* with *sepals* connate in the lower third, 1.3-2 mm long, recurved at anthesis; *stamens* 6; *anthers* 0.9 mm long; *filament* 1.5-2 mm long; *pistillode* small. *Pistillate flower* with *calyx* cup-shaped, 3-denticulate, 1-3 mm long, 3-4 mm wide, armed with strongly flexuous, flattened, black, 5-12 mm long spines; *corolla* cup-shaped, 1-4 mm long, armed with strongly flexuous, flattened, black, 5-8 mm long spines; *staminodial ring* entire, 6-denticulate, 1 mm long; *pistil* oblong, 0.9-1 mm long, 4-5 mm wide, *stigmas* 3, 5-6 mm long. *Fruit* elongato-obovate, 3-4 cm long including a usually curved, 0.8-1 cm long rostrum; *pericarp* brown to brown-red, deeply laciniate and open like a flower at maturity; *mesocarp* yellow; *perianth* with *corolla* cup-shaped, 6-10 mm long, *staminodial ring* 2-3 mm long, *calyx* 2-4 mm long, usually with a few flexuous, up to 12 mm long spines.

Specimens observed:

BRAZIL - *Aluisio de Souza s.n.* (INPA), 30 Jul 1976, km 26 Manaus-Itacoatiara road, Reserva Ducke. *Anderson 190* (INPA), 23 Sep 1975, 1°44'N, 63°39'W, Yanomama tribe, Tootobi River, basin of Denemí River. *Balick et al. 906* (BH), 31 Oct 1977, Pará, BR 230, S of Altamira. *Balick et al. 919* (BH), 10 Nov 1977, Pará, Santarém-Cuiabá road, km 879 from Santarém. *Balick et al. 925* (BH), 14 Nov 1977, Pará, Santarém-Cuiabá road, km 1004 from Santarém. *Chagas 470* (INPA), 5 Jan 1955, Amazonas, Manaus, igarapé do Buião. *Coelho 1164* (INPA), 10 Jun 1955,

Amazonas, Manaus, igarapé do Bindá. *Henderson et al. 186* (INPA, NY), 3 Apr 1985, 3°08'S, 60°01'W, Município Manaus. *Henderson et al. 193* (INPA), 7 Apr 1985, 7°10'S, 63°00'W, BR 319, 85 km of Humaitá, Bom Futuro. *Jobert 566, 783* (P), 1877-1878, Calderão, Solimões, North Brazil. *Kahn & Moussa 3230* (USM), 13 Dec 1991, Manaus, Hotel Tropical. *Krukoff 6765* (K, NY), 12 Oct-6 Nov 1934, Amazonas, Humaitá, near Liucamento, Livramento River, basin of Madeira. *Kuhlmann 253* (RB), 30 Aug 1923, Itapirrima, Madeira River. *Kulhmann 1907* (RB), 4 Jul 1924, Itapacurú, Tapajoz, Pará. *Lewis 1453* (K), 14 Mar 1987, 3°35'S, 61°50'W, Roraima, Município Boa Vista, Maracá ecological reserve. *Martius s.n.* (P), Pará. *Moore et al. 9523* (BH, INPA, NY), 14 Mar 1967, Tarumã road, ca. 18 km N of Manaus. *Mori & Cardoso 17548* (NY), 30 Dec 1984, 1°30'N, 53°30'W, Amapá, Município Macapá, 156 km NW of Porto Grande on BR 210. *Monteiro 1315* (INPA), 7 Feb 1977, Manaus. *Nee 34333* (K), 12 Mar 1987, 9°47'S, 64°04'W, Rondônia, 15 km N of Ariquemes on BR 364. *Nee 34767* (INPA), 11 Apr 1987, Rondônia, Município Guajara Mirim, 17 km E of BR 325. *Plowman et al. 9535* (INPA, K, NY), 3 Mar 1980, 250 m, 4°05'S, 47°32'W, Município Paragominas, Belém-Brasília highway, 6 km N of ligação do Pará. *Plowman et al. 12181* (INPA), 4-5 Dec 1982, 1°51'S, 65°36'W Amazonas, Município Maroa, Japurá River. *Prance et al. 2494* (INPA), 12 Sep 1966, Amazonas, Purus River, Boca do Acre. *Prance et al. 7215* (INPA, NY), 11 Sep 1968, km 18 Manaus-Itacoatiara road. *Prance et al. 20490* (BH, INPA), 13 Mar 1974, BR 319, Manaus-Porto Velho road, km 245, 3 km S of Igapó Açu. *Rodrigues 8419* (INPA), 19 Feb 1968, km 65 Manaus-Itacoatiara road, Egler Reserve. *Silva 139* (INPA), 16 Feb 1983, Porto Velho-Manaus road, BR 364. *Spruce 31* (K), Mar 1850, Santarém. *Stannard & Anais 673* (K), 11 Mar 1987, 3°35'S, 61°50'W, Roraima, Município Boa Vista, Maracá ecological reserve. *Trail 1071 (CCXIII)* (K, P), 2 Feb 1875, Amazonas, Barreiras de Mutum, Jutahy River. COLOMBIA - *Schultes 3885* (BH), 31 May 1942, 180 m, between El Encanto and La Chorrera. GUYANA - *Gleason 310* (K), 8 Jun-18 Jul 1921, Tumatumari. *Schomburg 1854* (K), no data. *Smith 3425* (NY), 31 Mar-16 Apr 1938, 150-400 m, northwestern slopes of Kanuku mountains in drainage of Moku-moku Creek, Takutu tributary. *Tillet & Tillet 45530* (NY), 24 Sep 1960, near falls of Kako, ca. 10 hours above mouth. FRENCH GUIANA - *Cremers 7966* (CAY), 12 Feb 1983, Paul Isnard. *Gentry & Zardini 50296* (CAY), 22 Feb 1985, Mahury mountain. *Granville 1879* (CAY), 20 Jul 1973, Petite Waki River. *Granville B-5249* (CAY), 16 Apr 1975; *4488* (CAY, K), 23 Mar 1981; *8223* (CAY), 22 Oct 1985; *Mori et al. 15097* (CAY), 17 Oct 1982: 3°37'N, 53°12'W, Saül. *Hallé 1118* (P), 25 Feb 1965; *Oldeman 1163* (CAY), 22 Feb 1985: 250 m, Cacao Mount. SURINAM - *Moore et al. 10324* (BH), 5 Jul 1977, on Tapanahoni River. *Moore et al. 10332* (BH), 8 Jul 1977, 240 m, Alapadu. VENEZUELA - *Davidse & Huber 15368* (BH), 24 Apr 1978, 90 m, 5°51'N, 67°25'W, 23 km NE of Ayacucho and 8 km E of the highway to El Burro. *Davidse et al. 16973* (NY), 30 Apr 1979, 3°40'N, 67°22'W, 100 m, Atabapo, Cucurital de Camane. *Colchester 2083* (K), 8 Dec 1975, 5°03'N, 65°35'W, 200 m, Amazonas, Tenua. *Henderson 35* (K, NY), 00°50'N, 66°10'W, 140 m, 29 Feb 1984, Amazonas, Rio Negro, Neblina base camp, Marawinuma River. *Liesner & González 11486* (NY), 10 Apr 1981, 7°28'N, 63°14'W, 350-500 m, Bolivar, 7 km of Ciudad Piar. *Lister 153* (K), 30 Jan 1976, 220 m, Amazonas, Mosquito stream, confluence of Marieta stream.

Distribution: In the eastern and central parts of the Amazon basin.

Ecology: In terra firme forests (Kahn & Castro, 1985; Kahn & Granville, 1992).

Uses: Not reported.

Vernacular names : marajá assu (Br), munbaca (Br).

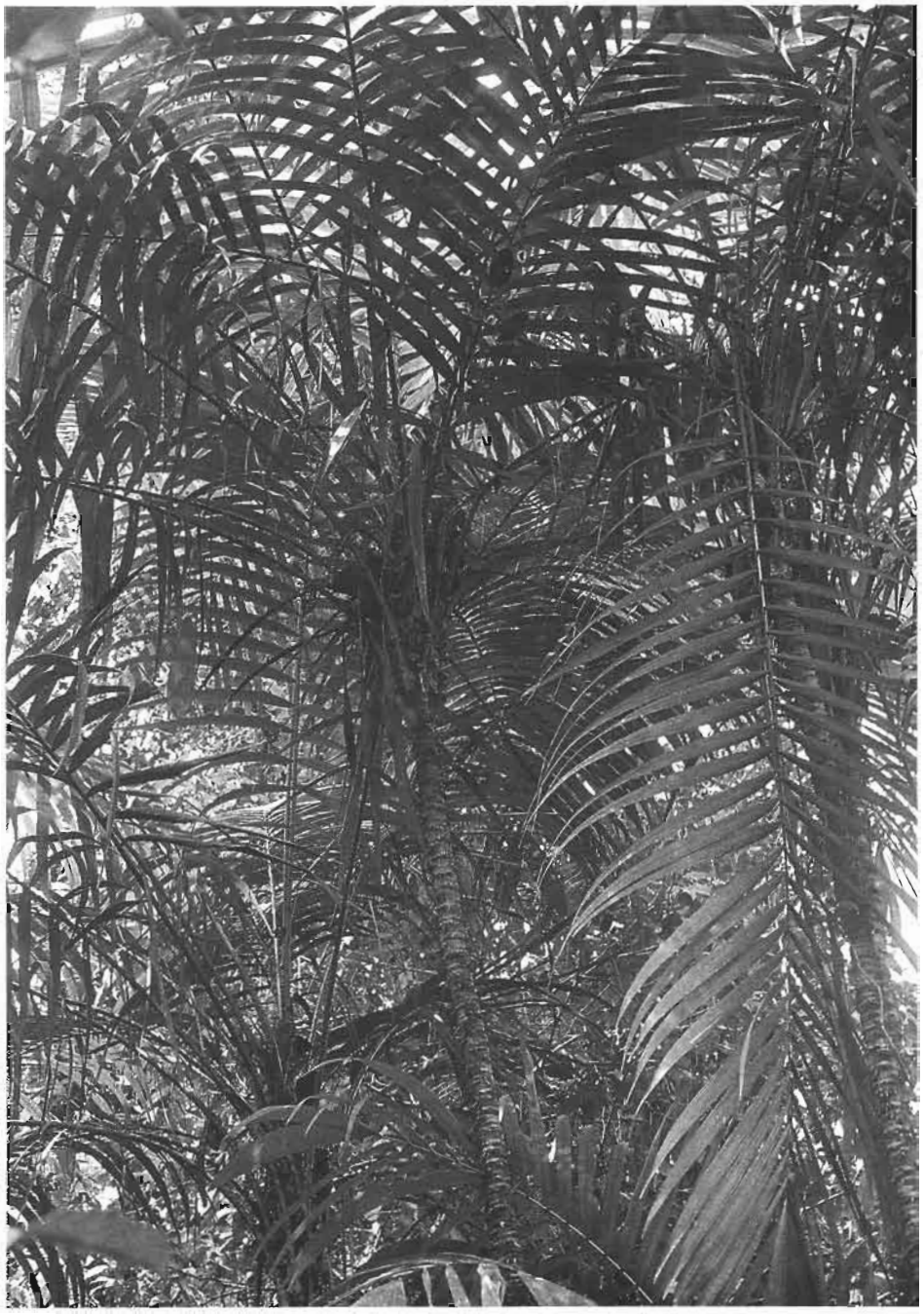

Fig. 17 - *Astrocaryum gynacanthum* in a forest of eastern Amazonia.

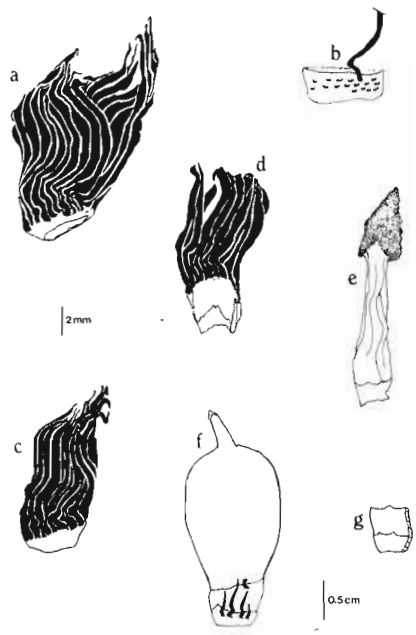

Fig. 18 - *Astrocaryum gynacanthum* - a. pistillate flower; b. calyx; c. corolla; d. staminodial ring in corolla; e. pistil; f. fruit; g. perianth in fruit: corolla with staminodial ring. (Material used: Kahn & Moussa 3230)

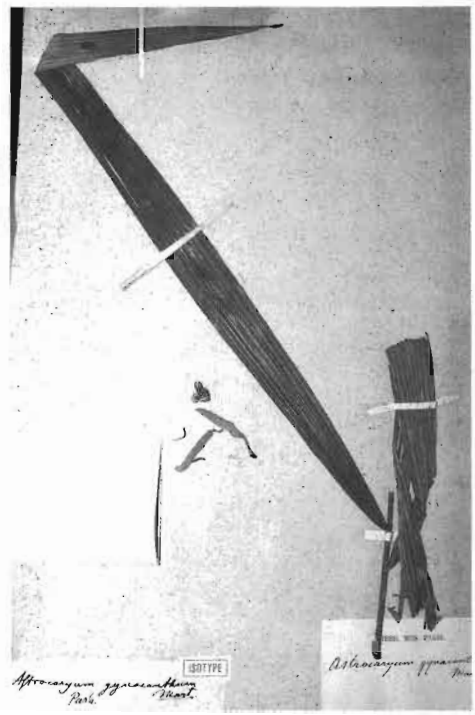

Fig. 19 - *Astrocaryum gynacanthum* - Isotype (Martius s.n., P).

Notes: A*strocaryum munbaca* is a synonym of *Astrocaryum gynacanthum* (Wessels Boer, 1988; Galeano, 1991). It is also the case of *Astrocaryum gymnopus* which was distinguished from *Astrocaryum gynacanthum* only by the lack of setae and spines on the peduncle.

Astrocaryum minus has been considered a synonym of *Astrocaryum rodriguesii* by Barbosa Rodrigues (1903) who was followed by Burret (1934) and Wessels Boer (1965). The former author has probably not seen the pistillate flower of *Astrocaryum rodriguesii* as suggested by its very short description: «FLOR. FEM. Solitarium evolventes» (Barbosa Rodrigues, 1903: 75). The type specimen of A*strocaryum minus* consists of a leaf portion and a few pistillate flowers (Fig. 20). These are clearly different from those of *Astrocaryum rodriguesii*. There is no armed peduncle bearing the flower, calyx is not 3-dentate, and spines on calyx and corolla are very similar to those of *Astrocaryum gynacanthum*. Moreover the abaxial side of the pinnae of *Astrocaryum minus* is setose, as leaflets of *Astrocaryum gynacanthum* are, to a minimal degree however. This is not the case of *Astrocaryum rodriguesii*. As commented by Trail upon *Astrocaryum minus* (1877: 78-79), «it can hardly be confounded with any species save *Astrocaryum gynacanthum* (...). Comparison of examples of the two species shows at once that they are distinct, though it is rather difficult to express the points of difference in a description». With its larger calyx and corolla, as well as the larger size of the whole plant, *Astrocaryum minus* might be a distinct species, akin to *Astrocaryum gynacanthum*. In regard to Trail's comments, andthinking that differential characters at specific level must be clearly expressed in a description, we choose to consider *Astrocaryum minus* a synonym of *Astrocaryum gynacanthum*, not of *Astrocaryum rodriguesii*.

Fig. 20 - *Astrocaryum minus* (= *A. gynacanthum*) - type specimen (Trail CCXIII, P).

7. Astrocaryum paramaca Martius, Palmet. Orbign.: 88, 1847. (Fig. 21, 22)

Bactris paraensis Splitgerber ex de Vriese, Jaarb. Kon. Ned. Mij. Aanm. Tuinb. 10, 1848

Type specimen: Splitgerber 507, Surinam (L) - not seen.

Astrocaryum acanthopodium Barbosa Rodrigues, pro syn., Enum. Palm. Nov., 1875. Type specimen not designated, Trombetas River, Brazil.

A *subterranean-stemmed* palm. *Leaves* 10-15, up to 6 m long, erect, slightly arching in the upper half; *sheath* and *petiole* up to 1.5 m long, armed with flattened, black, up to 10 cm long spines, these winged basally with margins serrate, scattered or a few in horizontal to oblique linear groups; *rachis* up to 4.5 m long, armed with shorter spines; *pinnae* 75-100 per side, regularly arranged in one plane; *median pinnae* 70-110 cm long, 2.5-3.5 cm wide; *apical pinnae* 10-30 cm long, 0.9-1.5 cm wide. *Inflorescence* and *infructescence* erect; *prophyll* 60 cm long, densely brown-setose on abaxial side, tomentum remarkably fur-like; *peduncular bract* up to 1.3 m long, with dense, brown, small spines in the upper half, up to 4 cm long at apex; *peduncle* 1 m long, with black, 3-5 cm long spines; *rachis* up to 70 cm long; rachillae many, distal part bearing staminate flowers ca. 12 cm long, proximal part 3 cm long, armed with 8-15 mm long spines, one pistillate flower inserted 10-15 mm from the rachis. *Staminate flower* yellowish; *sepals* connate basally, 0.8-1 mm long; *petals* connate basally, 3 mm long; *stamens* 6; *anthers* 1.5 mm long; *filament* 3 mm long; *pistillode* minute. *Pistillate flower* with *calyx* tubular, 15 mm long, setose, 3-dentate, margin ciliate; *corolla* tubular, shorter than calyx, 11-13 mm long, setose in the upper third, 3-dentate, margin ciliate; *staminodial ring* 1-3 mm long; *pistil* oblong; *stigmas*

3. *Fruit* oblong, 4 cm long including a 1 cm long rostrum, 2-2.5 cm in diameter; *pericarp* smooth, brown, black-setose in its upper part, not on rostrum, deeply laciniate and open like a flower at maturity; *mesocarp* yellow; *endocarp* obovate; *perianth* with *corolla* cup-shaped, dentate, 20 mm long, laciniate at margin, *staminodial ring* 10 mm long, *calyx* 15 mm long, irregularly lobed.

Specimens observed:

FRENCH GUIANA - *Crevaud* (P), no data. *Granville & Kahn 5407* (CAY), 12 Mar 1983, 3°37'N, 53°12'W, Saül. *Hallé 1097* (P), Feb 1965, Grand Matoury. *Mori et al. 14872* (CAY), 7 Sep 1982, 3°37'N, 53°12'W, 200-400 m, Saül. *Oldeman 1137* (P), Matoury Mount. *Sagot 595* (P), yr 1858, Karouany. *Sanders 1810* (CAY), 5°18'N, 53°01'W, piste de Saint Elie, rd 21. *Schnell 11736* (P), 3 Sep 1961, Degrad Roches. SURINAM - *Moore et Palmtak 10314* (BH), 2 Jul 1977, road from Paramaribo to Victoria.

Distribution: In the northeastern parts of the Amazon basin, Brazil and Guianas.

Ecology: In terra firme forests, in high density (Kahn & Granville, 1992).

Uses: Not reported.

Vernacular names : counana (FG); koenana, paramaka (S).

Fig. 21 -*Astrocaryum paramaca* - Fruiting in a forest of French Guiana.

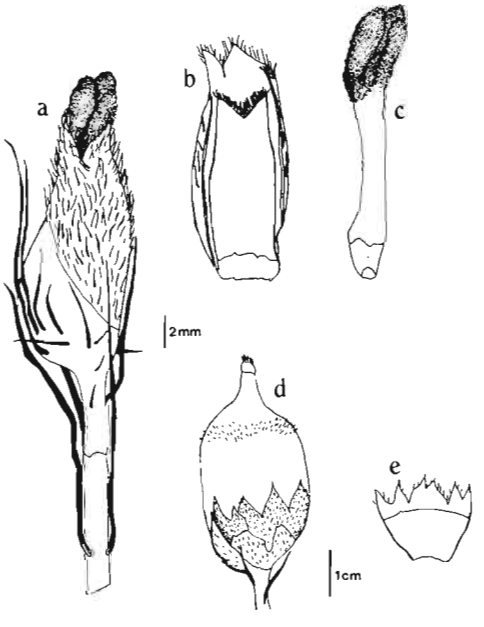

Fig. 22 - *Astrocaryum paramaca* - a. pistillate flower; b. staminodial ring in corolla; c. pistil; d. fruit; e. perianth in fruit: corolla with staminodial ring. (Material used: Granville & Kahn 5407, Moore & Palmtak 10314)

8. Astrocaryum rodriguesii Trail, J. Bot. 15: 79, 1977. (Fig. 23, 24, 25).

Type specimen: Trail 17, Trombetas River, Brazil (K?) - not seen at K.

Astrocaryum aculeatum auct. non Meyer: Barbosa Rodrigues, Enum. Palm. Nov. 20, 1975.

A *tall, slender, single-stemmed* palm. *Stem* up to 20 m high, 16-20 cm in diameter, with wide rings of black, flattened, up to 10 cm long spines; sheaths of dead leaves not persistent under the crown. *Leaves* 13-17, up to 6 m long; *sheath* and *petiole* up to 2.5 m long, whitish, armed with black, terete to flattened, up to 10 cm long spines, sheath fibrous at margins, petiole with adaxial side deeply canaliculate near rachis, spines more or less arranged in short, oblique groups on abaxial side; *rachis* 2-3.5 m long, with shorter spines in lower density; *pinnae* 70-77 per side, regularly distributed in one plane, plicate, obliquely acuminate, irregularly spiny at margins, the upper third of median pinnae frequently hanging in older leaves; *basal pinnae* 40-47 cm long, 0.5-1.6 cm wide; *median pinnae* 101-109 cm long, 6.3-7.0 cm wide; *apical pinnae* 9-21 cm long, 0.7-2.2 cm wide. *Inflorescence* pendulous; *prophyll* up to 90 cm long, brown-setose, carinate with brown to black, up to 3 cm long spines on abaxial side; *peduncular bract* 1.3 m long, tomentum fur-like basally, densely covered with red-brown, soft to rigid, 3-5 mm long setae and intermixed, flexuous, black, 1 cm long spines, these in higher density and longer, up to 3 cm long at apex; *peduncle* up to 1.2 m long, round in section near rachis, 2 cm in diameter, oval at base, 4.7 x 3 cm, whitish-tomentose, densely armed between rachis and bract insertion with terete, slightly flexuous, black, up to 4 cm long spines; *rachis* up to 60 cm long; *rachillae* whitish-tomentose, up to 8 cm long, distal part with staminate flowers 3-4 cm long, proximal part armed with flexuous, shiny black, 15-18 mm long spines and others, slender, brown, 6 mm long, bearing one pistillate flower inserted 18-27 mm from the rachis. *Staminate flower* not seen. *Pistillate flower* 20-25 mm long, 7-8 mm wide; *calyx* conoidal, brown-tomentose, 12-18 mm long, 3-dentate, armed with flexuous, light brown to black, 7-10 mm long spines; *corolla* 9-12 mm long, 3-dentate, densely covered with brown to black, 8-12 mm long spines inserted in the upper half; *staminodial ring* entire, 6-denticulate, 4-5 mm long; *pistil* conoidal, 11-16 mm long, 3-4 mm wide; *stigmas* 3, 4 mm long. *Fruit* oblong to ovoid, 4 cm long including a 1.4 cm long rostrum, 2-2.4 cm in diameter; *pericarp* smooth, unarmed, deeply laciniate and open like a flower at maturity; *mesocarp* yellow; *perianth* with *corolla* cup-shaped, dentate, 11-13 mm long, armed with black, slightly flexuous, 12 mm long spines, *staminodial ring* crenulate, 6 mm long, *calyx* deeply laciniate, 12-14 mm long.

Specimens observed:

FRENCH GUIANA - *Granville 4636* (CAY, K), 22 Jul 1981, Mana River, Saut Fracas. *Granville 9110* (CAY, K), 2 Jan 1987, 4°35'N, 52°17'W, 200 m, Degrad Limousin, basin of Counana River. *Granville & Kahn 11199* (CAY, P), 9 Mar 1991, RN2, near the junction with road to Cacao.

Distribution: In the northeastern parts of the Amazon basin.

Ecology: In terra firme forests under gaps in canopy.

Uses: Not reported.

Vernacular names : mourou-mourou (FG); murumuru da terra firme (Br).

Notes: *Astrocaryum rodriguesii* is the tallest species of the subgenus *Monogynanthus*. It can be easily identified on its large rings of spines on the stem, its pinnae which are regularly arranged in one plane, the apical pinnae very short making the blade obtuse, the inflorescence spicate, long and pendulous, and the large, single-stemmed habit.

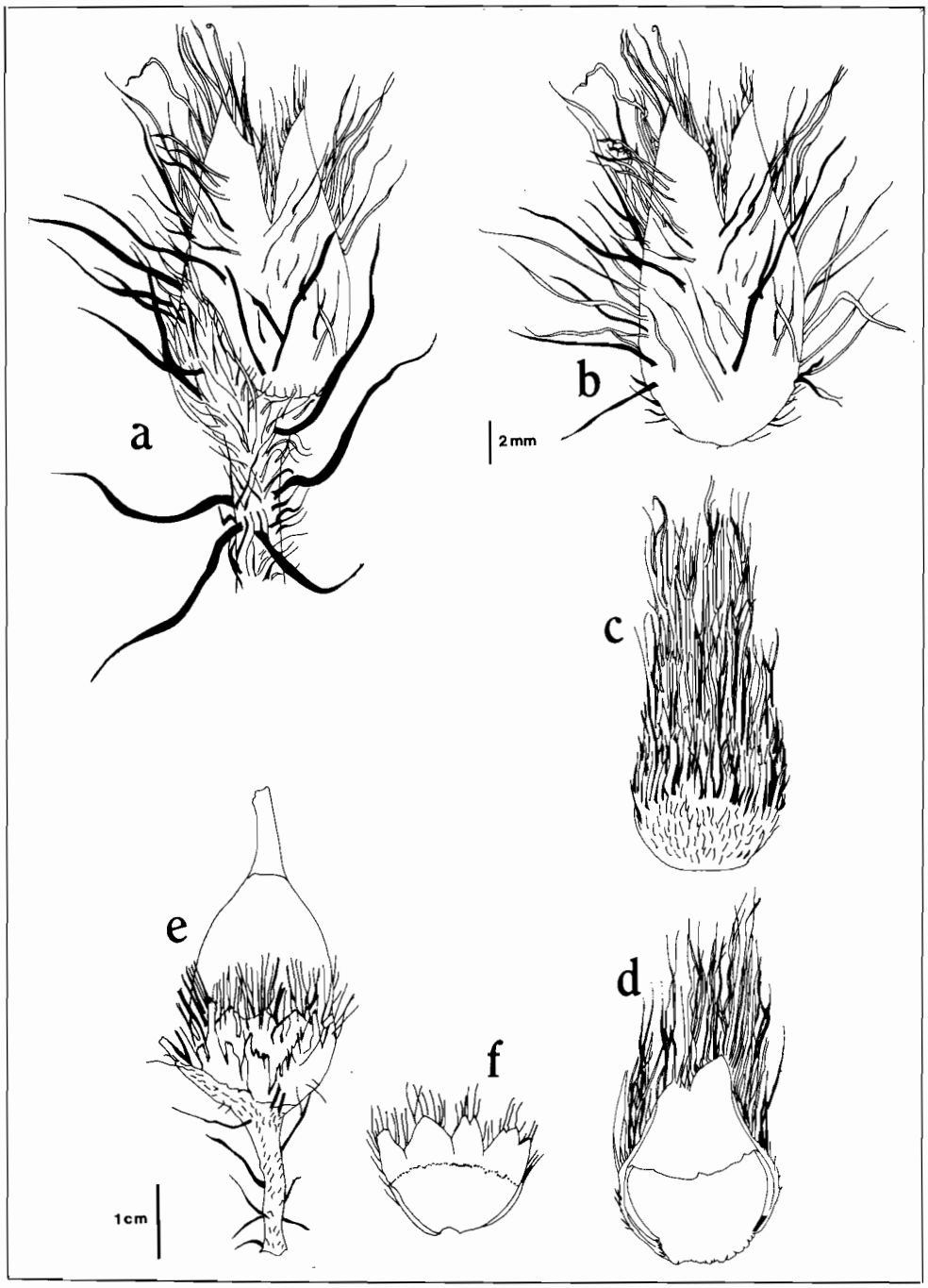

Fig. 23- *Astrocaryum rodriguesii* - a. pistillate flower (aborted flower); b. calyx; c. corolla; d. staminodial ring in corolla; e. fruit; f. perianth in fruit: corolla with staminodial ring. (Material used: Granville 9110; Granville & Kahn 11199)

Fig. 24 -*Astrocaryum rodriguesii* - in a forest of French Guiana.

Fig. 25 - *Astrocaryum rodriguesii* - spines on the stem.

9. Astrocaryum farinosum Barbosa Rodrigues, Enum. Palm. Nov.: 21, 1875 (Fig. 26, 27a). Type specimen not designated, Trombetas River, Brazil.

A *subacaulescent* species. *Leaves* 10-12, up to 7 m long; *petiole* subcylindric, covered with a rusty-red tomentum, 1.2-2 m long, armed with black, up to 8 cm long spines grouped in oblique rows; *rachis* 3.5-4 m long, with spines in scattered groups on abaxial side; *pinnae* 60-70 per side, plicate, regularly arranged in one plane; *median pinnae* 110-112 cm long, 3.2 cm wide; *apical pinnae* shorter, several connate together. *Inflorescence* and *infructescence* erect, up to 2 m long; *prophyll* unknown; *peduncular bract* brown-tomentose, armed with many spines, short basally, up to 4 cm long, flexuous, peniciliate at apex; *peduncle* 1.2 m long, cylindrical, covered basally with a rusty-red tomentum, armed with flexuous, black spines forming a ring at peduncular bract insertion, progressively oriented downwards towards the base, erect between rachis and bract insertion; *rachis* 15 cm long, spiny; *rachillae* short, flattened. *Staminate flower* unknown. *Pistillate flower* with *calyx* shorter than corolla, 3-dentate, minutely aculeate; *corolla* obtuse, 3-dentate, aculeate at margin; *pistil* cylindric, shorter than corolla; *stigmas* 3, recurved. *Fruit* turbinate, compressed at apex, 5.5 cm long, 4.3 cm wide, with a wide rostrum; *pericarp* brown with black, 1-3 mm long spines; *mesocarp* yellowish, mealy; *endocarp* bony; *perianth* with *corolla* crenate, 22 mm long, *staminodial ring* 16 mm long.

Specimens observed:

GUYANA - *Smith 2583* (K, NY, P), 21-26 Nov 1937, basin of Kuyuwini River, Equissebo tributary, about 150 miles from mouth.

Distribution: In the northern parts of the Amazon basin, Brazil and Guyana.

Ecology: In terra firme forests.

Uses: Meal and starch are prepared from the mesocarp and endosperm, respectively; young leaves are used for making hats and basketry, and leaves for thatching (Barbosa Rodrigues, 1903).

Vernacular names: murumuru-iry (Br).

Notes: This species was known only from the diagnosis with an illustration (Barbosa Rodrigues, 1903, t. 77, 78); the type specimen was not designated. Smith's collection n°2583, which includes leaflets, fruits, and 3 photographs, is so close to the drawing of Barbosa Rodrigues, that it must be the same species. Huebner's collection n°150 (fruit, BH) from Manaus, Brazil, which was identified by Burret as *Astrocaryum farinosum* (1934: 145), belongs to Ast*rocaryum sociale*.

Characters of the fruit (strong rostrum and small spines), of the pistillate flower with calyx shorter than corolla, the great size of the inflorescence, up to 2 m long, and the subacaulescent life form distinguish this species from A*strocaryum acaule* and *Astrocaryum sciophilum*.

Fig. 26 - *Astrocaryum farinosum* (After Barbosa Rodrigues' drawing, Table 77, 1903, and photographs by Smith 2583, P).

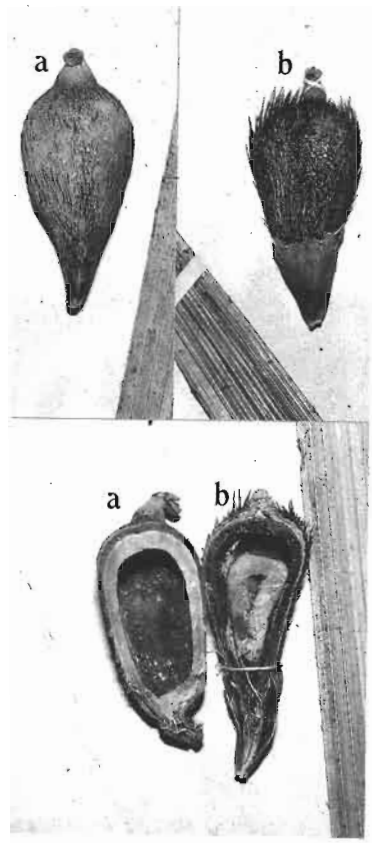

Fig. 27 - a. fruit of *Astrocaryum farinosum*; b. fruit of *Astrocaryum sciophilum*.

Barbosa Rodrigues, however, described the flowers as being long after anthesis (he did not see staminate flowers); the relative size of the calyx and corolla may have been changed. *Astrocaryum farinosum* is akin to *Astrocaryum sciophilum*. The differences in pistillate flower and fruit justify maintaining two species. Further material of *Astrocaryum farinosum* is needed to completely resolve the question.

10. Astrocaryum sciophilum (Miquel) Pulle, Enum. Pl. Surinam: 73, 1906. (Fig. 27b, 28, 29, 30).

Bactris sciophila Miquel, Natuurk. Verh. Nat. Holl. Mij. Wetensch. Haarlem 7: 208, 1851.

Type specimen: Focke 922, Blaauwe Berg, Suriname (L) - not seen.

Astrocaryum plicatum Drude, pro syn., Mart. Fl. Bras. 3 (1881) 375. Type specimen: Sagot 594, French Guiana (seen at K, P).

A *medium-sized, single-stemmed* palm. *Stem* 2-10 m high, 12-17 cm in diameter, dark, unarmed, with close, prominent leaf scar; sheaths of dead leaves persistent on about 1 m under the crown. *Leaves* 8-14, up to 6.7 m long; *sheath* and *petiole* 0.7-1.5 m long, strongly armed with black, flattened spines, up to 25 cm long, arranged in oblique rows spaced about 3-5 cm apart on lateral sides of petiole; *rachis* 3.5 to 5.2 m long; *pinnae* 70-80-(95) per side, plicate, regularly arranged in one plane; *basal pinnae* 38-42 cm long, 0.4-0.7 cm wide: *median pinnae* 100-108 cm long, 4-5 cm wide; *apical pinnae* 65-69 cm long, 17-20 cm wide. *Inflorescence* erect, *infructescence* arching, up to 1.5 m long; *prophyll* 0.7 m long, strongly flattened, abaxial side setose, adaxial side lustrous; *peduncular bract* 0.6-0.7 m long, decaying and becoming fibrous at fruit maturity, brown-tomentose with dense, black, 1.5 cm long spines; *peduncle* up to 1 m long, nearly cylindrical, the part from bract insertion to rachis armed with dense, black, 2.5 cm long spines, the basal part usually unarmed; *rachis* 10-25 cm long; *rachillae* 6 cm long, proximal part pilose, distal part with staminate flowers 4 cm long, a single pistillate flower inserted on the rachis. *Staminate flower* with *calyx* minute; *petals* 3, slightly connate basally, 2 mm long, yellowish; *stamens* 6; *anthers* 0.6 mm long. *Pistillate flower* 15 mm long; *calyx* tubular to urceolate, 7-11 mm long, slightly 3-dentate, whitish-tomentose with small, sparse spines, margin ciliate; *corolla* sligthly shorter than calyx, minutely setose, margin ciliate; *staminodial ring* up to 2.5 mm long, 6-dentate; *pistil* setose, 0.7 cm long; *stigmas* 3, ca. 1 cm long. *Fruit* turbinate to obovoid, densely congested and depressed basally, rounded at apex, to 7 cm long including a 0.5-1 cm long rostrum, 3-4 cm in diameter; *epicarp* brown with black, hard, 5-12 mm long spines; *mesocarp* dry, fibrous; *endocarp* 2-3 mm thick; *perianth* with *corolla* irregularly dentate, up to 28 mm long, *staminodial ring* up to 13 mm, *calyx* irregularly lobed, 14 mm long.

Specimens observed:

FRENCH GUIANA - *Billiet & Jadin 1872* (CAY), 27 Oct 1983, Cacao. *Granville 3257* (CAY, P), 10 Jan 1980; *4508 A* (P), 15 May 1981: 3°37'N, 53°12'W, 200-400 m, Saül. *Oldeman 1088* (CAY), 9 Feb 1965, ca. 40 km S of Cayenne. *Sagot 594, 597* (K, P), Jan 1855, Karouany. SURINAM - *Moore & Palmtak 10316* (BH), 2 Jul 1977, road from Paramaribo to Victoria.

Distribution: In the northeastern parts of the Amazon basin.

Ecology: In terra firme forests.

Uses: Liquid endosperm of unripe fruit is drunk.

Vernacular names: boegroemaka (S), mourou mourou (FG), pingomaka (S).

Fig. 28- *Astrocaryum sciophilum* - oblique rows of spines on petiole.

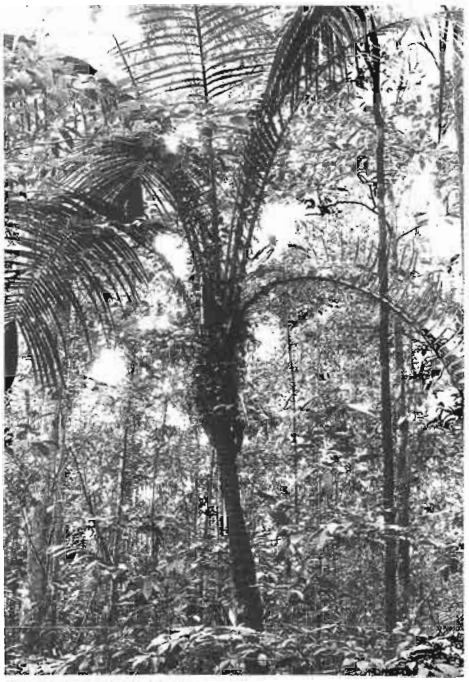

Fig. 29-*Astrocaryum sciophilum* in a forest of French Guiana.

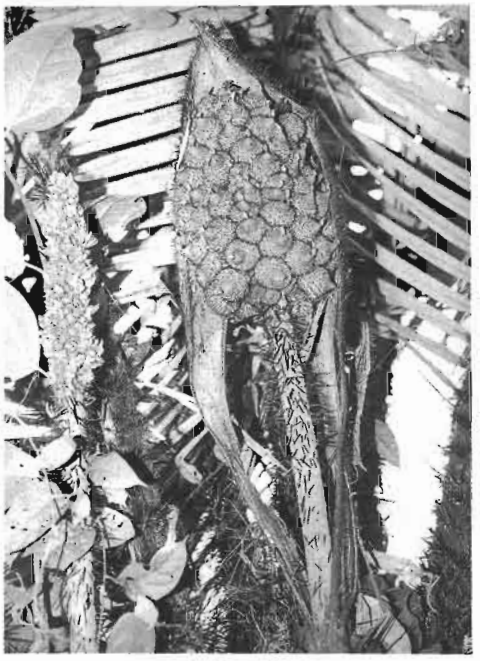

Fig. 30 - *Astrocaryum sciophilum* - infructescence.

11. Astrocaryum sociale Barbosa Rodrigues, Vellosia 1: 48, 1888 (Fig. 31, 32).

Type specimen not designated, Igarapé Tarumã-Miri, Rio Negro, Brazil.

A *subterranean-stemmed* palm. *Leaves* 6-10; *petiole* 109-144 cm long, with regularly spaced rows of flattened, black, up to 10 cm long spines; *rachis* 2.7-3.6 m long; *pinnae* 51-70 per side, plicate, regularly arranged in one plane; *basal pinnae* 41-79 cm long, 0.2-1.6 cm wide; *median pinnae* 76-88 cm long, 2.9-3.7 cm wide; *apical pinnae* 48-68 cm long, 6-16 cm wide. *Inflorescence* and *infructescence* erect; *prophyll* flattened, setose; *peduncular bract* 40 cm long with dense, black, 1-1.5 cm long spines; *peduncle* 40-50 cm long, densely armed below the rachis with black, 2 cm long spines; *rachis* 7-9 cm long; *rachillae* 6-7 cm long, proximal part pilose, distal part with staminate flowers 4-5 cm long, one pistillate flower at base inserted on the rachis. *Staminate flower* with *sepals* 0.6 ± 0.1 mm long; *petals* slightly connate basally, brown, 2.5 ± 0.2 mm long; *stamens* 6; *anthers* 1 mm long; *filament* 0.7 mm long; *pistillode* absent. *Pistillate flower* 12-14 mm long including stigmas, 7-8 mm wide; *calyx* urceolate, 8.2 ± 0.7 mm long, 3-denticulate, with very sparse, 0.2 mm long spines, margin ciliate; *corolla* smaller than calyx, 6.5 ± 0.4 mm, brown-tomentose with short spines, 0.2 mm long, whitish, brown at tip; *staminodial ring* 1.1 ± 0.2 mm long; *pistil* 7-8 mm long, 4-5.5 mm wide, tomentose, brown-red with sparse, flattened, whitish spines; *stigmas* 3, 7-10 mm long, 5.5-7.5 mm wide (together). *Fruit*

subglobose to turbinate, 4-6 cm long with a short rostrum, 3-3.5 cm in diameter; *pericarp* brown, with 1-2 mm long spines; *mesocarp* dry; *perianth* with *corolla* funnel-shaped, 20-26 mm long, crenate to irregularly dentate, *staminodial ring* crenulate, 11-14 mm long, *calyx* 3-5-lobed, 8-15 mm long.

Specimens observed:

BRAZIL - *Henderson 680* (NY), 10-21 Nov 1986, Reserva Ducke, 26 km near Manaus. *Huebner 150* (BH), Manaus. *Kahn 569* (P), 16 Jun 1981; *587* (INPA), 10 Aug 1981, Amazonas, km 36, Manaus-Itacoatiara road. *Kahn & Moussa 3223* (P), 13 Dec 1991, Amazonas, km 12, Manaus-Itacoatiara road.

Distribution: In the central northern parts of the Amazon basin.

Ecology: In terra firme forests where it forms very dense populations (Kahn & Castro, 1985).

Uses: Thatching occasionally.

Vernacular names: murumuru da terra firme, palha (Br).

Fig. 31 - *Astrocaryum sociale* in a forest of central Amazonia, near Manaus, Brazil.

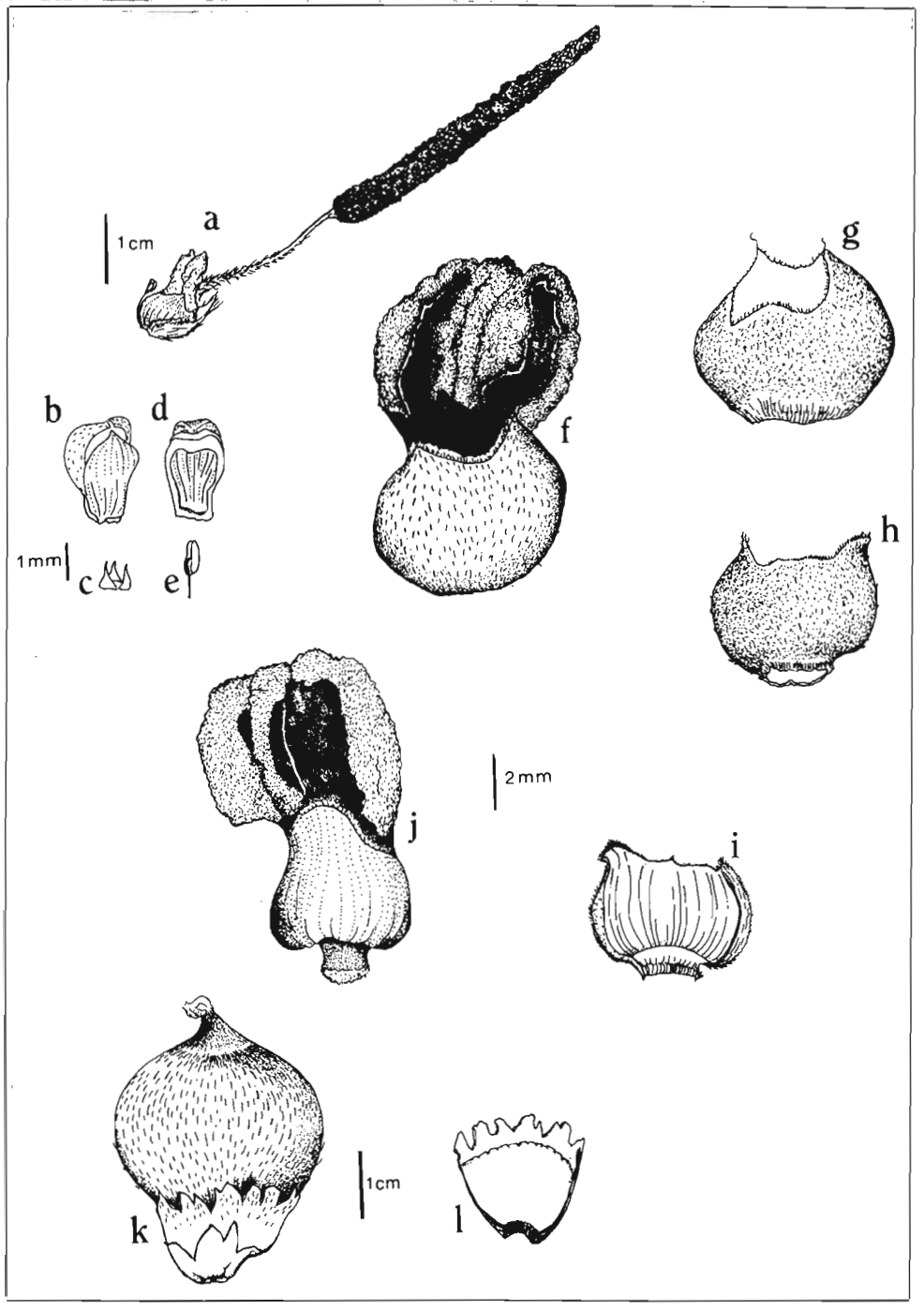

Fig. 32 - *Astrocaryum sociale* - a. rachilla; b. staminate flower; c. calyx; d. petal; e. stamen; f. pistillate flower; g. calyx; h. corolla; i. staminodial ring in corolla; j. pistil; k. fruit; l. perianth in fruit: corolla with staminodial ring. (Material used: Kahn 569; Kahn & Moussa 3223)

12. Astrocaryum ferrugineum F. Kahn et B. Millán, sp. nov. (Fig. 33-36).

Palma solitaria horridissima, floris pistillati calyce hirsuto, 3-dentato, obclavato, limbi pagina abaxiali pilosa.

Henderson A. 674 , Manaus, Brazil (Holotype: NY; Isotype: K).

A *medium-sized, single-stemmed* palm. *Stem* 2-8 m high, 17-25 cm in diameter, unarmed with prominent leaf scars; sheaths of dead leaves persistent on about 1 m under the crown. *Leaves* 10-16; *sheath* and *petiole* 60 cm long, densely armed with shiny black, up to 25 cm long spines; *rachis* 4.9 m long, armed with flattened black spines, shorter and less dense towards the apex; *pinnae* 105-120 per side, regularly arranged in a horizontal plane, abaxial side covered in a whitish indumentum with brown to rusty-red hairs; *basal pinnae* forming a V-shape open towards the stem, 90 cm long, 5 cm wide; *median pinnae* perpendicular to the rachis, 98-138 cm long, 5-5.5 cm wide; *apical pinnae* forming a V-shape open outwards, 72 cm long, 5.5 cm wide. *Inflorescence* erect, *infructescence* arching; *prophyll* 70 cm long, 12 cm wide, flattened, setose; *peduncular bract* inserted 30-35 cm from the rachis, with yellowish to brown, 5-11 mm long setae, in medium to high density, with intermixed flattened, 10-15 mm long, black spines, these up to 3 cm long, in higher density at apex; *peduncle* to 1 m long, light brown-setose, very densely armed above and below the bract insertion with flattened, grayish-floccose, black, obliquely erect, 2-6 cm long spines; *rachis* up to 40 cm long; *rachillae* many, proximal part glabrous, 3-5.5 cm long, distal part bearing staminate flowers 7-10 cm long, densely pilose with slender hairs, one pistillate flower at base inserted on rachis. *Staminate flower* with *sepals* slender, 1.5 ± 0.1 mm long, slightly connate basally; *petals* brown, 2.6 ± 0.1 mm long, slightly connate basally; *stamens* 6; *anthers* 1.1 ± 0.1 mm long; *filament* 1.3 mm long; *pistillode* slender, 1-parted, 0.8-1 mm long. *Pistillate flower* with *calyx* obclavate, 6-8 mm wide in the lower third, 3 mm wide at mouth, 11.7 ± 1 mm to 14-15 mm long, 3-dentate, with 0.5-5mm long setae; *corolla* shorter than calyx, oblong, 3-dentate with margin ciliate, 9.6 ± 0.8 mm to 11-12 mm long, with many flexuous, light brown to black, 3-4 mm long spines; *staminodial ring* entire, 6-denticulate, 4.7 ± 0.6 mm to 6 mm long; *pistil* conoidal, 9-16 mm long covered with 1.5 mm long spines; *stigmas* 3, 5-7 mm long. *Fruit* turbinate, depressed basally, 4.5-6 cm long including a 0.7 cm long rostrum, 2.7-3.8 cm in diameter; *pericarp* densely covered with black, 3-4 mm long setae; *mesocarp* dry; *endocarp* bony; *perianth* with *corolla* cup-shaped, margin irregularly dentate, 17-22 mm long, *staminodial ring* entire, dentate, 11-15 mm long, calyx several-lobed, 10-19 mm long.

Specimens observed:

BRAZIL - *Castro 635* (P), 12 oct 1983; ***Henderson 674*** (K, NY), 10-21 Nov 1986; *Kahn & Couturier 2295*, 16 Nov 1987: km 26 Manaus-Itacoatiara road, Reserva Ducke. *Kahn & Moussa 3227, 3228* (P), 12 Dec 1991; km 12 Manaus-Itacoatiara road. *MacKenzie s.n.* (P), Balbina.

Distribution: In the central northern parts of the Amazon basin.

Ecology: In terra firme forests on sandy-clayey soils.

Uses: Not reported.

Vernacular name: murumuru da terra firme (Br).

Notes: This species can hardly be confused with another. It is the most densely armed of all the Amazonian species of the section *Ayri*, and the only one which presents such a pilosity on abaxial side of the blade. The dead leaves, which persist obliquely from their point of insertion to the ground (see Fig. 33), also characterize this species.

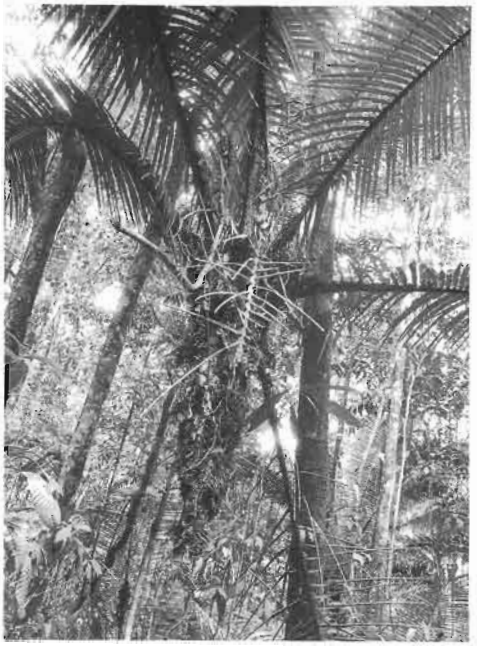

Fig. 33 - *Astrocaryum ferrugineum* in a forest of central Amazonia, near Manaus, Brazil.

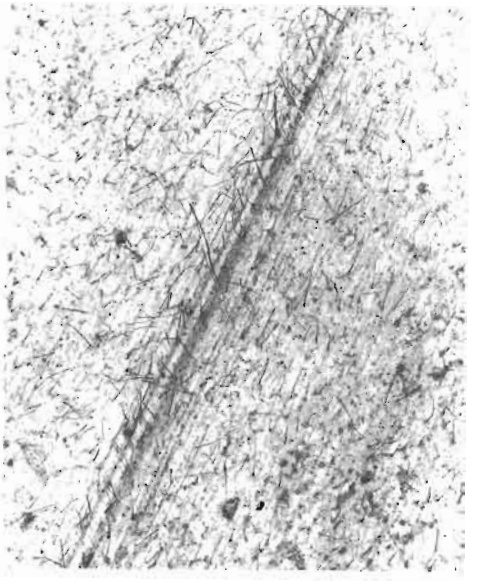

Fig. 34 - *Astrocaryum ferrugineum* - pilosity on abaxial side of the blade.

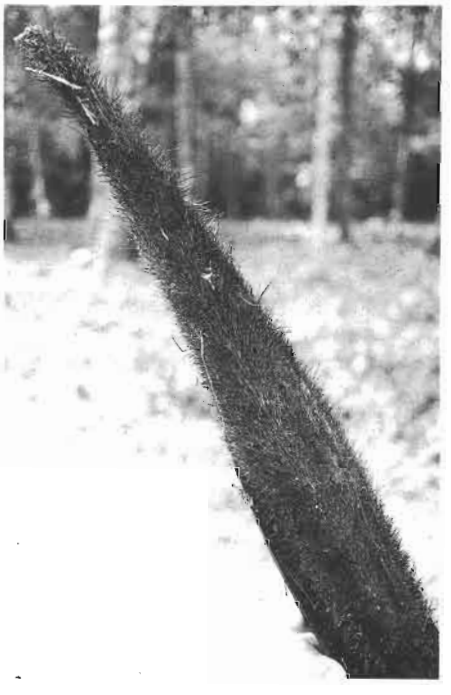

Fig. 35 -*Astrocaryum ferrugineum* - peduncular bract.

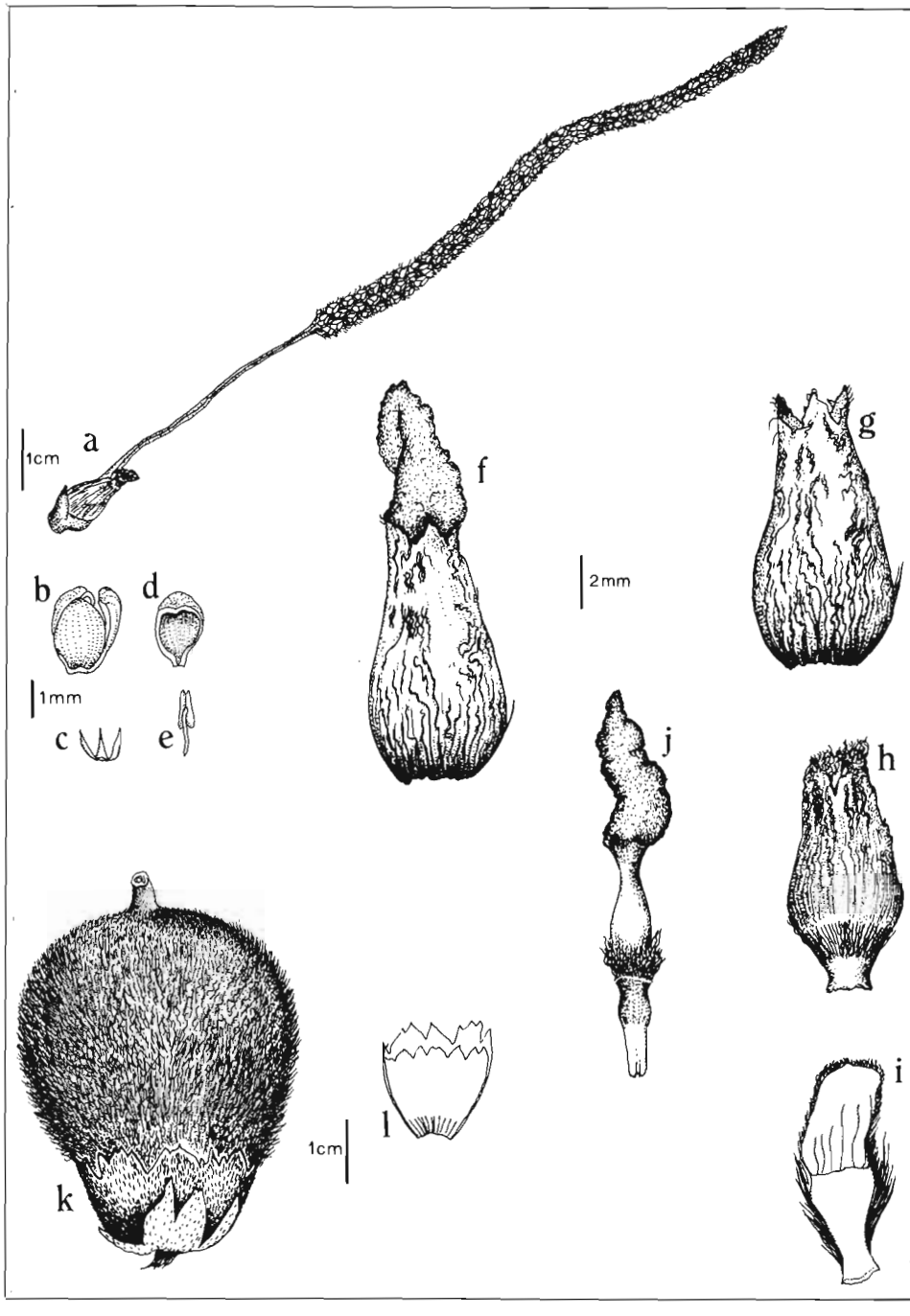

Fig. 36 - *Astrocaryum ferrugineum* - a. rachilla; b. staminate flower; c. calyx; d. petal; e. stamen; f. pistillate flower; g. calyx; h. corolla; i. staminodial ring in corolla; j. pistil; k. fruit; l. perianth in fruit: corolla with staminodial ring. (Material used: Henderson 674; MacKenzie s.n.; Kahn & Couturier 2295)

13. Astrocaryum ciliatum F. Kahn et B. Millán, sp. nov. (Fig. 37, 38, 39).

Palma solitaria, acaulis vel caudice humili. Flore pistillato hirsuto; calyce corollam valde superans; corollae limbo confertim aculeato; annulo staminodiali membranaceo, deminuto. Fructus cupula, insigniter ciliata.

Galeano G. & Huitoto J. 1315, Colombia (Holotype: COL; Isotypes: HA, NY)

Astrocaryum sciophilum auct. non (Miquel) Pulle: Galeano, Tropenbos-Colombia, vol. 1: 51-52, fig. 9, 1991.

A *subacaulescent, single-stemmed* palm. *Stem* in old trees up to 5 m high, 10-15 cm in diameter, covered with dead leaf sheaths. *Leaves* 7-12, erect; *sheath* and *petiole* up to 1.5 m long, armed with flattened, slightly winged, black, 5-10 cm long spines, petiole green; *rachis* 285-475 cm long, sparsely to densely armed with flattened spines; *pinnae* 47-84 per side, regularly arranged in one plane, with 1-2 parallel ribs near the margins on each side of the midrib, abaxial side covered in a whitish indumentum; *basal pinnae* 32-82 cm long, 0.5-2 cm wide; *median pinnae* 81-86 cm long, 3-3.5 cm wide; *apical pinnae* 30-32 cm long, 1-3 cm wide. *Inflorescence* and *infructescence* erect; *prophyll* not seen; *peduncular bract* up to 50 cm long, 8 cm wide, brown-setose, with black, up to 1 cm long spines, armed at apex with terete to flattened, flexuous, up to 3 cm long spines, these in high density beneath a narrow, setose, 3-5 cm long acumen; *peduncle* up to 90 cm long, oval, 1.2-2 cm wide, covered in a brown-red indumentum, armed between bract insertion and rachis with flexuous, brown-floccose, shiny black, up to 3 cm long spines; *rachis* 10-17 cm long; *rachillae* many, proximal part glabrous, 2-4 cm long, distal part bearing staminate flowers 4-6 cm long, one pistillate flower directly inserted on rachis. *Staminate flower* not seen. *Pistillate flower* totally covered with a bract at rachis base, this shorter above; *calyx* elongato-urceolate, 3-denticulate, slightly 3-lobed, 11.5-12.5 mm long, 9-9.5 mm wide in the lower third, 4-4.5 mm wide at mouth, covered with flexuous, light brown to black, up to 4 mm long spines; *corolla* tubular, 3-denticulate, slightly 3-lobed, 7.5 mm long, yellowish to brown-tomentose, densely armed in the upper part and at the margin with flexuous, black, up to 2.5 mm long spines, and with less dense, light brown spines towards the base; *staminodial ring* membranous, dentate, ca. 1 mm long; *pistil* cylindrical, 12.5 mm long not including stigmas, ca. 4 mm wide, brown, armed with brown to black, 1-2 mm long spines; *stigmas* 3. *Fruit* turbinate to pear-shaped, 4.6-5.2 cm long including a 0.6-1 cm long rostrum, 2.6-3.0 cm wide; *pericarp* brown-red, densely and minutely setose to spiny; *mesocarp* fibrous, dry; *endocarp* bony; *perianth* with *corolla* obconoidal, 14-18 mm long, whitish to brown tomentose, the upper part covered with flattened, flexuous, brown to black, 1-4 mm long setae or spines, margin crenulate, densely ciliate, *staminodial ring* inconspicuous, minutely denticulate, 6-12 mm long, *calyx* tawny, irregularly lobed, 10-12 mm long, with small, flexuous, brown to black spines, these not persistent at maturity.

Specimens observed:

COLOMBIA - *Galeano et al. 902* (COL), 18 Apr 1986; ***Galeano & Huitoto 1315*** (COL), 24 Sep 1987; *Torres et al. 3183* (COL, NY), 14 Apr 1986: 200-300 m, Amazonas, corregimiento de Araracuara. *Galeano & Miraña 1812* (COL), 17 Sep 1988, 250 m, Amazonas, Cahuinari River. *Galeano et al. 2216*, 17 Mar 1990 (COL), 180 m, Leticia-Tarapacá road, ca. 7 km N of Leticia.

Distribution: In the northwestern parts of the Amazon basin.

Ecology: In terra firme forest understory.

Uses: Liquid endosperm of unripe fruit is drunk (Galeano 1991); sap is used for curing snake bite (La Rotta *et al.*, 1989, *in:* Galeano, 1991).

Vernacular names: coco peludo, coco, cumare de guara (C).

Notes: This species will be easily identified (1) from thelimb of corolla in pistillate flower which is densely spiny, (2) from the setose to spiny, almost entire margin of corolla in fruit, (3) from the median pinnae with 1-2 parallel ribs near the margins on each side of the midrib, and (4) from the apical pinnae usually one-pointed in adult plant. It cannot be confused with *Astrocaryum sciophilum* and *Astrocaryum sociale* which do not present such characters: corolla limb is not densely spiny in pistillate flower, it is crenate to irregularly dentate, neither crenulate, nor densely ciliate in fruit; pinnae are clearly plicate, and apical pinnae are multi-pointed; the peduncular bract is strongly armed on its whole length, not only beneath the apex, and there is no narrow, unarmed acumen. Moreover the proximal part of rachillae is hirsute in these latter species, while it is glabrous in *Astrocaryum ciliatum*.

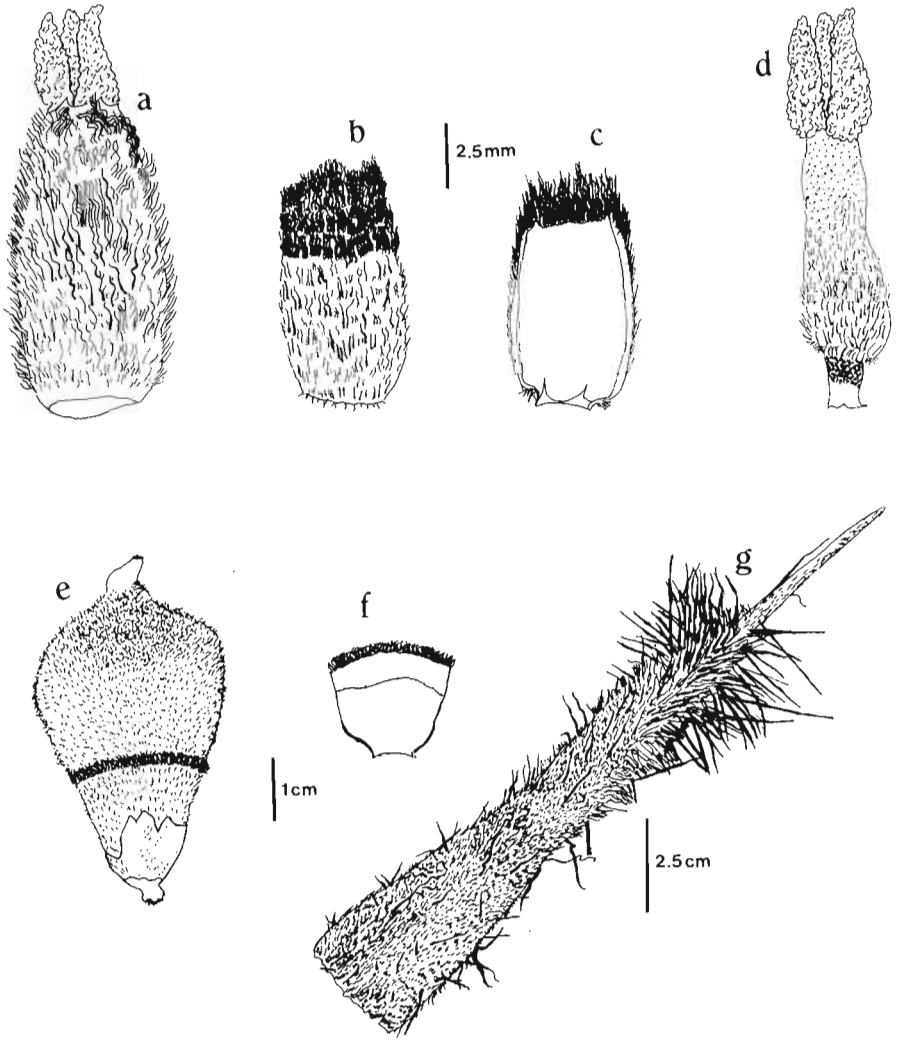

Fig. 37 - *Astrocaryum ciliatum* - a. pistillate flower; b. corolla; c. staminodial ring in corolla; d. pistil; e. fruit; f. perianth in fruit: corolla with staminodial ring; g. upper part of peduncular bract. (Material used: Galeano & Miraña 1812; Galeano & Huitoto 1315)

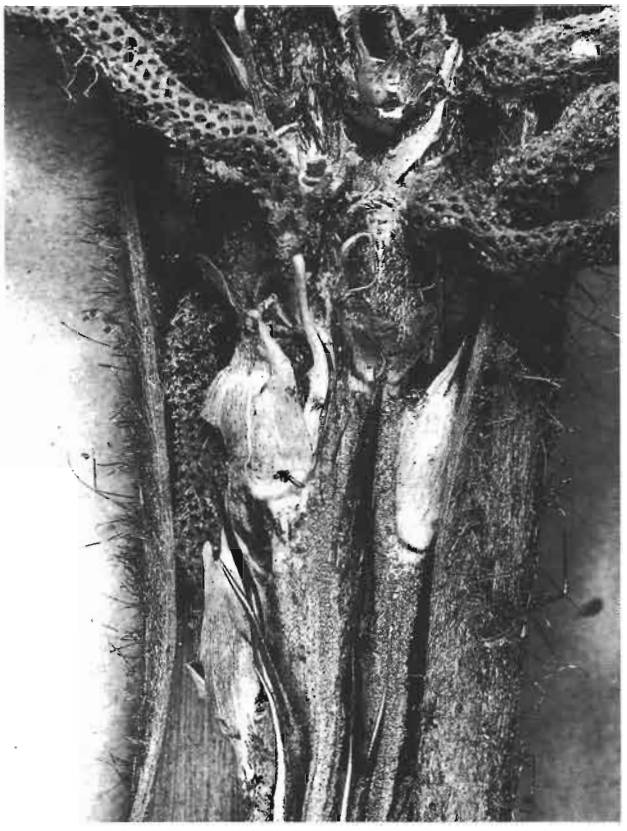

Fig. 38 - *Astrocaryum ciliatum* - Inflorescence: base of the rachis with pistillate flowers entirely covered with bracts.

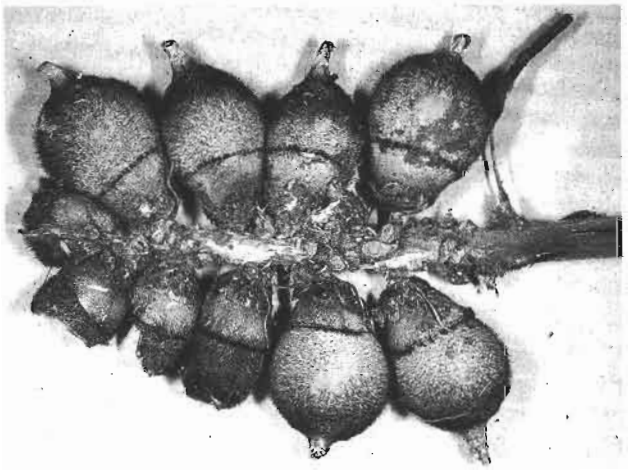

Fig. 39 -*Astrocaryum ciliatum* - Infructescence.

14. Astrocaryum scopatum F. Kahn et B. Millán, sp. nov. (Fig. 40).
Palma caespitosa, calyce hirsuto; differt a *Astrocaryum huicungo* Burret floris pistillati calyce cupelliformi; a *Astrocaryum carnosum* Kahn et Millán annulo staminodiali altiore.
Kahn F. & Borchsenius F. 2563, Peru (Holotype: P; Isotypes: AAU, K, USM).
A *subacaulescent, multistemmed* palm. *Stem* in old trees up to 2 m high, 15 cm in diameter, unarmed with prominent leaf scars; sheaths of dead leaves persistent on about 1 munder the crown. *Leaves* 8-12, up to 6.5 m; *sheath* and *petiole* 1.3-2.2 m long, sheath dark brown-setose, abaxial side with flattened, slightly flexuous, black, grayish-tomentose, up to 15 cm long spines, these shorter and more or less arranged in groups on petiole; *rachis* 3.6-4.2 m long, covered with a grayish indumentum, black-setose, abaxial side with flattened, black, up to 6 cm long spines in groups, adaxial side with shorter spines in lower density; *pinnae* 81-96 per side, regularly arranged in one plane; *basal pinnae* 124 cm long, 4.2 cm wide; *median pinnae* 95-121 cm long, 6-7 cm wide; *apical pinnae* 37-47 cm long, 6-7 cm wide. *Inflorescence* and *infructescence* erect; *prophyll* 65 cm long, 11 cm wide, flattened, densely setose, with brown to black spines, up to 2 cm long; *peduncular bract* 90 cm long inserted 33-46 cm from rachis, densely brown-setose, with intermixed black spines, grayish-tomentose, 0.8 cm long, in higher density in the upper part; *peduncle* up to 1 m long, section oval, 4 x 3 cm at base, 3 x 2 cm near rachis, with a few small spines; *rachis* 33-36 cm long, armed with a few flexuous, black spines between pistillate flowers; *rachillae* many, proximal part 4-9 cm long, glabrous, distal part bearing staminate flowers 9-13 cm long, thick, hirsute with slender whitish hairs, one pistillate flower at base inserted on rachis. *Staminate flower* with *sepals* carinate, 1.4 ± 0.1 mm long; *petals* brown with margin yellowish, slightly connate basally, 3.8 ± 0.4 mm long; *stamens* 6; *anthers* 1.7 ± 0.1 mm long; *filament* up to 1.8 mm long; *pistillode* small, 3-parted. *Pistillate flower* subglobose; *calyx* cask-shaped, 3-denticulate, 10.0 ± 0.3 mm long, 11 mm wide, with many dense, brown, 1-2 mm long spines; *corolla* subequal, 3-denticulate, 9.8 ± 0.6 mm long, covered with brown to black, 3-5 mm long spines; *staminodial ring* entire, wavy, 4.5 mm long; *pistil* conoidal, floccose, with light brown, 2 mm long spines basally, these dark brown and in lower density in the upper part; *stigmas* 3, 4-5 mm long. *Fruit* turbinate, round in the upper part, 6.7-7.1 cm long including a 0.7 cm long rostrum, up to 4.5 cm wide; *pericarp* densely covered with bristly, soft, dark brown, 2-4 mm long setae; *mesocarp* thin; *endocarp* bony, 4.5 mm thick; *perianth* with *corolla* funnel-shaped, crenate to irregularly dentate, 19-20 mm long, the upper part covered with brown, 2-4 mm long setae, *staminodial ring* crenulate, 11-12 mm long, *calyx* irregularly 3-5-lobed, 12-13 mm long, hirsute with brown, 2-3 mm long setae in the upper part; *putamen* obovate, asymmetrical, 3.5 cm long, 2.5 cm wide.
Specimens observed:
PERU: ***Kahn & Borchsenius 2563*** (AAU, K, P, USM), 22 May 1990, upper Marañon River valley, 10 mn from Santa María de Nieve, Amazonas, Bagua. *Berlin 831* (BH), 4 Jan 1973, 240 m, Amazonas, Bagua, Cenepa River, between mouths of Huampani and Tuhusik streams.
Distribution: In the northern parts of Peruvian Amazonia.
Ecology: On periodically flooded alluvial soils.
Uses: Liquid endocarp of unripe fruit is drunk.
Vernacular name: huicungo (P).
Notes: This species is characterized by the cask-shaped calyx, the lower density of the wide pistillate flowers on the rachis, and as a result, by having the widest fruits in this group. *Astrocaryum scopatum* differs from the two multistemmed *Astrocaryum carnosum* and *Astrocaryum huicungo* in the larger diameter of the distal part of rachillae including staminate flowers, in the whitish hairs between these flowers, and in the dry mesocarp.

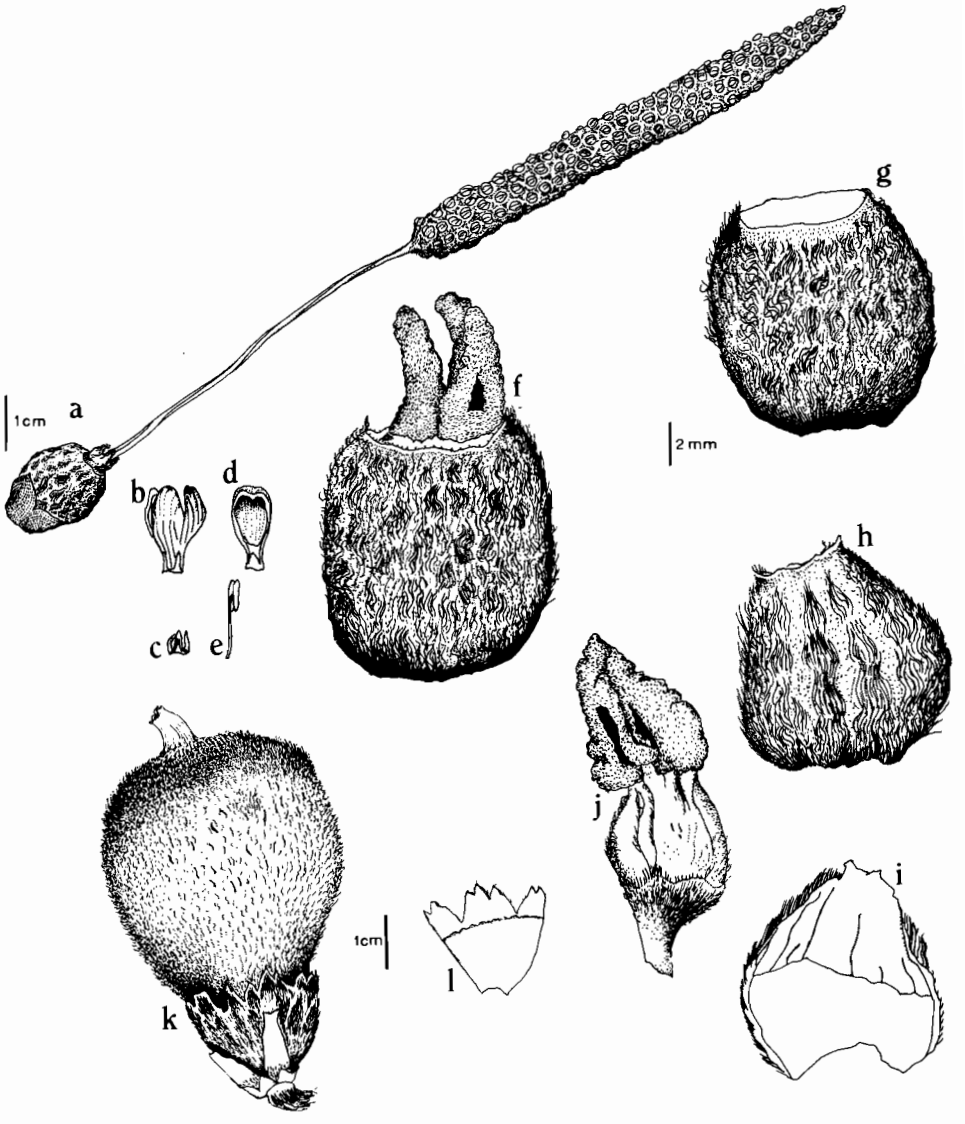

Fig. 40 - *Astrocaryum scopatum* - a. rachilla; b. staminate flower; c. calyx; d. petal; e. stamen; f. pistillate flower; g. calyx; h. corolla; i. staminodial ring in corolla; j. pistil; k. fruit; l. perianth in fruit: corolla with staminodial ring. (b-j with same scale. Material used: Kahn & Borchsenius 2563)

15. Astrocaryum carnosum F. Kahn et B. Millán, sp. nov. (Fig. 41).

Palma caespitosa, floris pistillati calyce tubulari hirsuto, mesocarpio carnoso; differt a *Astrocaryum huicungo* Burret annulo staminodiali dentato deminuto, epicarpii aculeis longioribus et irregulater longis.

Kahn F. 1839, Peru (Holotype: P; Isotypes: K, USM).

A *subacaulescent, multistemmed* palm. *Stem* in old trees up to 2 m high, 18 cm in diameter, unarmed with prominent leaf scars; sheaths of dead leaves persistent on about 1 munder the crown. *Leaves* 8-12, up to 7.5 m long; *sheath* up to 1.5 m long, with margins fibrous, densely setose, abaxial side densely armed with black, fulvo-tomentose, up to 20 cm long spines; *petiole* up to 1.2 m long, armed with 3-6 cm long spines, more or less arranged in linear groups; *rachis* 3.0-6.3 m long, red brown-tomentose and shortly black-setose with flattened, black, 3-5 cm long spines in the basal half; *pinnae* 85-120 per side, regularly arranged in one plane; *basal pinnae* 61-124 cm long, 1-2.5 cm wide; *median pinnae* 80-144 cm long, 4-6 cm wide; *apical pinnae* 28-60 cm long, 2.5-7.5 cm wide. *Inflorescence* and *infructescence* erect; *prophyll* up to 1 m long, 12 cm wide, flattened, densely setose, light to dark brown; *peduncular bract* to 1 m long inserted 35-50 cm from rachis, densely covered with light brown setae basally, other more rigid, and intermixed dark brown spines in the upper two thirds, and with up to 5 cm long spines at apex; *peduncle* up to 1.7 m long, usually shorter, section oval, 4 x 3 cm at base, 2.5 x 2 cm near rachis, not very spiny; *rachis* 15-40 cm long; *rachillae* many, proximal part 1.5-4.5 cm long, glabrous, distal part bearing staminate flowers 4.5-10 cm long, hirsute with clavate hairs, one pistillate flower at base inserted on rachis. *Staminate flower* with *sepals* minute, 0.7 to 1.2 ± 0.1 mm long, slightly carinate; *petals* brown, slightly connate basally, 2.7 ± 0.2 to 3.0 ± 0.3 mm long; *stamens* 6; *anthers* 1.2-1.3 mm long; *filament* up to 1.5 mm long; *pistillode* small, 3-parted. *Pistillate flower* not totally covered with a bract at rachis base; *calyx* tubular, slightly 3-dentate, dilated and pleated at extremity, 10.8 to 13.4 ± 1 mm long, hirsute, with many yellowish to brown, 1-3 mm long spines; *corolla* subequal or slightly shorter than calyx, oblong to tubular, pleated at extremity, slightly 3-dentate, 10.8 to 12.4 ± 0.7 mm long, covered with brown to black, 3-5 mm long spines; *staminodial ring* entire, membranous, 6-dentate, 1.4-2 mm long, often with setae at margin; *pistil* conoidal, floccose, with whitish to brown, 2 mm long spines; *stigmas* 3, 4-5 mm long. *Fruit* turbinate, 6.6-7.4 cm long including a 0.8-1.1 cm long rostrum, 3.5-4.2 cm wide; *pericarp* brown-tomentose, with flexuous, irregular in size, up to 7 mm long spines; *mesocarp* orange, 4 mm thick, fleshy at maturity; *endocarp* round at top, pointed basally, slightly asymmetrical, 5.2-5.8 cm long, 2.1-2.5 cm in diameter, 3 mm thick; *perianth* with *corolla* funnel-shaped, laciniate, 15-22 mm long, densely covered in the upper part with brown, 2-4 mm long spines, *staminodial ring* entire or 6-dentate, 7 mm long, *calyx* several-lobed, 9-15 mm long, hirsute with brown, 2-3 mm long spines in the upper part.

Specimens observed:

PERU - ***Kahn 1839*** (K, P, USM), *1840* (CAY, P), Dec 1985; *1933* (P), *1934* (CAY), Sep 1986; *2031* (NY, P), Apr 1987: 76°26'W, 8°17'S, 500 m, San Martín, Mariscal Cáceres, in the upper Huallaga River valley, near Uchiza, Palmas del Espino's oil palm plantation.

Distribution: In the central eastern Andean piedmont of Peru.

Ecology: In forests on periodically flooded alluvial soils (Kahn & Mejia, 1990; Kahn & Granville, 1992).

Uses: Liquid endosperm of unripe fruit is drunk.

Vernacular names : huicungo (P).

Notes : This species is akin to *Astrocaryum huicungo* and *Astrocaryum javarense*. The main differences are the calyx pleated at limb and longer to subequal to corolla and the staminodial

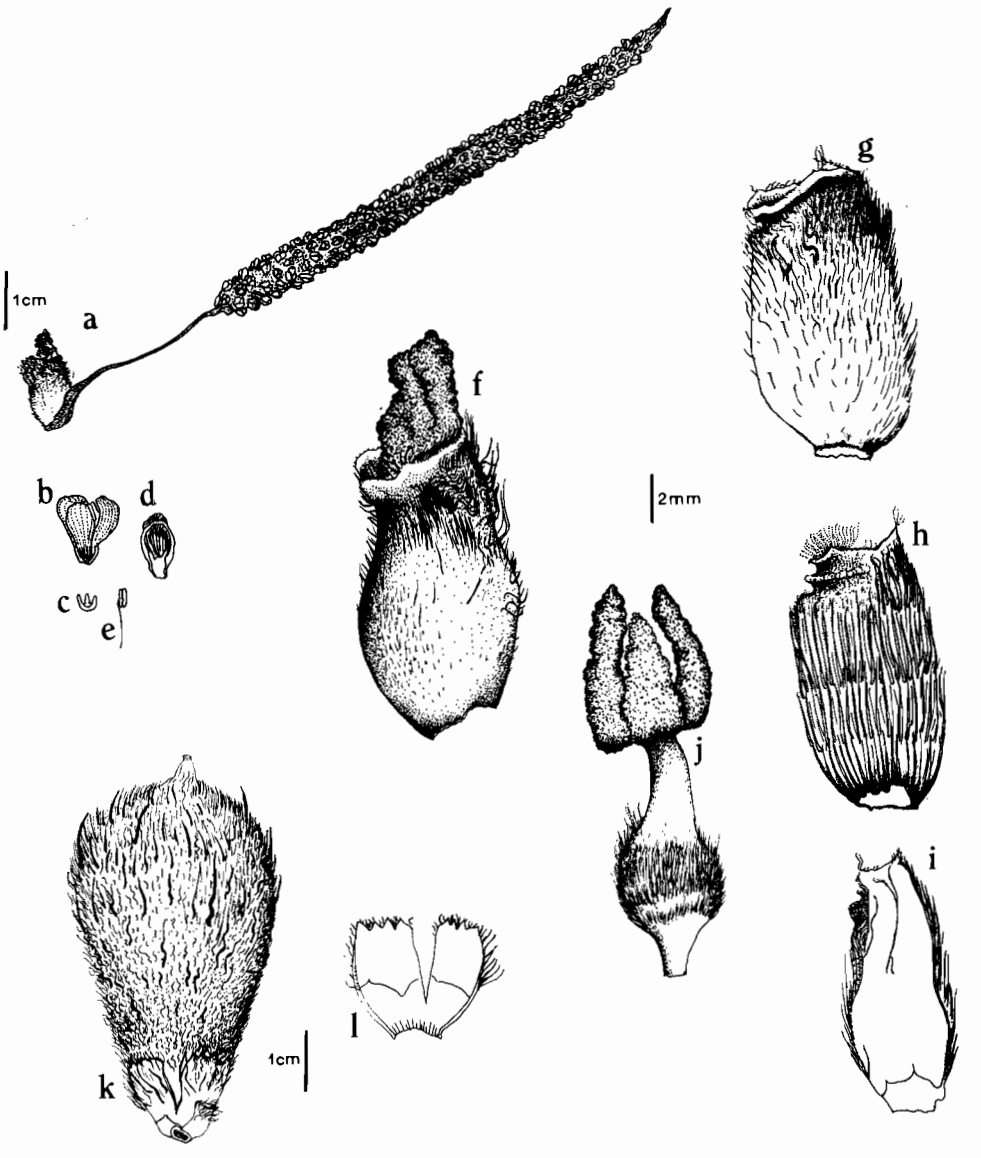

Fig. 41 - *Astrocaryum carnosum* - a. rachilla; b. staminate flower; c. calyx; d. petal; e. stamen; f. pistillate flower; g. calyx; h. corolla; i. staminodial ring in corolla; j. pistil; k. fruit; l. perianth in fruit: corolla with staminodial ring. (b-j with same scale. Material used: Kahn 1839, 1933, 2031)

ring membranous and low in corolla. From the former, the fruit of which is setose, it also differs in its dense, inequal-sized spines on the pericarp. From the latter which is single-stemmed with dry mesocarp, it differs in its multistemmed habit and its mesocarp fleshy at maturity.

16. Astrocaryum javarense Trail ex Drude, Mart. Fl. Bras. 3: 372, 1881 (Fig. 42, 43).

> *Astrocaryum paramaca* Martius var. *javarense* Trail, pro syn., J. Bot. 15: 77, 1877. Type specimen: Trail 186, Camaná, Jauari River, Brazil (1073, K?) - not seen.
>
> *Astrocaryum horridum* Barbosa Rodrigues, pro syn., Vellosia 2: 104, 1891. Type specimen not designated, Jauari River, Brazil.

A *subacaulescent, single-stemmed* palm. *Stem* in old trees up to 2 m high, 15-18 cm in diameter, dark, unarmed with prominent leaf scars; persistent sheaths of dead leaves on about 1 m under the crown. *Leaves* 8-16; *sheath* and *petiole* up to 3.4 m long, densely armed with flattened, black, up to 30 cm long spines; *rachis* 2.7-5.7 m long, abaxial sidewith a whitish indumentum, black-setose, with black, up to 8 cm long spines, these arranged in linear groups, adaxial side with fewer spines; *pinnae* 75-104 per side, regularly arranged in one plane, abaxial side with minute brown spines in a whitish indumentum; *basal pinnae* 41-73 cm long, 0.8-1 cm wide; *median pinnae* 70-124 cm long, 3.5-8.0 cm wide; *apical pinnae* 25-47 cm long, 2.3-4 cm wide. *Inflorescence* and *infructescence* erect; *prophyll* 60 cm long, 12 cm wide, strongly flattened, densely light to dark brown-setose, with some intermixed, black, 1-2 cm long spines; *peduncular bract* up to 80 cm long, densely light brown-setose basally, setae longer and more rigid at middle, with brown to black, 1-4 cm long spines, in higher density towards the apex; *peduncle* up to 1.3 m long, section oval, 3 x 3.5 cm, with many whitish-floccose, brown to black spines, very dense between rachis and bract insertion; *rachis* up to 40 cm long; *rachillae* many, proximal part glabrous, 2-7 cm long, distal part bearing staminate flowers 5-10 cm long, hirsute with slender hairs, one pistillate flower inserted on rachis at base of rachillae. *Staminate flower* with *sepals* minute, 0.7 to 1.4 ± 0.1 mm long, usually connate basally; *petals* constricted and slightly connate basally, brown, 2.4 to 3.2 ± 0.2 mm long; *stamens* 6; *anthers* yellow, 0.7 to 1 ± 0.1 mm long; *filament* brown, up to 2.5 mm long; *pistillode* slender, 3-parted. *Pistillate flower* oblong with *calyx* truncate, 3-denticulate, 8.6 ± 0.5 to 19.1 ± 2.2 mm long, hirsute with many, brown to black, up to 3 mm long spines; *corolla* subequal to longer than calyx, 10.2 ± 0.6 to 19.0 ± 3.0 mm, truncate, slightly 3-dentate, floccose with many brown to black, 3-5 mm long spines, those at base whitish; *staminodial ring* entire, 6-denticulate, 4.0 ± 0.5 mm to 10.6 ± 1.2 mm long; *pistil* oblong, floccose, with brown, short 1-2 mm long spines; *stigmas* 3, 3-5 mm long. *Fruit* turbinate to obovoid, depressed basally, 3.5-6.7 cm including a 0.4-mm long rostrum, 2.2-3.0 cm wide; *pericarp* floccose, brown, covered with light brown to black, flexuous, 4-8 mm long spines; *mesocarp* dry; *endocarp* bony; *perianth* with *corolla* crenulate to laciniate, 1.5-2.2 cm long, covered with dark brown, 3-4 mm long spines, *staminodial ring* crenate, 9-15 mm long, *calyx* 7-14 mm long, with 4-5 unequal, setose lobes.

Specimens observed:

PERU: *Gentry & Revilla 20873* (USM), Nov 1977, Yavari River, around margin of «cocha» across river from Brazilian village of Paumari. *Gentry et al. 56347* (USM), 22 Feb 1987; *Kahn & Mejia 1776, 1777, 1779, 1786* (CAY), *1780* (CAY, USM), 18-21 Mar 1985; *1858* (USM), 13 Mar 1986; *1971* (P), 13 Nov 1986; *2055* (USM), *2057* (AAU, K, P), 18 May 1987; *2069* (P), 22 Jul 1987; *Kahn et al. 2408* (NY), 15 Sep 1989; *Mejía 96* (P, USM), Oct 1982; *Millán 32* (USM), 9 Jul 1991; *89, 90* (USM), 24 Sep 1991: 4°55'S, 73°45'W, 130 m, Loreto, Requena, Jenaro Herrera. *Kahn 2340* (AAU, P), 4 Mar 1989; *Kahn & Moussa 3201* (NY), *3202* (K, P), 13 Nov 1991: Loreto, Ramón Castilla, Manití River.

Distribution: Only known from the Jauari River valley, in the western parts of the Amazon basin.

Ecology: In terra firme forests on clayey to sandy soils, also found on waterlogged soils, in lower density, however.

Uses: Liquid endosperm of unripe fruit is drunk.

Vernacular names: huicungo (P); murumuru da terra firme (Br).

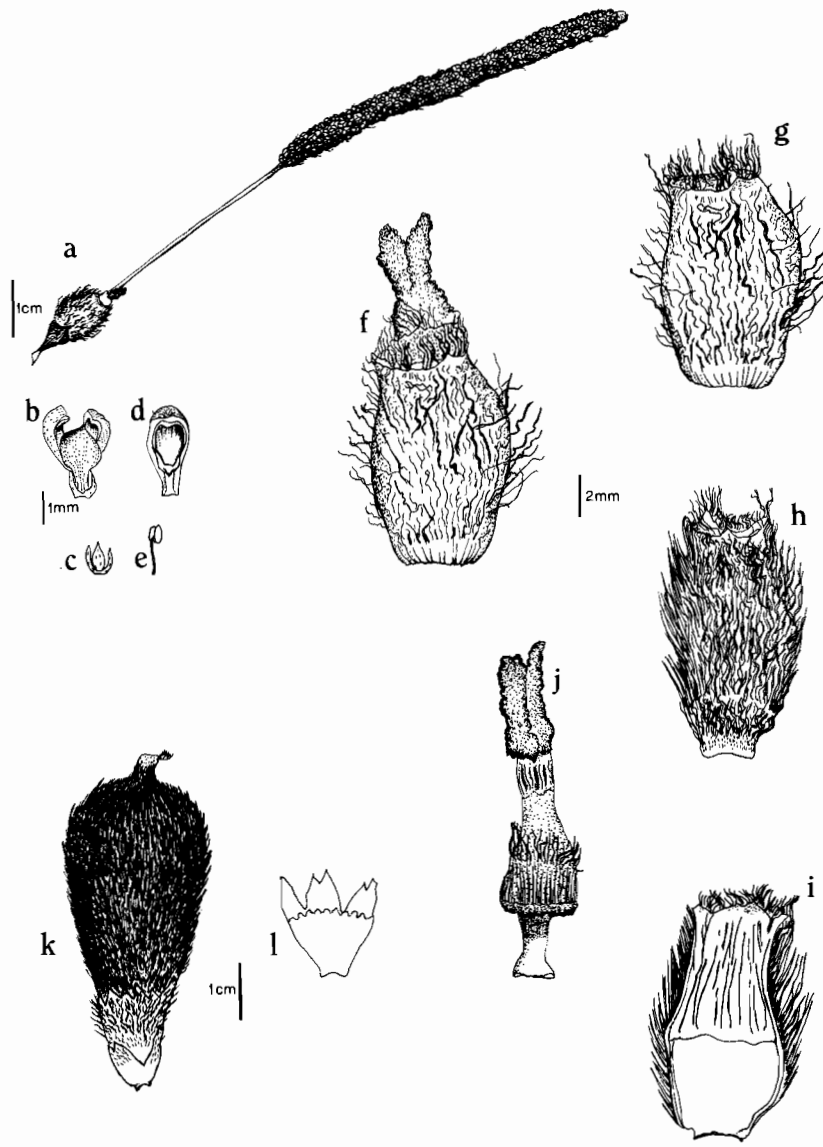

Fig. 42 - *Astrocaryum javarense* - a. rachilla; b. staminate flower; c. calyx; d. petal; e. stamen; f. pistillate flower; g. calyx; h. corolla; i. staminodial ring in corolla; j. pistil; k. fruit; l. perianth in fruit: corolla with staminodial ring. (Material used: Kahn & Mejía 2069; Kahn 2340)

Notes: *Astrocaryum horridum* is considered a synonym of *Astrocaryum javarense* because of the similarity of the diagnoses and of the vicinity of the type localities, both in the lower Jauari River valley. All the specimens observed were collected near the type locality (Manití River and Jenaro Herrera village are at about 100 km of the lower Jauari River). They clearly correspond to both diagnoses. The variability in size of the pistillate flower is high within a population (Fig. 43). The larger flowers are usually parasited by Curculionidae of the genus *Celetes* (Couturier & Kahn, unpubl.)

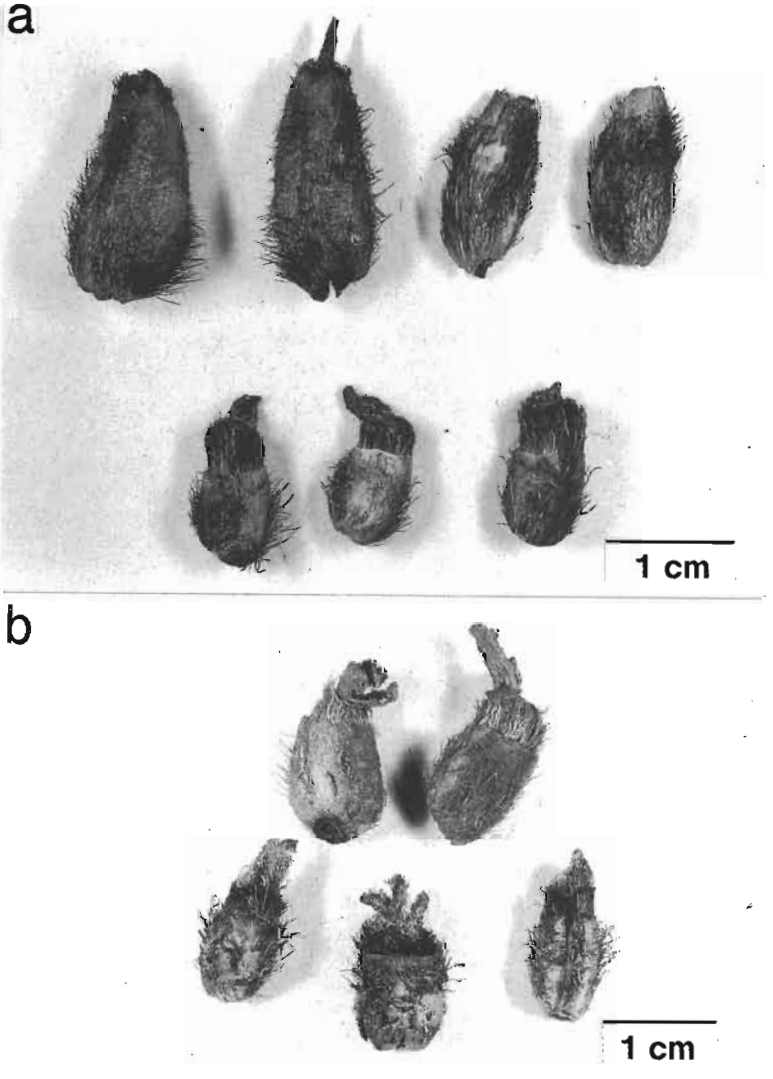

Fig. 43 - *Astrocaryum javarense* - Morphological variability in pistillate flowers. a. in a population located in the lower Manití River valley; b. in a population located in Jenaro Herrera, lower Ucayali River valley.

17. Astrocaryum huicungo Dammer ex Burret, Fedde Rep. 35: 146, 1934 (Fig. 44).

Type specimen (isotype): Weberbauer s.n., Peru (seen at BH, one fruit).

A *subacaulescent, multistemmed* palm. *Stem* in old trees up to 2 m high, 15-18 cm in diameter, unarmed with prominent leaf scars; sheaths of dead leaves persistent on about 1 m under the crown. *Leaves* 8-15, up to 7 m long; *sheath* and *petiole* up to 2.5 m long, green, black-setose, densely armed with flattened to 4-angulate, whitish-tomentose, black, up to 35 cm long spines, these shorter and arranged in cross-linear groups on petiole; *rachis* 3.7-4.5 m long, with a grayish-indumentum, shortly black-setose on its whole length, with scattered, flattened, black, up to 6 cm long spines on abaxial side; *pinnae* 74-117 per side, regularly arranged in one plane, abaxial side with minute brown spines in a whitish indumentum; *basal pinnae* 60 cm long, 0.5 cm wide; *median pinnae* 95-101 cm long, 4.5-5.1 cm wide; *apical pinnae* 23-40 cm long, 2-10 cm wide. *Inflorescence* and *infructescence* erect; *prophyll* 75 cm long, 14 cm wide, flattened, densely light to dark brown-setose, some setae more rigid, with a few brown, 1 cm long spines; *peduncular bract* up to 1 m long inserted 40 cm from rachis, densely covered with light brown, 5-8 mm long, soft setae basally, others more rigid, and intermixed black, 15 mm long spines, denser in the upper part, and with flexuous, grayish-tomentose, up to 4 cm long spines at apex; *peduncle* up to 1.2 m long, section oval, 7 x 4 cm, not very spiny; *rachis* up to 40 cm long; *rachillae* many, proximal part 2-8.5 cm long, glabrous, distal part bearing staminate flowers 7-10 cm long, hirsute with slender to clavate hairs, one pistillate flower at base inserted on rachis. *Staminate flower* with *sepals* minute, 0.6 to 1.1 ± 0.2 mm long, slightly carinate; *petals* brown, slightly connate basally, 2.8 ± 0.1 to 3.4 ± 0.2 mm long; *stamens* 6; *anthers* 1.1 to 1.2 ± 0.1 m long; *filament* up to 1.8 mm long; *pistillode* small, 3-parted. *Pistillate flower* entirely covered with a bract in the lower third of the rachis, this shorter in the upper part; *calyx* tubular, truncate, 3-denticulate, 10.8 ± 0.7 to 15.9 ± 1.2 mm long, hirsute, with many brown to black, 1-4 mm long setae; *corolla* subequal or slightly longer than calyx, oblong to tubular, truncate, 3-denticulate, 10.8 ± 0.5 to 17.3 ± 1.4 mm long, covered with brown to black, 3-5 mm long setae; *staminodial ring* entire, 4-9 mm long; *pistil* conoidal, floccose, with whitish to brown, 2 mm long spines; *stigmas* 3, 4-5 mm long. *Fruit* turbinate, 6.5-7.7 cm long including a 0.7-0.9 cm long rostrum, 3.7-4.4 cm wide; *pericarp* tawny, densely covered in the upper part with red-brown, soft setae; *mesocarp* orange, fleshy at maturity; *endocarp* bony; *perianth* with *corolla* funnel-shaped, irregularly dentate, 22-28 mm long, densely covered in the upper part with brown, 2-4 mm long setae, *staminodial ring* minutely crenulate, 10-15 mm long, *calyx* deeply laciniate, 13-16 mm long, with brown, 2-3 mm long spines in the upper part.

Specimens observed:

PERU: *Weberbauer s.n.* (BH), N of Moyobamba, 900 m. *Kahn & Borchsenius 2654* (NY), *2655* (AAU), 27 May 1990; *Kahn & Moussa 3203, 3204, 3207, 3211, 3212* (USM), *3206* (P), *3208* (K, P), 18-19 Nov 1991: N of Moyobamba, 900 m, km 496 of the Marginal road.

Distribution: In the eastern Andean piedmont of Peru, only known from the type locality.

Ecology: On hill slopes in wet places; very abundant in secondary forest and pastures.

Uses: Liquid endosperm of unripe fruit is drunk.

Vernacular names : huicungo (P).

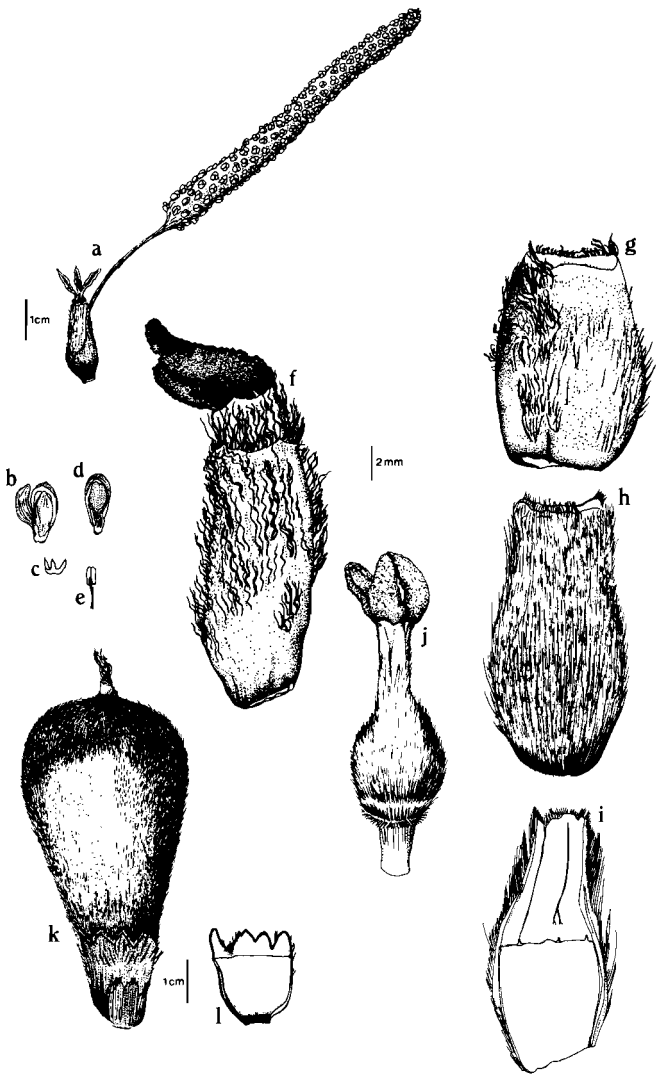

Fig. 44 - *Astrocaryum huicungo* - a. rachilla; b. staminate flower; c. calyx; d. petal; e. stamen; f. pistillate flower; g. calyx; h. corolla; i. staminodial ring in corolla; j. pistil; k. fruit; l. perianth in fruit: corolla with staminodial ring. (b-j with same scale. Material used: Kahn & Moussa 3204; Kahn & Borchsenius 2655)

Notes: This species is very close to *Astrocaryum javarense*. It differs in its fruit which is fleshy, not dry at maturity, with pericarp and perianth covered with setae, not with sharp small spines; and in its multistemmed habit. The margin of the staminodial ring in corolla at fruit maturity is linear or minutely crenulate in *Astrocaryum huicungo*, while it is clearly crenate in *Astrocaryum javarense* (Fig. 42, 1 vs 44, l).

18. Astrocaryum macrocalyx Burret, Fedde Rep. 35: 150, 1934 (Fig. 45, 46).

Type specimens (syntypes): Hopp 1126, Amazonas-Marañon, Peru (B? not seen); Tessmann 5117, Peru (seen at NY).

> *Astrocaryum cuatrecasanum* Dugand, pro syn., Caldasia 1: 18, 1940. Type specimen: Cuatrecasas 8957, Colombia (seen at COL).

A *medium-sized, single-stemmed* palm. *Stem* up to 2-10 m high, 18-20 cm in diameter, unarmed with prominent leaf scars; sheaths of dead leaves persistent on about 1 m under the crown. *Leaves* 8-16; *sheath* and *petiole* up to 2.2 m long, with a grayish to brown indumentum, abaxial side convex armed with dense, flattened, black, up to 25 cm long spines on back and others shorter, up to 10 cm long on the upper part of lateral sides; *rachis* 3.3-4.7 m long, with dense, 0.5-1 cm long spines and a few longer, up to 7 cm, on lateral sides at base, apical part of rachis black-setose, unarmed; *pinnae* 90-115 per side, regularly arranged in one plane; *basal pinnae* 22-61 cm long, 0.9-1.3 cm wide; *median pinnae* 100-110 cm long, 6.5-7.5 cm wide; *apical pinnae* 32-52 cm long, 1.5-2.5 cm wide. *Inflorescence* and *infructescence* erect; *prophyll* 70 cm long, 12 cm wide; *peduncular bract* 1.1 m long, inserted ca. 40 cm from rachis, covered with a grayish tobrown indumentum and brown setae, not dense, and armed at apex with flattened, grayish-floccose, 2-3 cm long spines; *peduncle* 1.1 m long, section oval, 4 x 3 cm near rachis, 7 x 4 cm at base, densely armed with flattened, 6 cm long spines from bract insertion to 10 cm beneath rachis base, with 2-6 cm long bracts at a few cm beneath flowers; *rachis* up to 55 cm long; *rachillae* many, proximal part glabrous, 2-5 cm long, distal part bearing staminate flowers 4.8-8.0 cm long, with small, transparent, clavate hairs, one pistillate flower at base inserted on rachis. *Staminate flower* with *sepals* minute, 0.6-0.9 ± 0.1 mm long; *petals* 2.2 to 2.5 ± 0.2 mm long, slightly connate basally; *stamens* 6; *anthers* 0.7-0.9 ± 0.1 mm long; *filament* up to 1.5 mm long; *pistillode* 3-parted. *Pistillate flower* with *calyx* ovoid to pear-shaped, wide basally, narrow at mouth, overlapping corolla, slightly 3-denticulate, glabrous, 9.6 ± 0.9 to 12.1 ± 0.8 mm long, 9-9.6 mm wide; *corolla* ovoid to pear-shaped, whitish-tomentose, with 1 mm long setae, limb turned inwards girdling the base of stigmas, slightly shorter than calyx, 9.1 ± 0.5 to 11.7 ± 0.8 mm long; *staminodial ring* entire, wavy, 6-denticulate, 4.5 to 5.3 mm lo. *Pistil* oblong to conoidal, whitish-tomentose with 0.3 mm long setae; *stigmas* 3, 3-4 mm long. *Fruit* obovate to oblong, 7.2-9.0 cm long including a 0.8-1 cm long rostrum, 2.9-3.4 cm wide; *pericarp* with dense, dark brown, soft, 2-4 mm long setae; *mesocarp* orange, fibrous, fleshy at maturity; *endocarp* bony; *perianth* with *corolla* erose-dentate, setose, 16-20 mm long, *staminodial ring* crenulate, 11-15 mm long, *calyx* 3-5-lobed, 10-12 mm long.

Specimens observed:

COLOMBIA - *Cuatrecasas 8957* (COL), 31 Mar 1940, 400 m, Comisaría del Caquetá, between Florencia and Venecia. *Cuatrecasas 10775* (COL), 24 Nov 1940, 230 m, Comisaría del Putumayo, Putumayo River in Puerto Ospina. PERU - *Kahn 2296* (USM), 21 Nov 1987; *Kahn & Couturier 3334* (P), 5 Feb 1992; *Millán 49, 50* (USM), *64* (P), 28 Nov-2 Dec 1990: Loreto, km 7-15 Iquitos-Nauta road. *Moore et al. 8420* (BH), 11 May 1960, km 6-7 between Iquitos and Quistococha. *Moore et al. 8482* (USM), 17 May 1960, Itaya River opposite San Antonio.

Tessmann 5117 (NY), May 1925, 100 m, Iquitos. *Vásquez 544* (BH, USM), 18 Oct 1980, 3°30'S, 72°50'W, 106 m, Loreto, Maynas, Yanamono Tourist camp, 50 miles NE of Iquitos.

Distribution: In the western parts of the Amazon basin.

Ecology: In forests and deforested areas on clayey to sandy soils.

Uses: Liquid endosperm of unripe fruit is drunk; fruit are occasionally sold in Iquitos markets.

Vernacular names : chuchana (C), huicungo (P), murumuru (Br).

Notes: *Astrocaryum cuatrecasanum* is considered a synonym of *Astrocaryum macrocalyx*. It was distinguished by (1) the absence of spines on the peduncle of the inflorescence, (2) the larger basal part of rachillae, and (3) the smaller fruit. The development of spines on peduncle may vary between populations as observed in other species, and the basal part of rachillae (3cm long) is, in fact, similar to Peruvian populations. Moreover, the type specimen includes fruits which were probably not collected at maturity. This point, which is difficult to corroborate on dry materiel, is suggested by the description of liquid endosperm. So, the difference in size of fruit is not likely to be significant. Cuatrecasas'collection n°10775 from Putumayo River includes pistillate flowers which undoubtedly belong to *Astrocaryum macrocalyx*.

Fig. 45 - *Astrocaryum macrocalyx* in a pasture, near Iquitos, Peru.

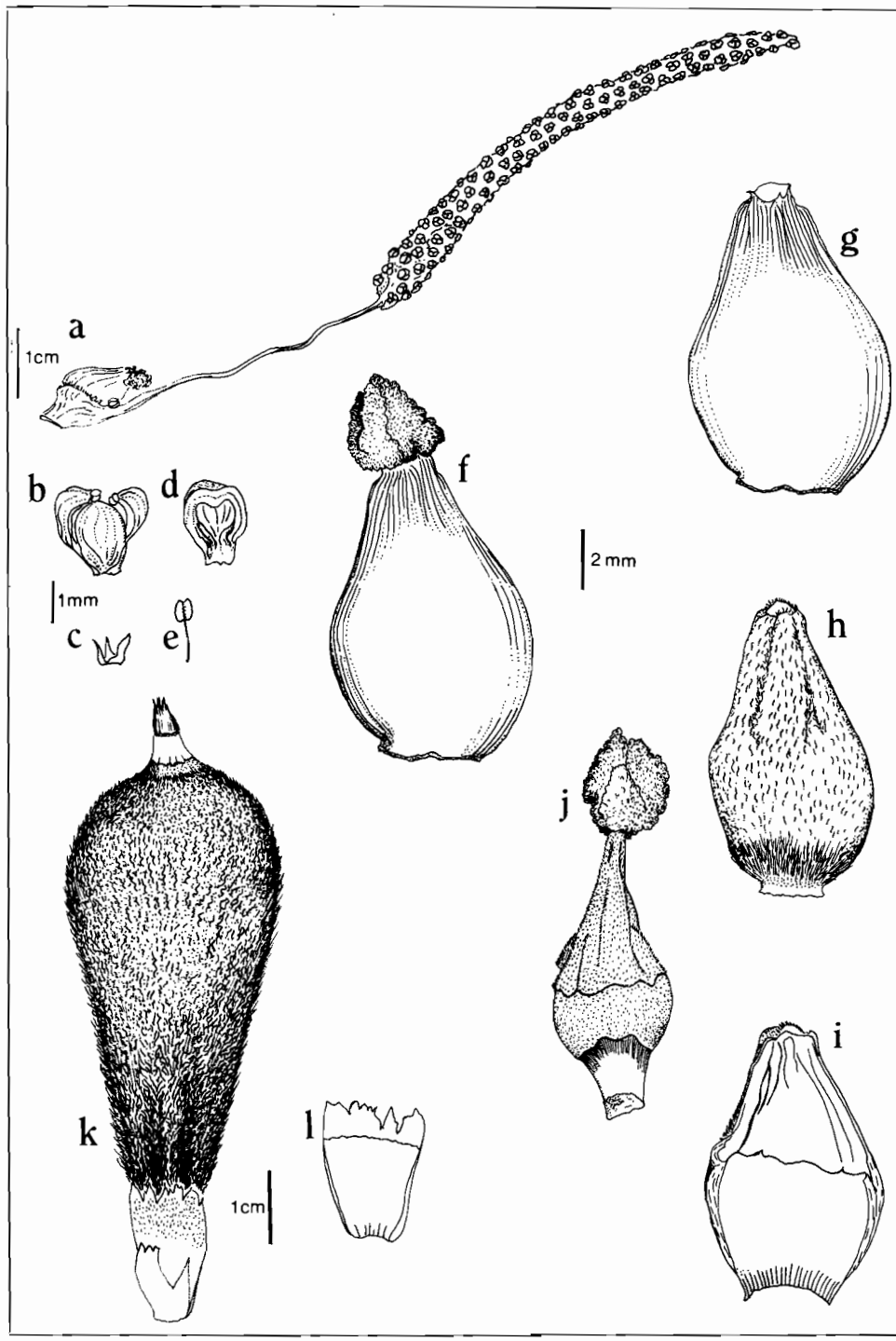

Fig. 46 - *Astrocaryum macrocalyx* - a. rachilla; b. staminate flower; c. calyx; d. petal; e. stamen; f. pistillate flower; g. calyx; h. corolla; i. staminodial ring in corolla; j. pistil; k. fruit; l. perianth in fruit: corolla with staminodial ring. (Material used: Millán 64; Kahn & Couturier 3334)

19. Astrocaryum urostachys Burret, Fedde Rep. 35: 151, 1934 (Fig. 47, 48)

Type specimen: Hopp 1078, Napo River, ca. 200 m, Ecuador (?) - not seen.

A *medium-sized, multistemmed* palm. *Stem* up to 10 m high, 18 cm in diameter, completely covered with dead leaf sheaths. *Leaves* 10, up to 8.5 m long; *sheath* and *petiole* up to 3.5 m long, abaxial side green, convex, covered with flattened, black spines, up to 20 cm long, 0.7 cm wide basally, adaxial side brown, channelled to round; *rachis* up to 6 m long, whitish-tomentose to green, with spines on abaxial side, more or less in groups of different lengths, up to 7 cm; *pinnae* 105-130 per side, regularly arranged in one plane; *basal pinnae* 90 cm long, 2.5 cm wide; *median pinnae* 118 cm long, 7 cm wide; *apical pinnae* 18 cm long, 2 cm wide. *Inflorescence* erect; *prophyll* up to 90 cm long, 13 cm wide, bicarinate, adaxial side brown, smooth, abaxial side tomentose basally, densely covered with 0.5-1 cm long spines at apex; *peduncular bract* 1.2 m long inserted 30 cm from rachis, covered with 1 cm long spines, the apex with flattened, 2-4 cm long spines; *peduncle* up to 1.4 m long, smooth with flattened, dark brown, whitish-floccose, up to 2.5 cm long spines; *rachis* 45 cm long; *rachillae* many, proximal part glabrous, 2-7 cm long, distal part bearing staminate flowers 6-7 cm long, with transparent, clavate hairs. *Staminate flower* with *sepals* slightly carinate, connate basally, 1 ± 0.1 mm long; *petals* connate basally, 3.4 ± 0.1 mm long; *stamens* 6; *anthers* 1.3 ± 0.1 mm long; *filament* to 2.4 mm long; *pistillode* small. *Pistillate flower* 19-24 mm long; *calyx* elongato-ovoid to pear-shaped, overlapping corolla, 16.6 ± 0.7 mm long, 3-denticulate, glabrous or with black setae; *corolla* ovato-urceolate, with a limb turned inwards girdling the base of stigmas, 15.6 ± 0.9 mm long, tomentose, armed with many, black, slightly flexuous, up to 4 mm long setae, white basally; *staminodial ring* entire, 9.2 ± 0.5 mm long; *pistil* oblong, 14-16 mm long, 5.5-6.5 mm wide, tomentose, with a few setae; *stigmas* 3, 5-6 mm long. *Fruit* turbinate, 7-8 cm long including a 0.6-1 cm long rostrum, 3 cm wide; epicarp densely covered with brown, soft, 4-6 mm long setae; *perianth* with *corolla* deeply obconoidal, dentate at margin, brown-setose in the upper part, 23-28 mm long, *staminodial ring* 18-22 mm long, *calyx* deeply divided into 3-5 lobes, 14-18 mm long.

Specimens observed: *Balslev 4344* (AAU, NY), 26 Jul 1983, 00°05'S, 76°11'W, 230 m, Napo, Cuyabeno River inlet of Tarapuy River at Pto. Bolivar. *Balslev & Irvine 4568* (NY), 1 Dec 1983, 00°30'S, 77°18'W, 300 m, Napo, San José de Payamino at Payamino River. *Balslev et al. 60702* (CAY), 28 Jul 1985; *Mori and Luteyn 14678, 14680* (NY), 17 June 1982: 300 m, 00°32'S, 76°23'W, Napo, Añangu. *Borgtoft Pedersen & Navarete 97646* (P), 2 Mar 1991, 1°03'S, 77°34'W, 470 m, Puerto Napo-Ahuana road, km 24.

Distribution: In Ecuadorean Amazonia.

Ecology: On periodically flooded alluvial soils (Balslev *et al.*, 1987).

Uses: Liquid endosperm of unripe fruit is drunk.

Vernacular names: chuchana (E).

Notes: *Astrocaryum urostachys* is very close to *Astrocaryum macrocalyx*. It differs from this latter in its larger pistillate flower with a glabrate calyx, its fruit with longer setae and a larger perianth, and its multistemmed habit.

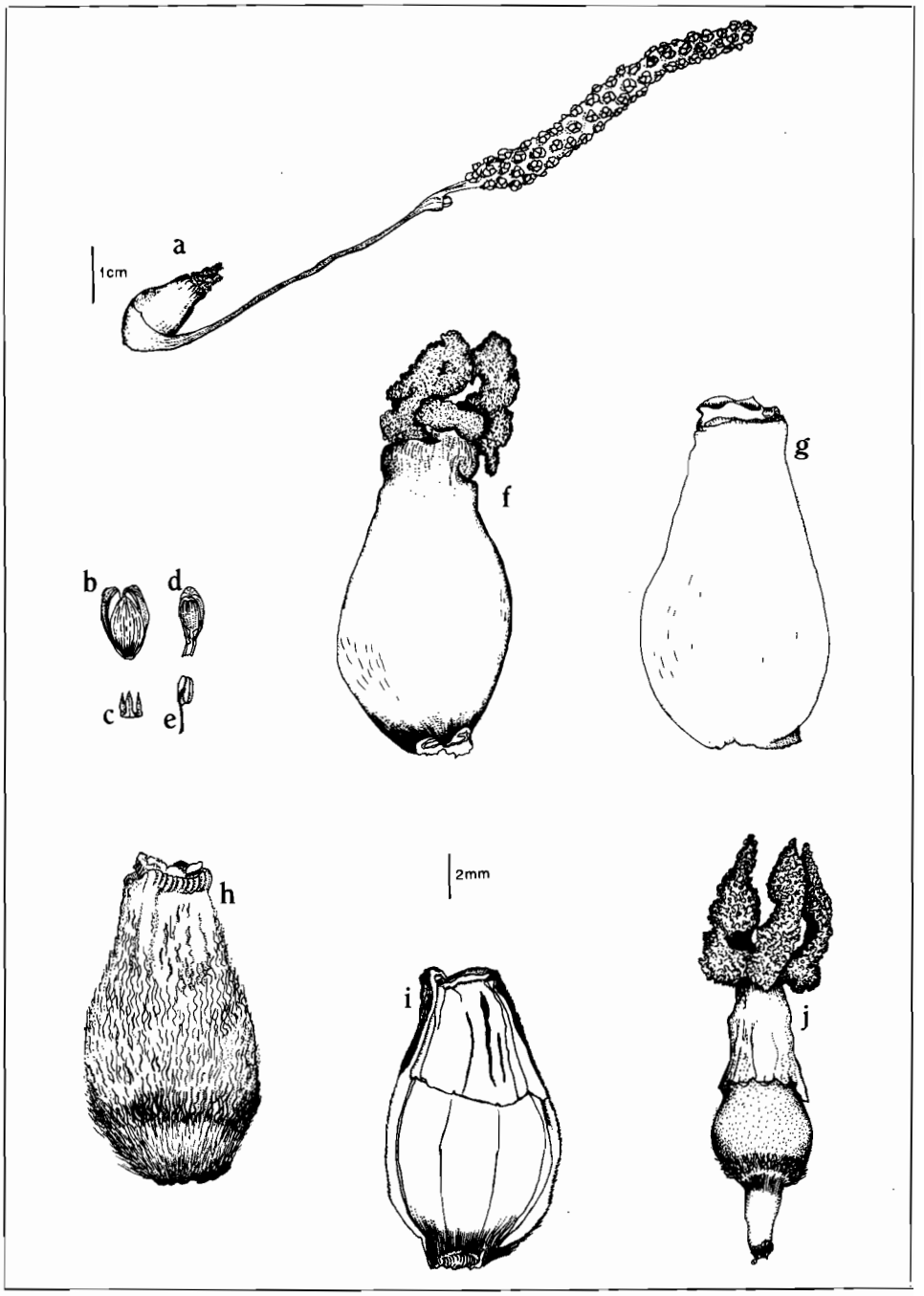

Fig. 47 -*Astrocaryum urostachys* - a. rachilla; b. staminate flower; c. calyx; d. petal; e. stamen; f. pistillate flower; g. calyx; h. corolla; i. staminodial ring in corolla; j. pistil. (b-j with same scale. Material used: Borgtoft Pedersen & Navarete 97646)

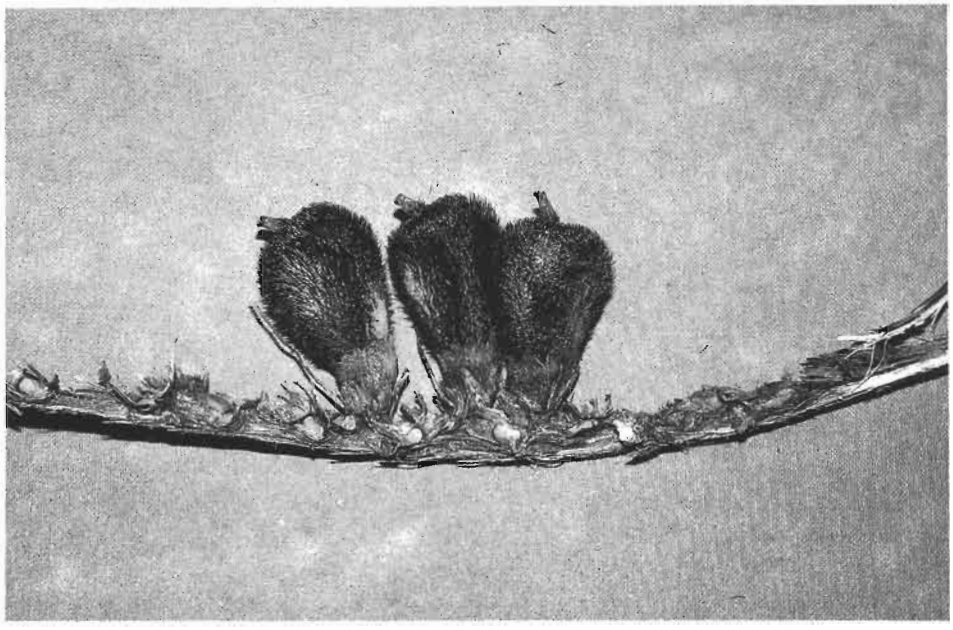

Fig. 48 - *Astrocaryum urostachys* - fruits.

20. Astrocaryum perangustatum F. Kahn et B. Millán, sp. nov. (Fig. 49, 50).

A sectionis Ayri speciebus fructu perangustato differt.

Kahn F. 3232, Peru (Holotype: P, Isotypes: AAU, K, NY, USM).

A *medium-sized, single-stemmed* palm. *Stem* up to 4 m high, 20-23 cm in diameter, with some spines in groups, partially or totally covered with dead leaf sheaths. *Leaves* 8-14; *sheath* and *petiole* green, black-setose, 117-190 cm long, sheath fibrous at margins, densely armed with black, terete to flattened, slightly flexuous, grayish-floccose, 4-6 cm long, spines, and with others, up to 40 cm long, intermixed on abaxial side, petiole short, densely armed on upper lateral parts of convex abaxial side; *rachis* up to 4.5 m long, black-setose, armed with a few flattened, up to 4 cm long spines, usually in groups of 2-3; *pinnae* 92-110 per side, regularly arranged in one plane, abaxial side golden, satiny; *basal pinnae* 88-91 cm long, 1.5-4 cm wide; *median pinnae* 117-132 cm long, 9-11 cm wide; *apical pinnae* 34-41 cm long, 2.5-5 cm wide. *Inflorescence* erect; *prophyll* 66-87 cm long, 24-26 cm wide; abaxial side flattened, adaxial side convex with out sides flattened; *peduncular bract* 116-127 cm long, 36 cm wide when open, inserted 52-54 cm from rachis, abaxial side with a grayish-brown indumentum, or yellowish without indumentum, with a few light brown setae and some flattened, flexuous, whitish-floccose, 1 cm long spines in the upper part; *peduncle* 1.2 m long, 5.1-5.5 cm x 4.4-4.5 cm in cross-section beneath rachis, 9.2-12.2 cm x 7.1-9 cm at base, with some small, flexuous, whitish-floccose, 0.5 cm long spines between rachis and bract insertion; *rachis* 57-61 cm long; *rachillae* many, proximal part 0.3-5 cm long, distal part bearing staminate flowers 8-11 cm long, with transparent, clavate hairs, one pistillate flower inserted 1 cm from the rachis. *Staminate flower* with *sepals* connate basally, 1.1 ± 0.2 mm long; *petals* 3.5 ± 0.3 mm long; *stamens*

6; *anthers* 1.5 ± 0.1 mm long; *filament* 1.7 ± 0.2 mm long; pistillode short, 3-parted. *Pistillate flower* with *calyx* urceolate to cylindrical, 9.2 ± 0.5 to 11.4 ± 0.7 mm long, glabrous, 3-dentate; *corolla* 3-denticulate with limb ciliate, 8.3±0.5 to 10.9±0.8 mm long, with flattened, yellowish, flexuous, 1-2 mm long setae; *staminodial ring* entire, 4 mm long, 6-denticulate (or laciniate 3-9.5 mm long, rigid, spiny at margin); *pistil* tomentose, whitish, with 1-1.5 mm long spines; *stigmas* 3, 4-5 mm long. *Fruit* turbinate to oblong, asymmetrical, very narrow basally, 7.1-8.7 cm long including a 0.5-1 cm long rostrum, 2.5-2.6 cm wide, with a 0.5-1-(2) cm long pedicel; *pericarp* covered with dense, shiny brown, 4 mm long spines; *mesocarp* fleshy, thin at maturity; endocarp bony, acuminate basally; *perianth* with *corolla* irregularly dentate, 19-24 mm long, with a few setae, *staminodial ring* crenulate, 14-16 mm long, *calyx* glabrous, 3-5 lobed, 9-13 mm long.

Fig. 49 - *Astrocaryum perangustatum* in an open area in the Palcazu River valley.

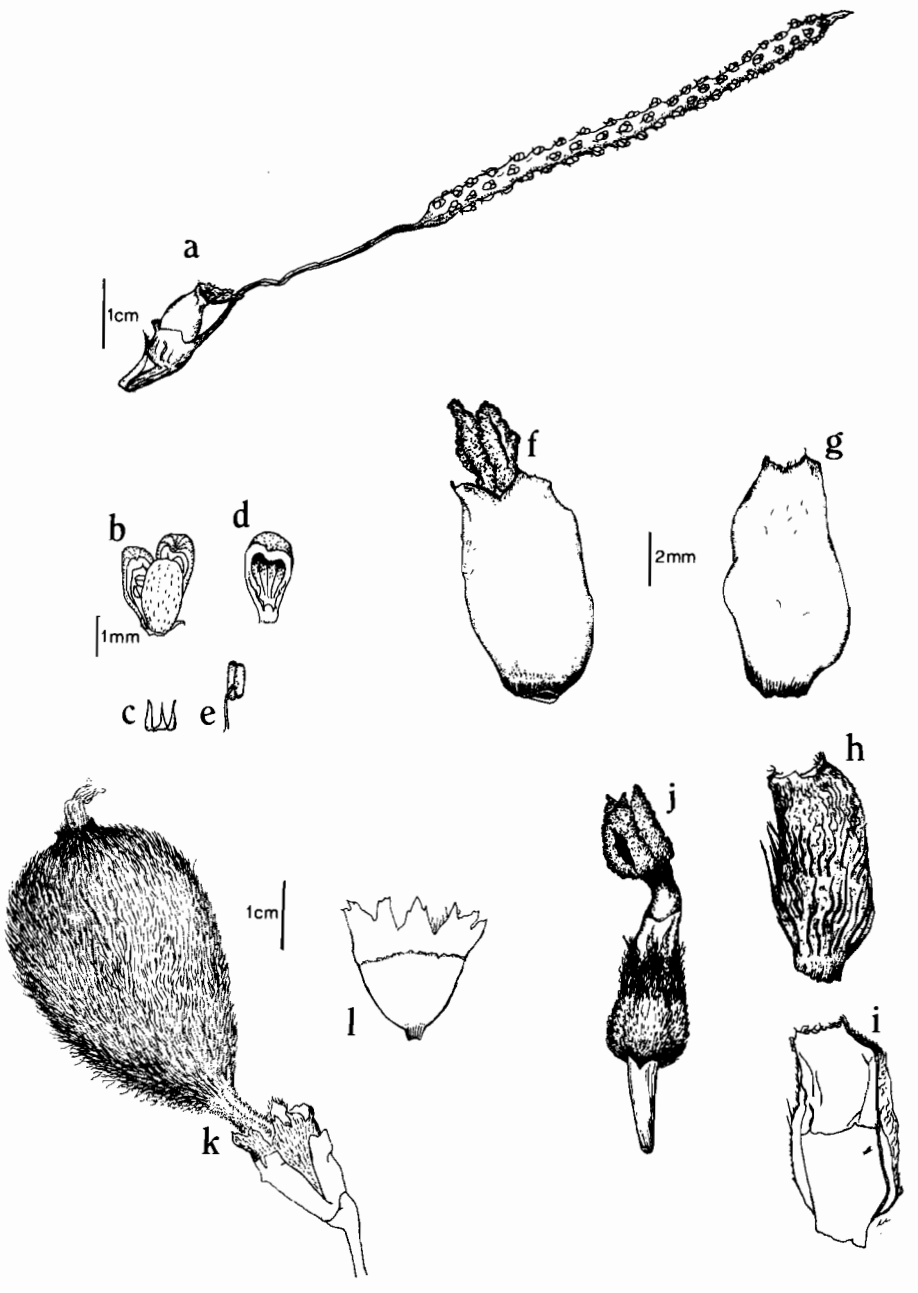

Fig. 50 - Astrocaryum perangustatum - a. rachilla; b. staminate flower; c. calyx; d. petal; e. stamen; f. pistillate flower; g. calyx; h. corolla; i. staminodial ring in corolla; j. pistil; k. fuit; l. perianth in fruit: corolla with staminodial ring. (Material used: Kahn 3232; Smith 4045)

Specimens observed:
PERU - *Kahn 3230* (USM), *3231* (K, P), 11 Jan 1992, 500 m, Pasco, Oxapampa, La Merced-Villa Rica road, Puerto Capelo village. ***Kahn 3232*** (AAU, K, P, NY, USM), 13 Jan 1992, 400 m, Pasco, Oxapampa, Villa Rica-Iscozacin road, San Juan de Cacazu village. *Smith 4045* (MO, P, USM), 15 May 1983, 10°09'S, 75°19'W, 350 m, Pasco, Oxapampa, Chuchurras River drainage, Belén on the Comparichimas River.
Distribution: In the central and southeastern piedmont of Peru, 380-800 m in elevation.
Ecology: In understory of forests on steep slopes, frequent in open areas.
Uses: Liquid endosperm of unripe fruit is drunk.
Vernacular names: chonta (P)
Notes: *Astrocaryum perangustatum* is characterized by the fruit being remarkably narrow basally, and the pinnae very wide (up to 11 cm), golden and satiny beneath.

21. Astrocaryum gratum F. Kahn et B. Millán, sp. nov. (Fig. 51).
Palma solitaria; differt a *Astrocaryum macrocalyx* Burret et *Astrocaryum perangustatum* Kahn et Millán annulo staminodiali deminuto vel 6 staminodiis dentiformibus.
Kahn F. & Llosa J.A. 2147, Peru (Holotype: P; Isotypes: CAY, K, USM).
A *medium-sized, single-stemmed* palm. *Stem* 3-10 m high, 17-20 cm in diameter, with some spines in groups; sheaths of dead leaves persistent on about 1 m under the crown. *Leaves* 8-12; *sheath* and *petiole* up to 2 m long, purplish, fibrous at margins, densely setose, armed with dense, flattened, black, up to 15 cm long spines on abaxial side, these shorter on lateral sides of petiole; *rachis* 4.6-5 m long, black-setose, with up to 3 cm long spines in groups of 2-3; *pinnae* 90-110 per side, regularly arranged in one plane; *basal pinnae* 105-131 cm long, 1.9-3 cm wide; *median pinnae* 134-145 cm long, 5-7 cm wide; *apical pinnae* 40-61 cm long, 2.5-12.5 cm wide. *Inflorescence* and *infructescence* erect; *prophyll* 1 m long, 11-12 cm wide, abaxial side with dense, dark brown, 3-5 mm long setae, adaxial side smooth or with dense, short setae; *peduncular bract* 90 cm long, inserted 40 cm from rachis, with scattered black and dense tawny setae, and flattened, black, 2-3 cm long spines at apex; *peduncle* 1.3 m long, section oval, 4 x 3 cm near rachis, 7 x 4 cm at base; *rachis* up to 70 cm long; *rachillae* many, proximal part glabrous, 2-4.5 cm long, distal part bearing staminate flowers in low density, 11.5-15 cm long, covered with transparent, clavate to globose hairs, one pistillate flower inserted 0.5-1 cm from the rachis. *Staminate flower* with *sepals* 0.6-0.7 ± 0.1 mm long; *petals* 2.8 to 2.9 ± 0.2 mm long, slightly connate basally; *stamens* 6; *anthers* 1.3-1.5 ± 0.1 mm long; *filament* up to 1.3 mm long; *pistillode* 3-parted. *Pistillate flower* with *calyx* ovoid to pear-shaped, slightly 3-dentate, with a few minute setae, margin ciliate, 6.4 ± 0.4 to 9.6 ± 0.7 mm long; *corolla* urceolate, slightly shorter than calyx, 5.4 ± 0.4 to 9.1 ± 0.5 mm long, with setae or 0.5 mm long spines, margin ciliate; *staminodial ring* 0.9 to 2.5 ± 0.4 mm, very short or reduced to 6 teeth; *pistil* wide basally and tapered into a slender style, brown-tomentose, with white setae; *stigmas* 3, 3-4 mm long. *Fruit* turbinate to obovate, depressed, 3.9-6.7 cm long, 2.7-3.9 cm wide, with a pedicel, up to 3.5 cm long; *pericarp* orange with brown to black, flexuous, 1-3 mm long setae; *mesocarp* fleshy, up to 1.2 cm thick; *endocarp* bony, turbinate, slightly acuminate and curved basally, 2.6-4.3 cm long, 1.7-2.3 cm wide; *perianth* with *corolla* cup-shaped, crenate, laciniate, or irregularly lobed, 9-18 mm long, *staminodial ring* wavy, 6-denticulate, 4-10 mm long, *calyx* deeply lobed, 5-12 mm long.

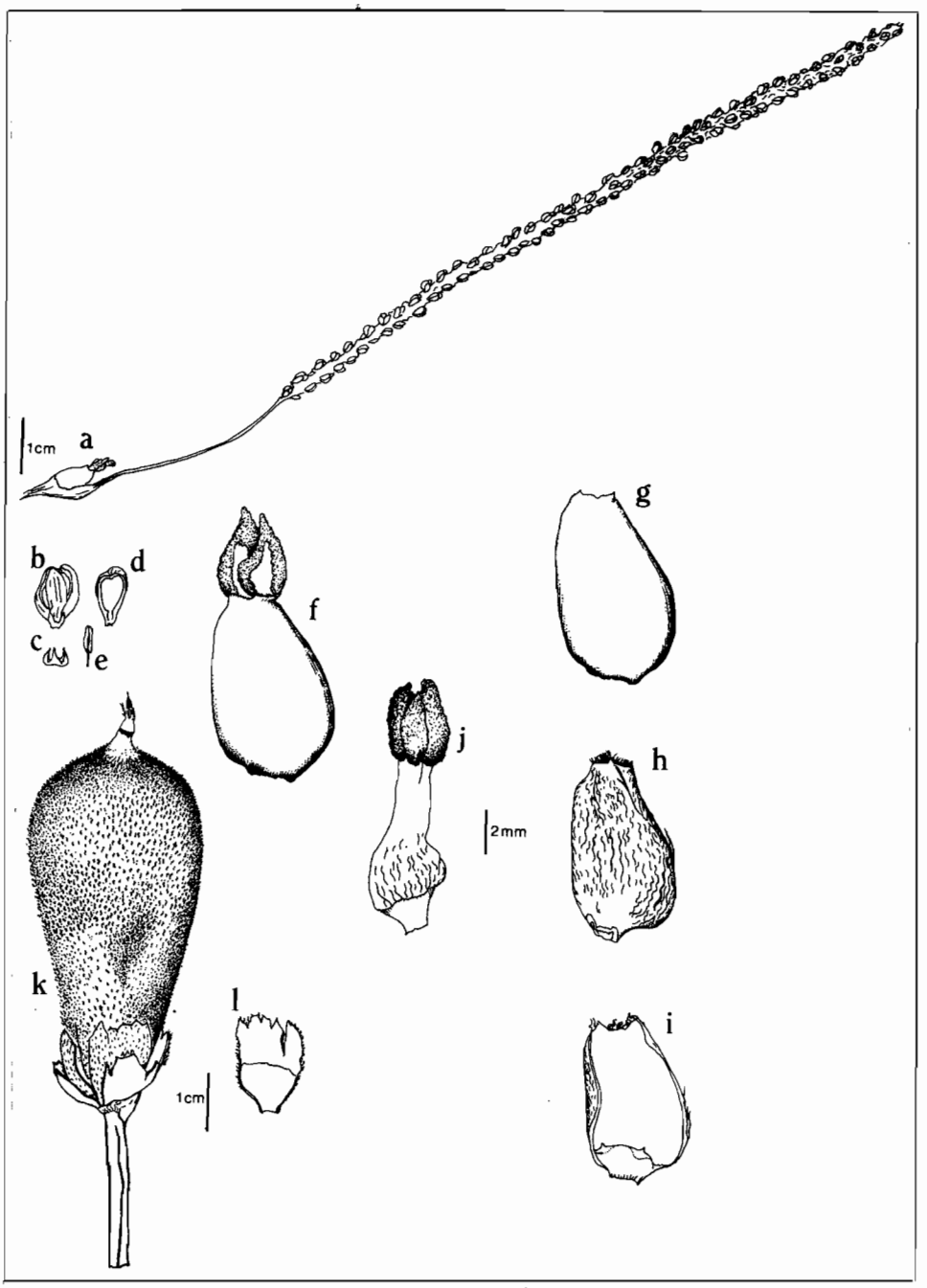

Fig. 51 - *Astrocaryum gratum*- a. rachilla; b. staminate flower; c. calyx; d. petal; e. stamen; f. pistillate flower; g. calyx; h. corolla; i. staminodial ring in corolla; j. pistil; k. fruit; l. perianth in fruit: corolla with staminodial ring. (b-j with same scale. Material used: Kahn 2400; Kahn & Llosa 2147; Millán 118)

Specimens observed:

BOLIVIA - *Henderson & Salomon 534* (NY), 7 Dec 1985, 15°58'S, 67°37'W, 800 m, Nor Yungas, ca. 4 km beyond San Pedro on road to Incahuara. *Kahn 2400* (LPZ, P), 19 Aug 1989; *Mejia s.n.* (USM), Aug 1991; *Moraes 922* (LPZ, NY), 22 Dec 1987: 14°30'S, 66°28'W, 250 m, Beni/Yacuma, Biological Station. PERU - ***Kahn & Llosa 2128*** (NY, USM), 28 Sep 1987; *2143, 2144* (USM), ***2147*** (CAY, K, P, USM), 1 Oct 1987; *Millán 118, 119, 120* (USM), 2-4 Apr 1992: Puerto Maldonado, Madre de Dios. *Vargas 18574* (BH), 15 Jan 1967, 350 m, Madre de Dios, Tambopata, Concepción to lake Sandobal. *Vargas 18718* (BH), 17 Jan 1967, 350 m, Madre de Dios, Tambopata, Barrola, De las Piedras River.

Distribution: In the southwestern parts of the Amazon basin.

Ecology: In forests on sandy soils, in secondary vegetation, in gallery forests in periodically flooded savannahs.

Uses: Liquid endosperm of unripe fruit is drunk; fleshy mesocarp is sweet and edible.

Vernacular names: chonta, chonta negra, chonta de macallo (B); huicungo (P).

Notes: *Astrocaryum gratum* differs from *Astrocaryum macrocalyx* and *Astrocaryum perangustatum* in the staminodial ring which is short, entire or reduced to 6 teeth in flower, and in its fruit with a long pedicel, the pericarp sparsely setose, and the mesocarp thick and fleshy. The rachis of its inflorescence, up to 70 cm, is the longest in the section *Ayri*. Its fruit is not remarkably narrow basally and its pinnae are whitish, not golden beneath as in *Astrocaryum perangustatum*. The calyx in fruit is not so deep and obconoidal as in *Astrocaryum macrocalyx*.

22. Astrocaryum chonta Martius, Palmet Orbign.: 84, t. 4, figs. 1-2, t. 29C, 1844 (Fig. 52, 53).

Type specimen: d'Orbigny 15, Santa Cruz de la Sierra (?), not seen.

A *medium-sized, single-stemmed* palm. *Stem* up to 10 m high, 18-27 cm in diameter, unarmed with prominent leaf scars; sheaths of dead leaves persistent on about 1-2 m under the crown. *Leaves* 8-12-(16), up to 9.5 m long; *sheath* and *petiole* up to 2.3 m long, fibrous, armed with flattened, black, up to 20 cm long spines; *rachis* up to 7.6 m long, whitish-tomentose, with flattened, black, up to 10 cm long spines, arranged in groups in the middle part, distal part black-setose with scattered, 1-2 cm long spines; *pinnae* 80-130 per side, regularly arranged in one plane; basal *pinnae* 65-120 cm long, 0.5-3.4 cm wide; *median pinnae* 84-163 cm long, 4-8 cm wide; *apical pinnae* 23-48 cm long, 1.8-6 cm wide. *Inflorescence* and *infructescence* erect; *prophyll* 85 cm long, 12 cm wide, brown-setose, with a few flattened, black spines; *peduncular bract* up to 1.1 m long, covered with dense, soft, light to dark brown, 5 mm long setae, with whitish-floccose, flexuous, black, 2 cm long spines at apex; *peduncle* 1.1 m long; *rachis* up to 60 cm long; *rachillae* many, proximal part glabrous, 1-7 cm long, distal part bearing staminate flowers 6.5-10.5 cm long, covered with transparent, clavate hairs, one pistillate flower at base inserted 3-10 mm from rachis. *Staminate flower* with *sepals* small, 0.6 to 0.9 ± 0.1 mm long, connate basally; *petals* brown 2.5 ± 0.1 to 2.9 ± 0.2 mm long, slightly connate basally; *stamens* 6; *anthers* 0.7 to 1.4 ± 0.1 mm long; *filament* up to 1.9 mm; *pistillode* irregularly 3-parted. *Pistillate flower* with *calyx* truncate to cup-shaped, slightly setose, 3-denticulate, wide at mouth, margin ciliate,

5.5 ± 0.5 to 10.5 ± 1.0 mm long; *corolla* slightly to clearly longer than calyx, 7.6 ± 1.0 to 11.6 ± 1.2 mm, tubular and tubate, ovato-urceolate with limb turned outwards, or campanulate, with 0.5 mm long setae, 3-denticulate, margin ciliate; *staminodial ring* entire or laciniate, or reduced to 6 teeth, 0.6 ± 0.2 to 3.2 ± 0.5 mm long; *pistil* conoidal, tomentose, with short 0.3 mm long spines; *stigmas* 3, 4-6 mm long. *Fruit* obovate to oblong, 3.9-6.5 cm long including a 0.6 cm long rostrum, 2.2-2.7 cm long; *pericarp* brown, tomentose, with soft, flexuous, 2-3 mm long setae; *mesocarp* thin, fibrous; *endocarp* obovate to clavate, round to pointed basally; *perianth* with *corolla* cup-shaped, limb slightly pleated, crenulate with a few deep incisions, sparsely setose, 13-20 mm long, *staminodial ring* 5-8 mm long, *calyx* cup-shaped, crenate, glabrous, 6-8 mm long.

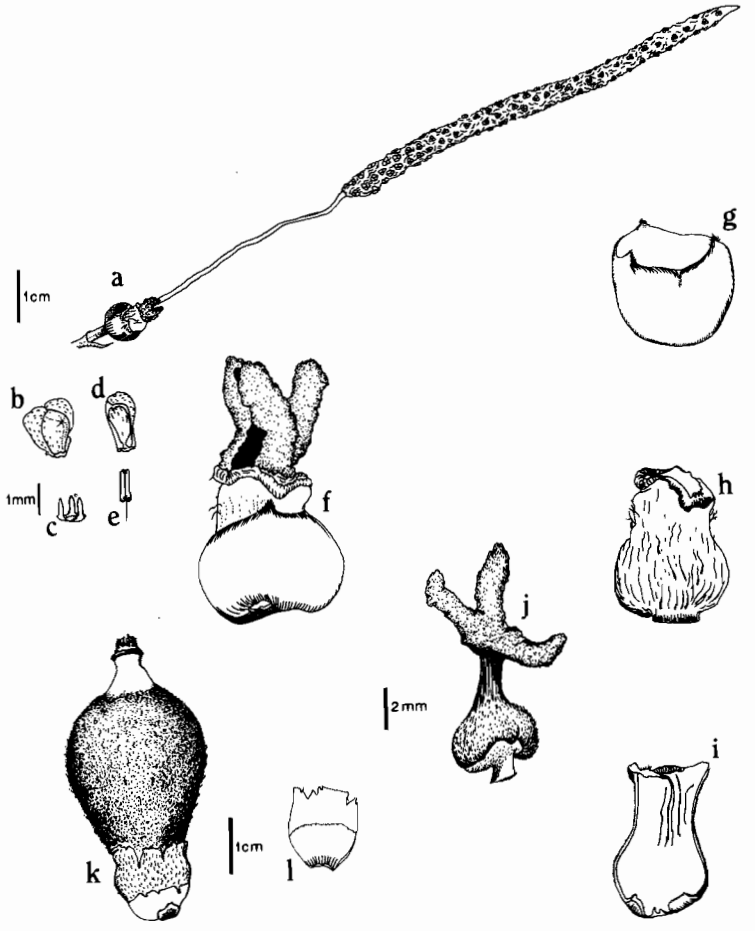

Fig. 52 -*Astrocaryum chonta* - a. rachilla; b. staminate flower; c. calyx; d. petal; e. stamen; f. pistillate flower; g. calyx; h. corolla; i. staminodial ring in corolla; j. pistil; k. fruit; l. perianth in fruit: corolla with staminodial ring. (Material used: Kahn 2081; Kahn & Mejía 1782)

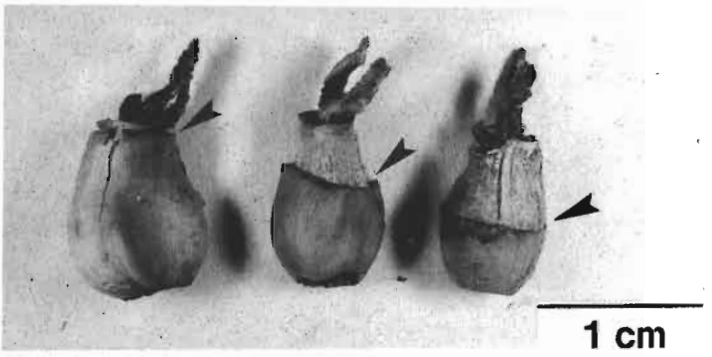

Fig. 53 - *Astrocaryum chonta* - calyx size variability in a population located in the lower Ucayali River valley.

Specimens observed:

BOLIVIA - *Nee 36034* (BH), 21 Jan 1988, 17°39'S, 63°43'W, 400 m, Santa Cruz, Ichilo, Amboro national park. PERU - *Kahn 2081* (P, USM), Sep 1989; *Kahn & Mejia 1782* (CAY, K, P), Mar 1985; *1823* (CAY, USM), Nov 1985; *Mejia 106* (USM), Sep 1982; *Millán 60, 61, 63* (USM), 7-11 Dec 1990; *97, 99, 107* (USM), 16-19 Dec 1991: 130 m, 4°55'S, 73°45'W, Loreto, Requena, near Jenaro Herrera in the lower Ucayali River valley. *Gentry 26925* (USM), 19 Nov 1979, 380 m, Madre de Dios, Manu, Cashu Cocha camp.

Distribution: In the southwestern parts of the Amazon basin.

Ecology: Dense populations in forests on periodically flooded alluvial soils (Kahn & Mejía, 1990; Kahn & Granville, 1992).

Uses: The liquid endosperm of unripe fruit is drunk. Fruits are occasionally sold in the markets of Iquitos.

Vernacular names: chonta (B); huicungo (P).

Notes: The calyx in pistillate floweris highly variable in size within a same population, but always remains shorter than corolla (Fig. 53).

The type specimen of *Astrocaryum chonta* has not been found; and there was no identified material in the herbaria (Balslev & Moraes, 1989). The above-described species corresponds to Martius' description well enough to be considered *Astrocaryum chonta*. This is corroborated by the similarity between Peruvian material and Nee's collection n°36034 from Santa Cruz Bolivian Province where the type specimen was collected.

23. Astrocaryum murumuru Martius, Hist. Nat. Palm. 2: 70, 1824 (Fig. 54, 55).

Type specimen (isotype): Martius s.n., Pará, Brazil (seen at P).

> *Astrocaryum yauaperyense* Barbosa Rodrigues, pro syn., Vellosia 1: 48, 1888. Type specimen not designated, Yauapery River, RioNegro, Brazil .

A *medium-sized, multistemmed* palm. *Stem* up to 15 m high, 17-27 cm in diameter, unarmed with prominent leaf scars, partially or totally covered with persistent dead leaf sheaths. *Leaves* 12-20, up to 8.5 m long; *sheath* and *petiole* 2-2.8 m long, fibrous at margins, whitish-

tomentose, densely armed with flattened, black, up to 30 cm long spines; *rachis* 5.0-6.2 m long, with flattened, black spines on margins of adaxial side and on abaxial side, and smaller, 1-2 cm long spines near the apex; *pinnae* 80-135 per side, regularly arranged in one plane; *basal pinnae* 56-76 cm long, 1-7.5 cm wide; *median pinnae* 114-135 cm long, 6-7 cm wide; *apical pinnae* 21-40 cm long, 1.5-3.5 cm wide. *Inflorescence* and *infructescence* erect; *prophyll* to 1.3 m long, 13 cm wide, flattened, densely brown-setose, with intermixed flattened, grayish-floccose, black, up to 3 cm long spines; *peduncular bract* up to 1.5 m long, inserted 35-40 cm from rachis, covered with soft, light to dark brown, 5-7 mm long setae, and in the upper part, with dense, flattened to terete, black, grayish-floccose, more or less flexuous, 2.5 cm long spines; *peduncle* up to 1.7 m long, section oval, 3.2 x 2.5 cm near rachis, 5 x 3.3 cm at base, whitish, densely armed on 20-25 cm between bract insertion and rachis with flattened, grayish-floccose, black, up to 4.5 cm long spines; *rachis* up to 70 cm long; *rachillae* many, proximal part glabrous, 3-8 cm long, distal part bearing staminate flowers 8-14 cm long, with transparent, clavate hairs, one pistillate flower at base inserted on rachis or 4-6 mm from it. *Staminate flower* with *sepals* 1.0 ± 0.2 mm long; *petals* slightly connate basally, 3.3 to 3.5 ± 0.2 mm long; *stamens* 6; *anthers* 1.4 to 1.7 ± 0.1 mm long; *filament* up to 1.6 mm long; *pistillode* shortly 3-parted. *Pistillate flower* 1.8-2.4 cm long; *calyx* glabrous, cup-shaped, truncate, 3-denticulate, 5.6 ± 1.1 to 7.4 ± 0.7 mm long, sometimes with margin ciliate; *corolla* longer than calyx, 12.1 ± 0.6 to 15.0 ± 0.9 mm, tubular with limb turned outwards, slightly 3-dentate, with many brown, 3-5 mm long spines; *staminodial ring* entire, 6-denticulate, 6-8 mm long; *pistil* conoidal, tomentose, unarmed or spiny; *stigmas* 3, 5-7 mm long. *Fruit* turbinate, asymmetrical, 6.0-8.5 cm long including a 0.8 cm long rostrum, 3.8-4.4 cm wide; *pericarp* tomentose in the upper part, with soft, dark brown, flexuous, 2-3 mm long setae; *mesocarp* yellow, fleshy at maturity, 6-10 mm thick; *endocarp* 2.5-4.5 mm thick; *perianth* with *corolla* campanulate, irregularly dentate to lobed, brown-setose, 11-23 mm long, *staminodial ring* crenulate, 8-15 mm long, *calyx* cream to tawny, 3-5-lobed, 4-7 mm long.

Specimens observed:

BRAZIL - *Hopp 30* (BH), no data. *Martius s.n.* (P), Amazon River, Pará. *Moore 9551* (BH), 21 Mar 1967, Pará, IAN, Belém. *Strudwick et al. 5003* (K), 20 Oct 1984, at mouth of Francés River on Moções River, Município Anajas, Marajó island. FRENCH GUIANA - *Granville 4481*, 22 Mar 1981 (K), *Granville & Kahn 5397* (P), *5406* (CAY), 9 Mar 1983; *11201* (CAY, P), *11202* (CAY), 12 Apr 1991; *Prance et al. 30662* (K), 22 Jun 1988: 3°37'S, 53°12'W, Saül. *Granville 7222* (AAU, CAY, K), 11 Mar 1985, Matouri, N of RN1.

Distribution: In the eastern region, French Guiana and Amazon estuary.

Ecology: In swampy areas under tidal influence or not.

Uses: The fruit is edible and has been used for oil production in eastern Brazil (Coradin & Lleras, 1983; Pesce, 1985; Lleras & Coradin, 1988).

Vernacular names : mourou mourou (FG); murumuru (Br).

Notes: *Astrocaryum murumuru* described by Wallace (1853: 101, t. 38) corresponds to Martius'species according to the text (p. 102): «This tree grows on the tide-flooded lands of the Lower Amazon (...). The specimen figured is from Pará». And partly it corresponds to another species of the section *Ayri* from the upper Amazon. The drawing of the palm and its fruit is not a good likeness, but this is also true for some of the other species. Wallace's palm is not *Astrocaryum rodriguesii* as was considered in the literature. This latter species never grows in flooded forests.

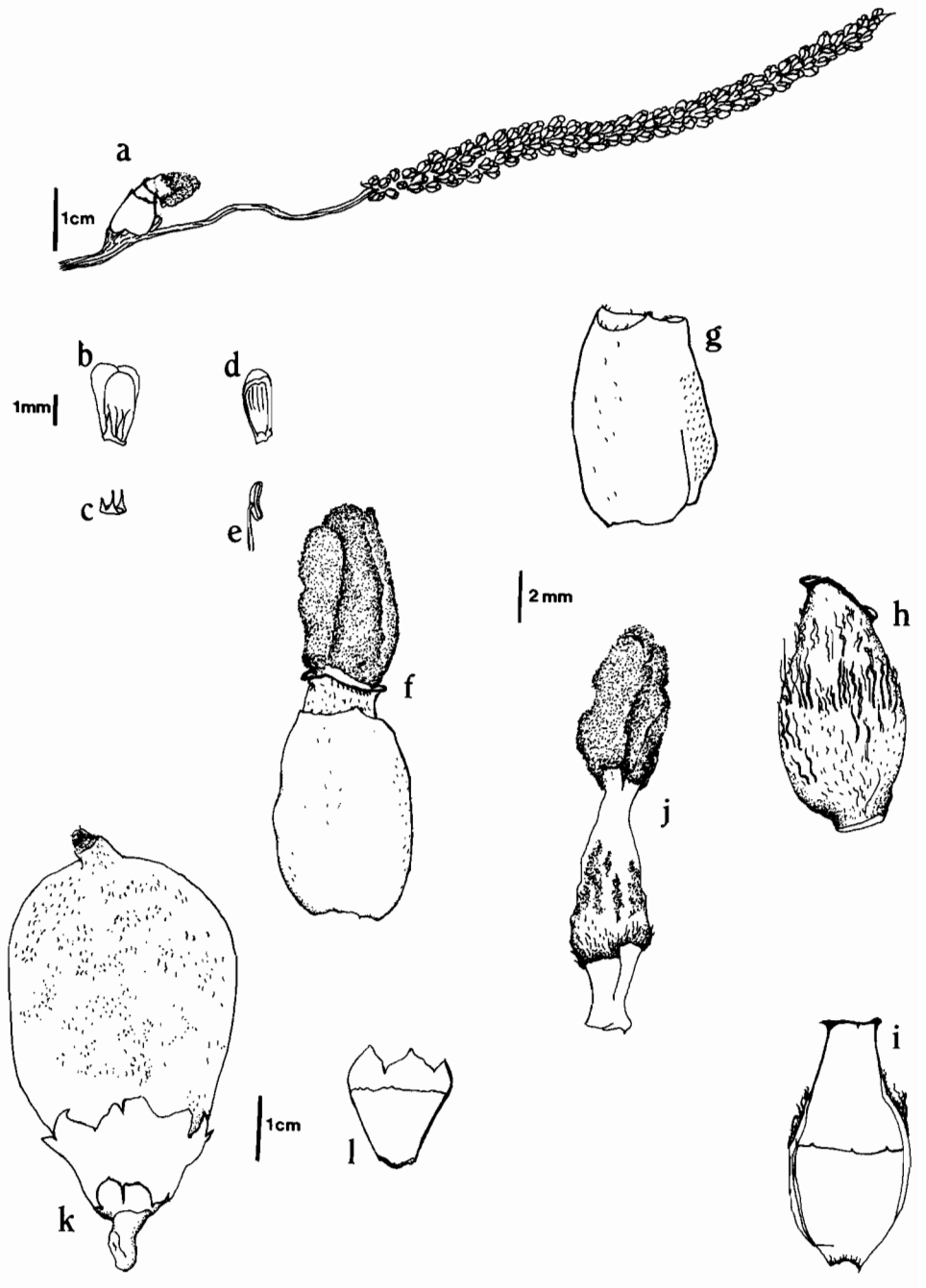

Fig. 54 - *Astrocaryum murumuru* - a. rachilla; b. staminate flower; c. calyx; d. petal; e. stamen; f. pistillate flower; g. calyx; h. corolla; i. staminodial ring in corolla; j. pistil; k. fruit; l. perianth in fruit: corolla with staminodial ring. (Material used: Granville 7222; Granville & Kahn 11201)

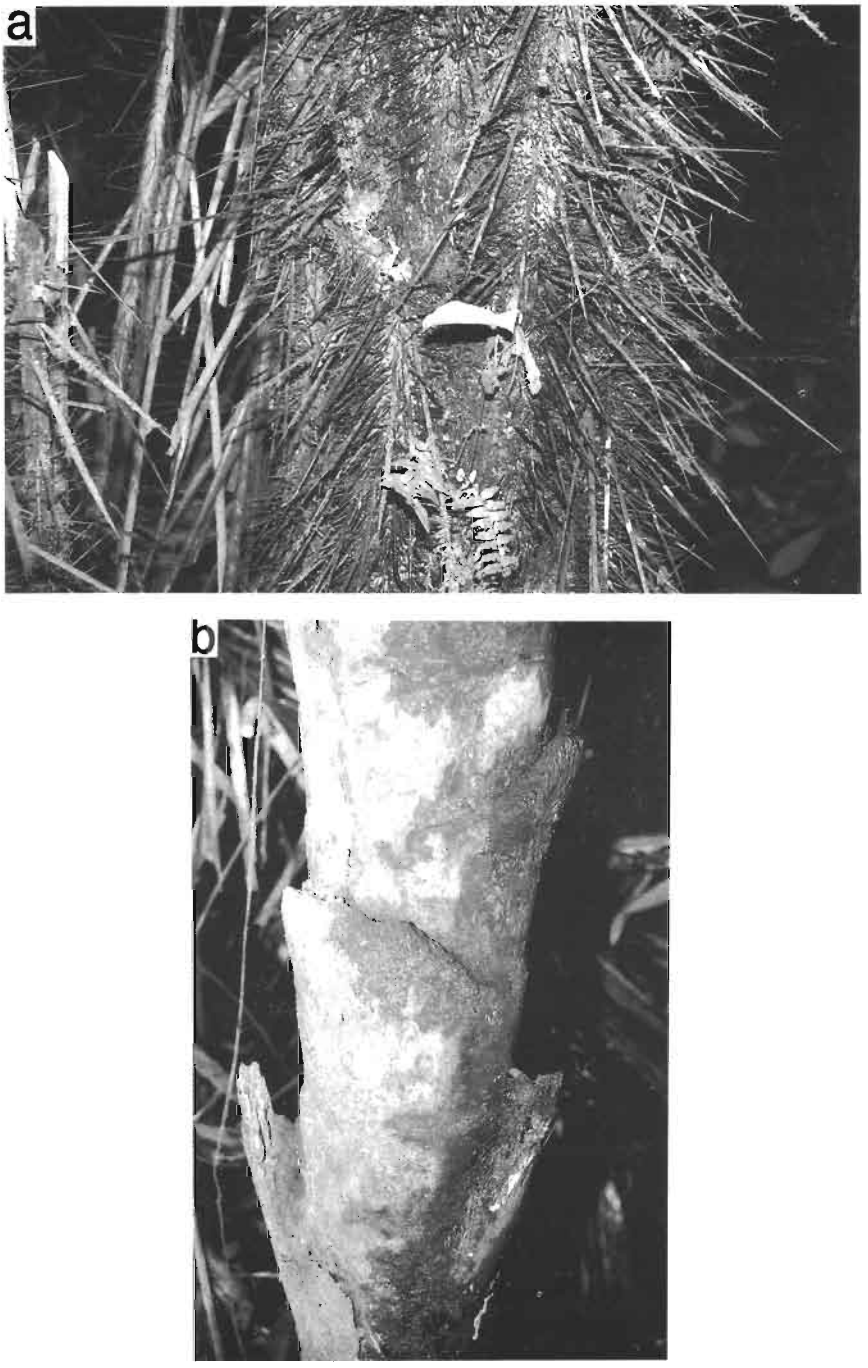

Fig. 55 - *Astrocaryum murumuru* - a. sheaths of dead leaves persistent on the stem; b. lower part of the stem.

We considered *Astrocaryum yauaperyense* a synonym of *Astrocaryum murumuru*, taking into account the pistillate flower (Barbosa Rodrigues, 1903, tab. 80A). However, this drawing may have been made from material of another species; as the author wrote (p. 80), he did not have time to collect flowers of the species and did not take them into account in the diagnosis.

24. Astrocaryum ulei Burret, Fedde Rep. 35: 147, 1934. (Fig. 56)

Type specimen: Ule 106, Acre River, Brazil (MG?) - not seen.

A *subacaulescent* palm. *Leaves* 11; *petiole* 1.5 m long, armed with flattened, brown-floccose, up to 30 cm long spines, 1 cm wide at base; *rachis* 3.5 m long, spiny; *pinnae* 98 per side, regularly arranged in one plane; *basal pinnae* 70 cm long, 2 cm wide; *median pinnae* 100 cm long, 6 cm wide; *apical pinnae* 27 cm long, 2 cm wide. *Inflorescence* erect; *prophyll* 55 cm long, densely brown-setose; *peduncular bract* up to 95 cm long, brown-setose basally, with spines in higher density and longer, up to 5 cm long, towards the apex; *peduncle* up to 1.3 m long, spiny between bract insertion and rachis, tomentose basally; *rachis* up to 35 cm long; *rachillae* many, up to 10 cm long, distal part bearing staminate flowers with transparent, clavate hairs, one pistillate flower at base of rachillae inserted directly on rachis in its middle and upper parts, slightly pedicelate at its base. *Staminate flower* with *sepals* 1 mm long; *petals* 2.5-3 mm long, connate in the lower third; *stamens* 6; *anthers* 1 mm long. *Pistillate flower* 11 mm long; *calyx* glabrous, pergamaceous, cup-shaped, truncate, 3-denticulate, 2.5 mm long; *corolla* oblong to cask-shaped, 8 mm long, with many dark brown spines; *staminodial ring* entire, 5 mm long; *pistil* conoidal, red-brown, tomentose, with slender, whitish, flexuous setae basally, black setae above; *stigmas* 3, 4 mm long. *Fruit* not collected; *mesocarp* fleshy at maturity (Boom *in schedula*).

Specimens observed:

BOLIVIA - *Boom 4154* (NY), 12 Dec 1983, 11°45'S, 66°02'W, 200 m, Beni, Vaca Diez, vicinity of Chácobo village Alton Ivon.

Distribution: In the southwestern parts of the Amazon basin.

Ecology: In terra firme forests.

Uses: edible fruits (Boom, 1988).

Vernacular names : chonta loro (B).

Notes: The type specimen was collected in Acre, Brazil, not very far from Beni where Boom collected. The pistillate flower is noticeable with a very short, cup-shaped calyx.

DISCUSSION

The species are very well delimited in *Pleiogynanthus* and *Monogynanthus* section *Munbaca*. In the section *Ayri* of this latter subgenus, there are four groups of closely related species. The using of floral characters to differentiate them, in all cases, justifies the statement at the specific level. The species will be easily identified, always taking into account the pistillate flower at anthesis and/or the fruit at maturity. After fecundation, the size and form of calyx, corolla and staminodial ring strongly change. Moreover, fruits of several species present differential characters which become obvious only at maturity. Many specimens in the herbaria have been incompletely collected and are not in a good enough state for accurate

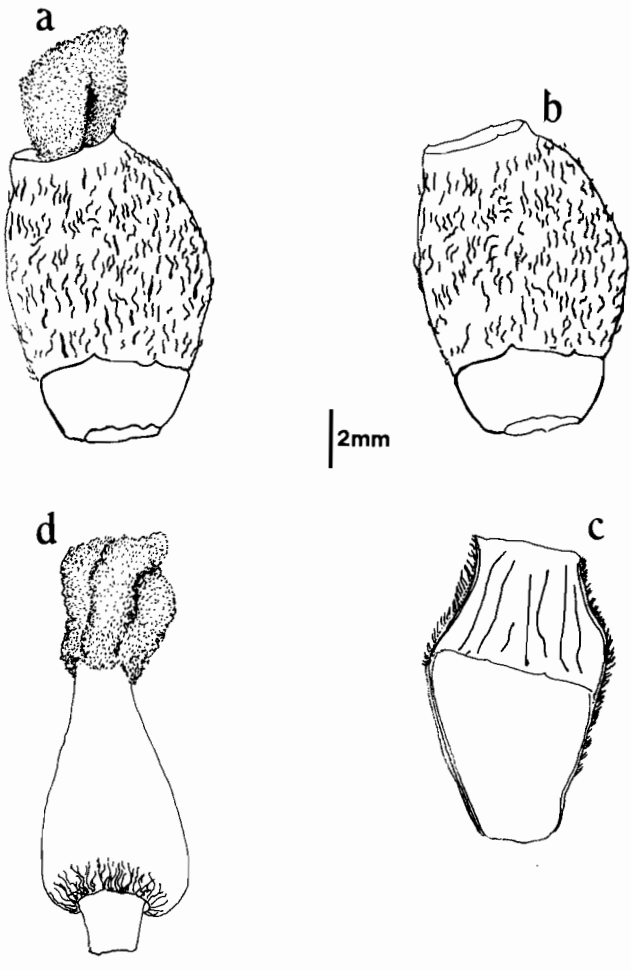

Fig. 56 - *Astrocaryum ulei* - a. pistillate flower; b. calyx; c. staminodial ring inside corolla; d. pistil. (Material used: Boom 4154)

identification. This has contributed to maintaining a great confusion. The life form - single or multistemmed , aerial or subterranean-stemmed, or subacaulescent palms - will be also helpful. As multistemmed species first develop monocaulous plants, and aerial-stemmed palms are first subacaulescent, several individuals will have to be observed in the population. This will be quite possible because all these species are gregarious. Except for *Astrocaryum farinosum* and *Astrocaryum ulei*, each known by the authors from only one specimen, and *Astrocaryum ciliatum* collected in recent years in Colombia, all other species were seen in the field.

On the whole, six new species are described, two names in synonymy are re-validated (*Astrocaryum farinosum* and *Astrocaryum sociale*), and several species only known from the type specimen and diagnosis (*Astrocaryum chonta, Astrocaryum huicungo, Astrocaryum javarense*) are now described from series of specimens.

This treatment is provisional, however. All problems have not yet been solved. For instance, *Astrocaryum giganteum*, *Astrocaryum caudescens*, and *Astrocaryum yauaperyense* are considered synonyms of *Astrocaryum acaule*, *Astrocaryum aculeatum*, and *Astrocaryum murumuru*, respectively. Type specimens of the three former were not designated, and «almost all of the specimens collected personally by Barbosa Rodrigues were apparently destroyed by fire» (Glassman, 1972, in Introduction). New collections are needed to corroborate the statement proposed here. So, work on the revision of *Astrocaryum* is continuing. Amazonian forests are still very extended, and may reveal some new secrets.

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