Two Amazonian Palm Species Revalidated: *Astrocaryum farinosum* and *A. sociale*

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***Astrocaryum farinosum* and *A. sociale*, two species described by J. Barbosa Rodrigues, were treated as synonyms of *A. sciophilum*. Data from new material of these palms show that differences in vegetative and reproductive characters are significant enough to treat them as species.**

Astrocaryum farinosum and *A. sociale* were described and commented on by Barbosa Rodrigues (1875, 1879, 1888, 1891, 1902, 1903) whose collections have disappeared, probably in a domestic fire (Glassman 1972). These taxa have been put into synonymy with *A. sciophilum* (Miquel) Pulle by Wessels Boer (1965). Only two vouchers of *A. farinosum* were collected in Guyana (*Smith 2583*, 21–26 Nov. 1937, this with three photographs; and *Black & Ledoux 50-10779*, 12 Nov. 1950). Kahn and Millán (1992) treated the three taxa as species. They justified their position with knowledge of *A. sciophilum* and *A. sociale* in the field as well as from herbarium vouchers, and by considering the similarity between Barbosa Rodrigues'(1903) drawing of *A. farinosum* and Smith's photographs; both illustrate the remarkably long and very slender inflorescence which characterizes this species. However, Kahn and Millán had not seen *A. farinosum* in the field at this time, and Smith's herbarium voucher includes only leaf parts and fruit. Henderson (1995) followed Wessels Boer (1965)'s assessment with only one species, *A. sciophilum*.

Smith collected *Astrocaryum farinosum* in Guyana along the Equissebo tributary of the Kuyuwini river about 150 miles from its mouth, i.e. about 120 km air-distance from the Brazilian locality. The palm was recollected along Kuyuwini river by *Jansen-Jacob et al. 2390*, 5 Feb. 1991. In 1993 and 1994, *A. farinosum* was revisited in the Upper Jatapú River valley (north Brazil) where Barbosa Rodrigues collected it in 1873; the palm forms dense stands in the understory of terra firme forest on uneven relief near the border with Guyana. Ripe fruit and flowers at anthesis were collected (*Kahn and Moussa 3526–3531, 3533–3535, 3536–3539, 3563–3568*). It was recently found in central Brazilian Amazonia near Balbina about 400 km air-distance from the Upper Jatapú (*Rabelo 50*), and at Km 145 from Manaus on highway BR 174 (*Kahn 3636*). The characters of *A. farinosum* – slender infructescence, large fruit, epicarp with short spines – are remarkably constant in spite of the fairly large distance between the populations.

Astrocaryum farinosum extends from southern Guyana to about 120 km north of Manaus.

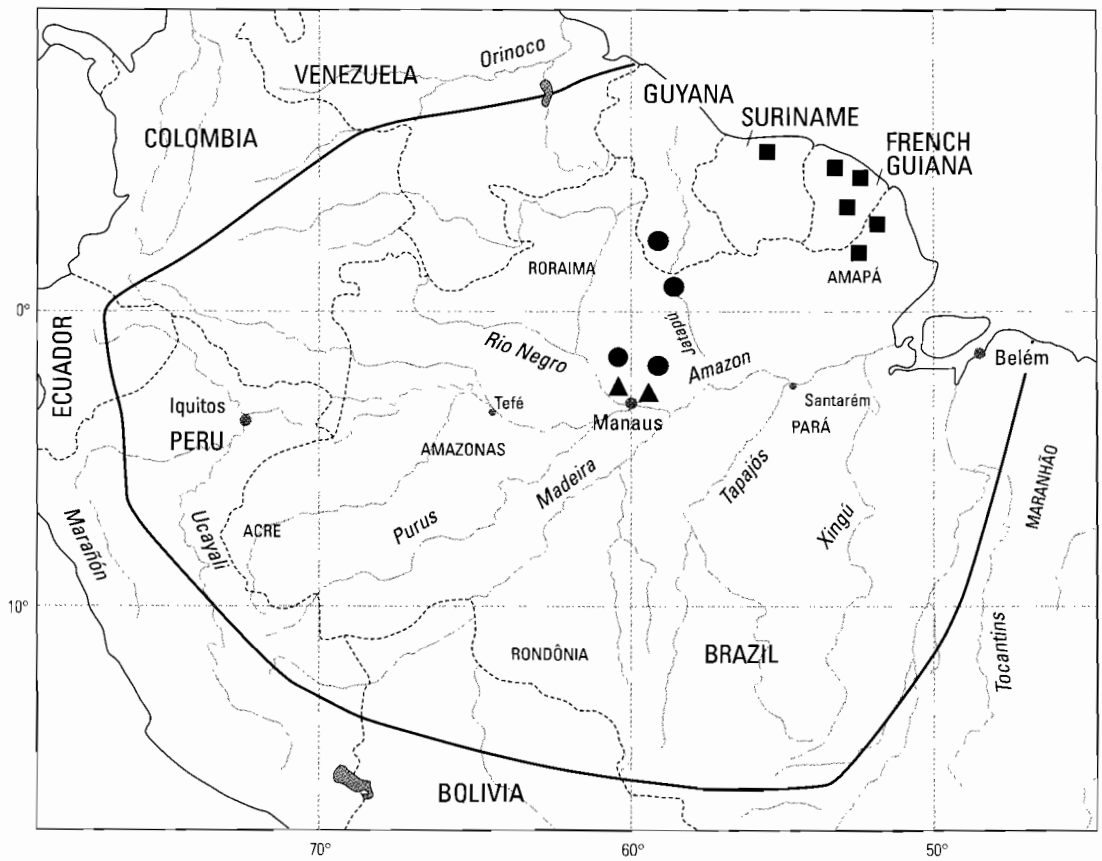
1: Distribution areas of *Astrocaryum farinosum*, *A. sciophilum* and *A. sociale* in the Amazon basin.

Astrocaryum sciophilum occurs in French Guiana, Suriname, and in Brazil at the border with French Guiana in the state of Amapá. *Astrocaryum sociale* is limited to central Amazonia in the immediate northern region of Manaus (Fig. 1).

Distinctive characters among *Astrocaryum farinosum*, *A. sciophilum* and *A. sociale*

The measures of vegetative and reproductive parts of the three species are given in Table 1.

Vegetative parts. Astrocaryum farinosum has the same habit, and almost the same physionomy as that of *A. sciophilum*, being most often subacaulescent (Fig. 2, 3). Both species have oblique rows of spines on the petiole and may develop a trunk, which is usually 3–4 m in height, exceptionally up to 10 m. The trunk of *A. sciophilum* keeps the sheaths of the dead leaves only under the crown, while that of *A. farinosum* usually remains covered with the sheaths throughout its whole length. *Astrocaryum sociale* develops a subterranean trunk



● *Astrocaryum farinosum* Barbosa Rodrigues
■ *Astrocaryum sciophilum* (Miquel) Pulle
▲ *Astrocaryum sociale* Barbosa Rodrigues

Table 1. Vegetative and reproductive characters of the three species. (Data from [1]Kahn's vouchers cited in text; [2]*Henderson 1047, 1070, Kahn 569, 587, 3223, 3229, sn;* [3]*Granville 3257, 11074, Oldeman 1088).*

	A. farinosum[1]	*A. sociale*[2]	*A. sciophilum*[3]
Trunk	aerial	subterranean	aerial
Leaf length (cm)	491–681	410–466	595–700
Rachis length (cm)	352–520	280–370	441–446
N pinnae/side	57–81	51–70	64–82
Median pinna			
length (cm)	85–118	76–88	100–105
width (cm)	3.6–4.2	2.9–3.7	4.2–4.8
Inflorescence length (cm)			
Peduncle	139–180	35–50	up to 100
Rachis	6.5–20	7–11	10–25
Rachilla length (cm)			
basal part (without stam. fl.)	1.1–2.6	0.8–3.0	1.9–2.9
distal part (bearing stam. fl.)	8.0–20.5	3.9–7.5	5.5–11.3
Staminate flower (mm)			
Sepal length	0.7–1.3	0.4–0.8	0.3–0.5
Petal length	2.4–4.0	1.9–2.9	2.0–2.4
Filament length	0.8–1.3	0.6–0.9	0.4–0.9
Anther length	0.9–1.6	0.8–1.1	0.7–0.9
Pistillode length	0.1–0.8	absent	?
Pistillate flower (mm)			
length	12.5–19.2	8.8–13.1	13.3–18.8
width	9.4–11.9	5.8–8.0	7.5–8.4
Calyx length	8.3–14.4	4.9–9.4	9.4–12.5
Corolla length	6.3–11.7	4.0–7.2	6.3–9.4
Staminodial ring height	1.4–3.8	0.9–1.6	0.8–1.7
Gynoecium			
length	7.0–13.3	5.0–6.9	7.8–10.9
diam.	4.2–9.1	3.9–5.6	4.2–5.0
Stigma			
length	6.6–11.3	5.3–9.4	7.5–10.5
width	6.3–9.7	5.5–9.4	5.2–7.2
Fruit (mm)			
length	48–76	39–58	70
width	32–47	24–39	30–40
Perianth (mm)			
Calyx length	9–14	8–13	14
Corolla length	18–30	17–27	28
Staminodial ring height	11–22	10–14	14
Spines on epicarp	short	short	long

which cannot be observed without excavation (Fig. 4, 5). Its leaves are significantly shorter than those of both former species.

Reproductive parts. The inflorescence of *A. farinosum* is very slender, up to 2 m long, and erect (Fig. 6); that of *A. sociale* is short, no more than 0.6 m long (Fig. 7); and that of *A. sciophilum* is intermediate in size, initially erect when flowering and more or less pendent at fruit maturity (Fig. 8). The rachis of *A. farinosum* and *A. sociale* is short, that of *A. sciophilum* is longer. The distal part of the rachilla, which is covered with staminate flowers, is clearly shorter in *A. sociale* than in the other species. Rachilla indumentum consists of obclavate hairs in *A. sciophilum* and of thread-like hairs in *A. farinosum* and *A. sociale.*

The staminate flower is larger in *A. farinosum* with very minute pistillodes which are not observed in the other species. A small bract, usually present at the base of the flower in the three species, is more developed in *A. farinosum.*

The pistillate flower is significantly smaller in *A. sociale.* The staminodial ring is usually higher in *A. farinosum* than in *A. sciophilum* (both species with flowers of same size). However, the main differences concern the morphology of the flower parts which makes these species easily to identify (Fig. 9):

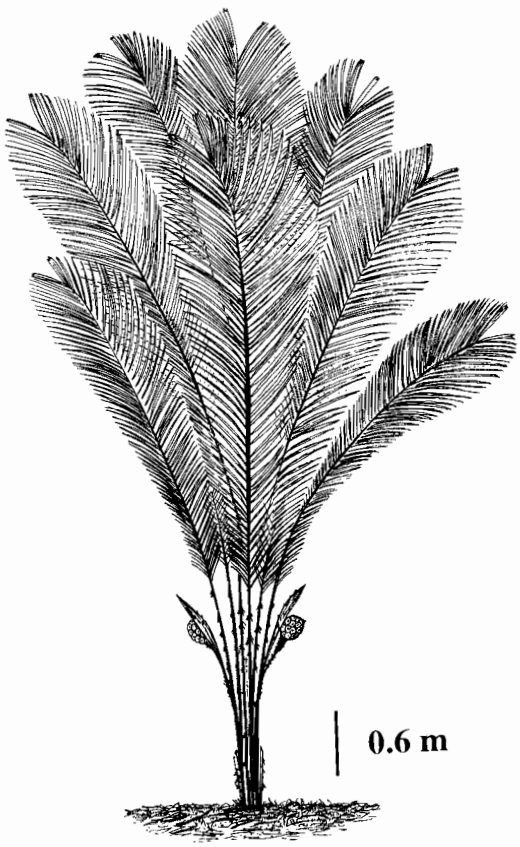
Astrocaryum sciophilum – calyx 3-dentate, oblong-urceolate, narrowed at top, encompassing the style up to the base of the stigmas; corolla 3-denticulate, oblong-urceolate.

Astrocaryum farinosum – calyx strongly 3-dentate, urceolate, not narrowing in the upper part; corolla 3-denticulate, subglobose to slightly urceolate.

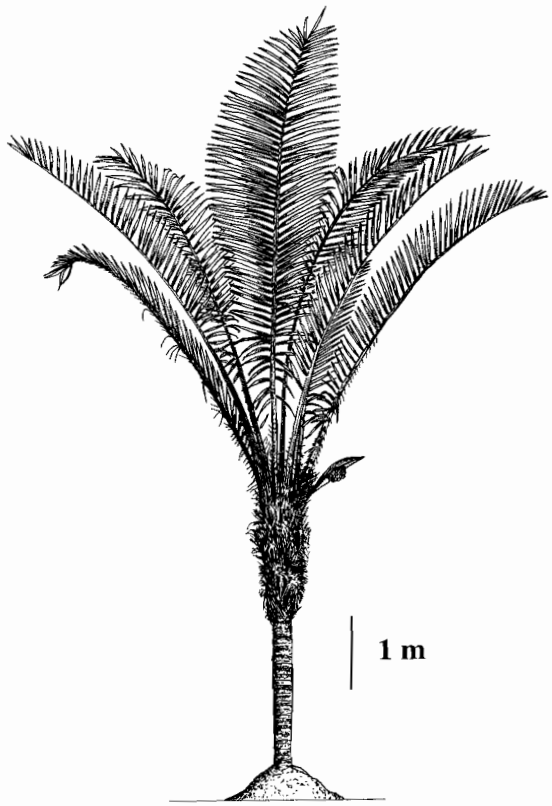
Astrocaryum sociale – calyx 3-dentate, subglobose, not narrowing in the upper part; corolla 3-dentate, globose.

The fruit is strongly or sightly turbinate to globose; the epicarp is covered with hard spines in *A. sciophilum,* with small spines in *A. sociale* and *A. farinosum* (Fig. 10). This last species develops the biggest fruits with a massive rostrum. There is no significant difference in the perianth, except for the staminodial ring being usually higher in *A. farinosum.*

2. *Astrocaryum farinosum* (after Barbosa Rodrigues' drawing, 1903, and Smith's photographs, yr 1937)



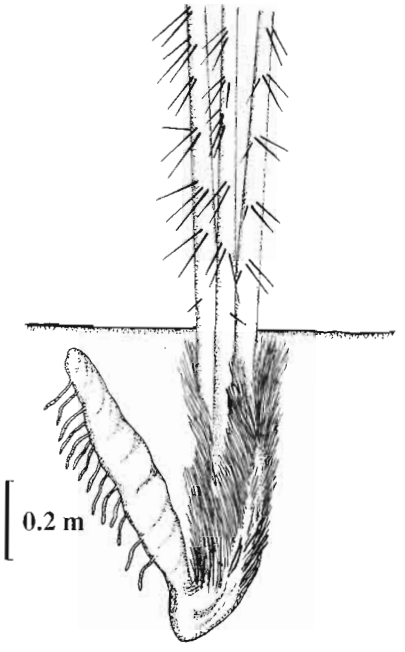
3. *Astrocaryum sciophilum* (by J.-J. de Granville).



Discussion and Conclusion

Wessels Boer (1965) considered *Astrocaryum farinosum* and *A. sociale* as synonyms of *A. sciophilum*. He based his argument on the variability of vegetative parts of these spiny palms and on the controversial additional small bracts – inserted on the peduncle and on the base of the rachis – which were emphasized by Burret (1934). Only *A. sciophilum* had such bracts according to Burret, which distinguish it from the other species. It is true that Barbosa Rodrigues did not refer to such structures in his descriptions and did not illustrate them in his drawings. Wessels Boer did not observe them in *A. sciophilum*, and he concluded on Burret's discussion of this character "I fail to understand what he meant." And this was his main argument to consider *A. farinosum* and *A. sociale* as synonyms of *A. sciophilum*. In fact, the three species possess small chartaceous, brown bracts, highly variable in shape, number and size and therefore not significant taxonomically. On the other hand, Wessels Boer could not have considered differences in flowers because only those of *A. sciophilum* were then available in the herbaria.

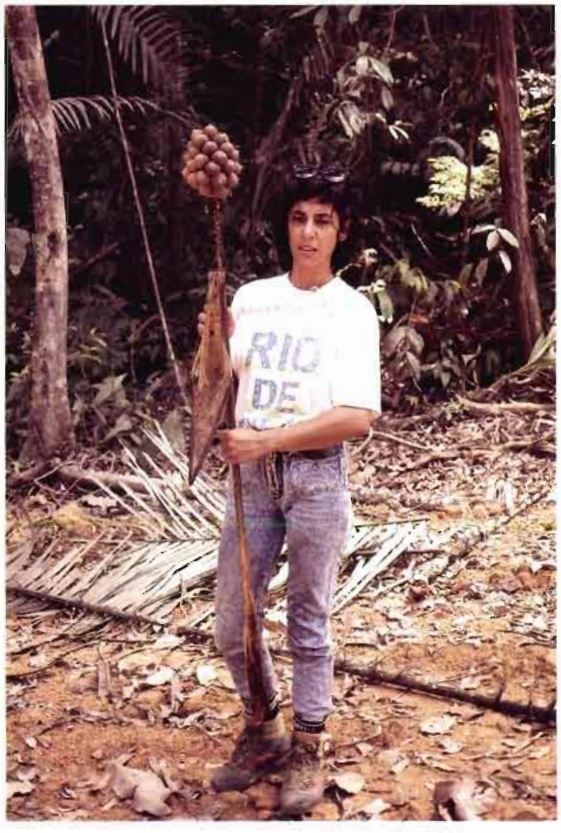
Henderson (1995) treated them again as synonyms of *A. sciophilum*. He considered *A. sociale* and *A. farinosum* as short-trunked palms, and by the way, introduced a confusion: It may be true for *A. farinosum*, most often subacaulescent, but it is not the case with *A. sociale* which has a subterranean trunk growing downwards. Henderson interpreted



5. *Astrocaryum sociale* – subterranean trunk (by F. Kahn).

both species as short-stemmed populations of *A. sciophilum* and explained this morphological difference as the probable result of rainfall which is higher in the Guianas than in central Amazonia. Higher rainfall would then favor the development of a trunk. There is a difficulty, however: his large species *A. paramaca* presents trunked individuals in central Amazonian while it develops acaulescent (subterranean-trunked) palms in the

4. *Astrocaryum sociale* (by F. Kahn).



6. *Astrocaryum farinosum* – infructescence (by F. Kahn).

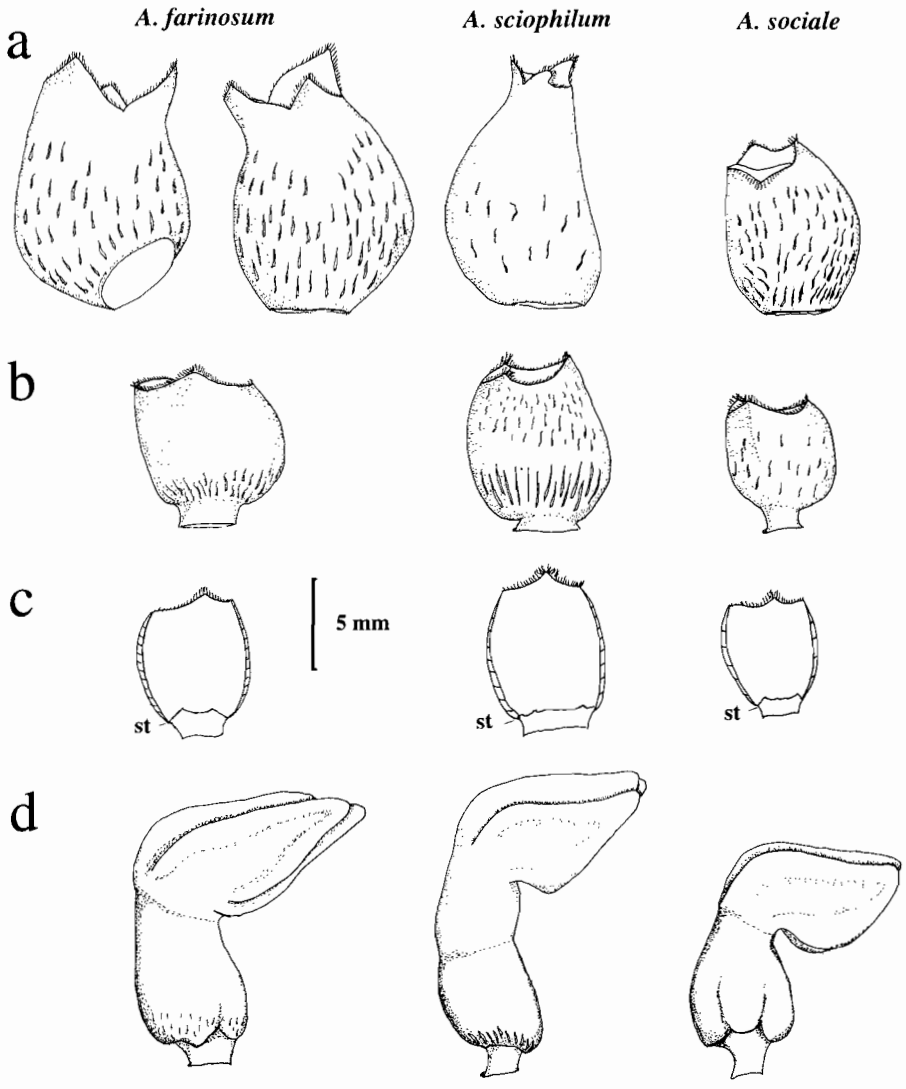
7. *Astrocaryum sociale* – infructescence (by A. de Castro).

8. *Astrocaryum sciophilum* – infructescence (by J.-J. de Granville).

Guianas (under higher rainfall). Could higher rainfall in the Guianas favour the trunk development in one species (*A. sciophilum*) and limit it in another species (*A. paramaca*), both species growing in the same Guianan locality inside the same forest? Moreover, trunked individuals of *A. farinosum* (*Kahn 3636*) have been found in central Amazonia within 60 km of the most important population of the subterranean-trunked *A. sociale* (Fig. 1), both species growing under the same climatic conditions.

Wessels Boer and Henderson's positions are far from convincing. 1) Wessels Boer had seen neither *A. farinosum* nor *A. sociale* in the field, and discussed variability of vegetative parts from *A. sciophilum* only. The few collections available in 1965 were very incomplete. We can assume that Wessels Boer did not observe specimens of *A. sociale* and knew *A. farinosum* only from Smith's voucher, which was then identified as *A. sciophilum* by Burret. 2) Henderson's position is ecologically inconsistent and is not based on new information about these species.

Data from new material of *A. farinosum* and *A. sociale* show that differences in vegetative and reproductive characters are so significant that they should not be called "evidently homogeneous" as concluded by Henderson (1995).



9. Pistillate flowers of the three species. a – calyx; b – corolla; c – staminodial ring (st) adnate in corolla; d – gynoecium (by F. Kahn).

This group of very close species belongs to subgenus *Monogynanthus*, section *Ayri* (Burret 1934). Cladistic and phenetic analyses of morphological characters as well as DNA phenetic analysis – genomic AFLP – show that the three species are as distant from section *Munbaca* (the second section of subgenus *Monogynanthus*) as from the other species of section *Ayri* (Kahn & Second 1999, Pintaud et al. in press).

These results as well as the distributions of the three species which extend in northern Amazonia – from the central region to the Guianas with *A. sociale* and *A. sciophilum* at the south and northeast, respectively, and with *A. farinosum* between these poles – offer a relevant biogeographical scheme to study evolutionary processes in the genus.

Acknowledgments

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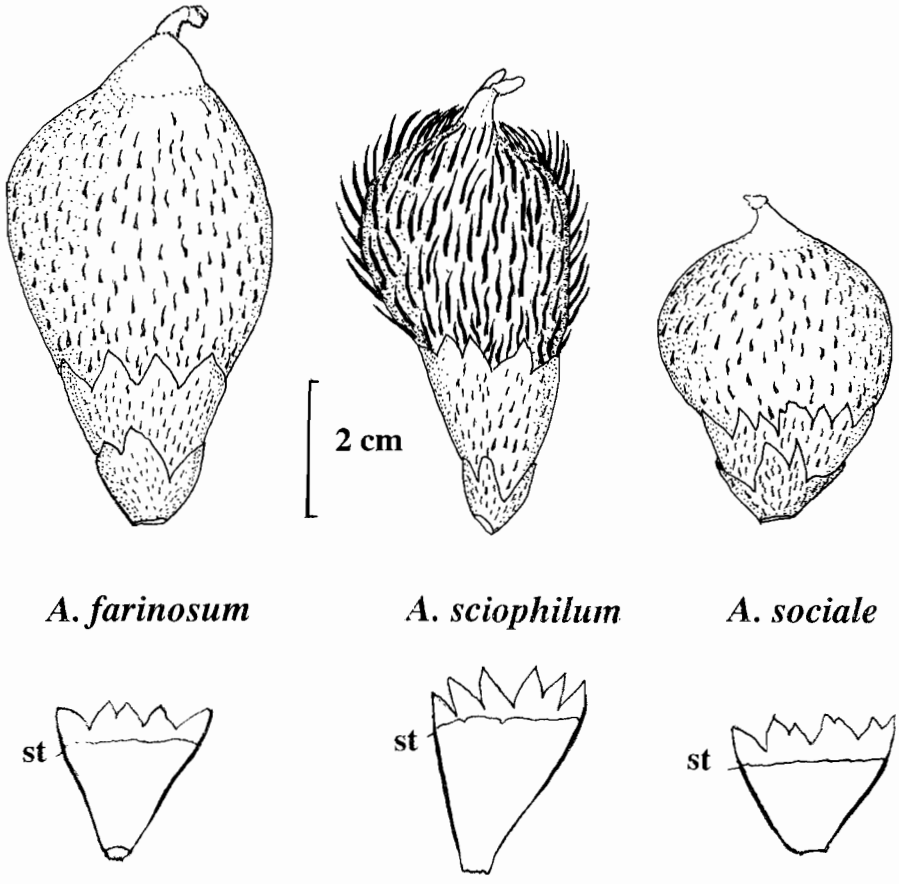
LITERATURE CITED

BARBOSA RODRIGUES, J. 1875. Enumeratio Palmarum Novarum quas Valle Fluminis Amazonum, Rio de Janeiro.

BARBOSA RODRIGUES, J. 1879. Prostesto-Appendice ao Enumeratio Palmarum Novarum, Rio de Janeiro.

BARBOSA RODRIGUES, J. 1888. Palmae Amazonenses Novae. Vellosia 1: 33–56.



10. Fruits of the three species; below: perianth with staminodial ring inside (by F. Kahn).

BARBOSA RODRIGUES, J. 1891. Palmae Amazonenses Novae. Vellosia 2: 91–112.

BARBOSA RODRIGUES, J. 1902. Palmae-Amylocarpus. Contr. Jard. Bot. Rio de Janeiro, 3: 69–88.

BARBOSA RODRIGUES, J. 1903. Sertum Palmarum Brasiliensium, ou relation des palmiers nouveaux du Brésil, découverts, décrits et dessinés d'après nature. Imprimerie Monnom, Bruxelles, 2 vol.

BURRET, M. 1934. Die Palmengattung *Astrocaryum* G. F. W. Meyer. Repert. Spec. Nov. Regni Veg. 35: 114–158.

GLASSMAN, S.F. 1972. A Revision of B. E. Dahlgren's Index of American Palms. Phanerogamarum Monographiae Tomus VI, Verlag Von J. Cramer, Lehre.

HENDERSON, A. 1995. The palms of the Amazon. Oxford University Press, New York.

KAHN, F. AND B. MILLÁN, 1992. *Astrocaryum* (Palmae) in Amazonia. A preliminary treatment. Bull. Inst. fr. Et. andines 21: 459–531.

KAHN, F. AND G. SECOND, 1999. The genus *Astrocaryum* in Amazonia: Classical taxonomy and DNA analysis. Mem. New York Bot. Gard., 83: 179–184.

PINTAUD, J.-C., G. SECOND AND F. KAHN. Phylogeny of the Amazonian species of *Astrocaryum* (Palmae) inferred from cladistic and phenetic analyses of morphological and DNA (AFLP) characters. Amer. Jour. Bot., in press.

WESSELS BOER, J.G. (1965). The indigenous palms of Suriname. E.J. Brill, Leiden.