

Voanioala (Arecoideae: Cocoeae: Butiinae), a new palm genus from Madagascar

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Summary. *Voanioala* J. Dransf., a palm genus with a single species *V. gerardii* from the rain forests of the Masoala Peninsula, Madagascar, is described for the first time and its relationships with other members of subtribe *Butiinae* (Arecoideae: Cocoeae) discussed.

The first suggestion that there might be an undescribed palm belonging to tribe *Cocoeae* in Madagascar came in 1984 from Dr M. E. Darian, a palm enthusiast from Vista, California. Dr Darian had made frequent trips to Madagascar to collect palm seeds to grow in his garden in California, being helped while in the north east of the island by Dominic Halleux and Gerard Jean. It was clear from the tantalising fragments of palms brought back by Darian, that there were several unusual undescribed palms in Madagascar, but only in one instance was material sufficiently representative for description (Dransfield & Uhl 1984). One of the curiosities shown to Natalie Uhl and myself was a palm endocarp, collected by Gerard Jean and given to Darian, said to be from the 'Forest Coconut', a tall palm with the habit of a coconut. The endocarp, extremely thick and heavy, resembled strongly the endocarp of members of subtribe *Attaleinae* (Dransfield & Uhl 1986). This however was all that could be deduced from the empty dead endocarp. Obviously it would be a high priority to find and make proper collections of the 'Forest Coconut'. When David Cooke (Kew) and I, accompanied by P. P. Lowry II and J. H. Beach (Missouri Botanical Garden) and Armand Rakotozafy (Parc de Tsimbazaza) arrived in Maroantsetra in October 1986 for field work on the Masoala Peninsula, the possibility of finding the 'Forest Coconut' was uppermost in our minds. However, all the localities known by Gerard Jean seemed to be at least three days' walk away. The most accessible locality was said to be near the village of Ambanizana, but even this locality would require a trek into the interior of the Peninsula for three days followed by three days for the return. In Ambanizana itself, however, we were very fortunate to meet villagers who had seen the palm nearer to the coast, in a much more accessible area near to Antalavia, and it was this locality that Gerard Jean, two villagers, David Cooke and I reached on 17 October 1986. Two mature individuals of the palm were discovered and we were fortunate that inflorescences and mature fruit were available, so that the affinities of this remarkable palm can be clarified. The Malagasy name for the palm is 'voanio-ala', literally 'forest coconut'; this vernacular name is taken up here as *Voanioala* for the Latin name of a most distinctive new genus. In doing so I follow the long-established precedent of latinizing Malagasy names (e.g. the palm genera *Vonitra*, *Raphia*, *Marojejya*, *Masoala* and *Antongilia*). The specific epithet chosen recognizes the person who must be regarded as the real 'discoverer' of the palm.

THE AFFINITIES OF *VOANIOALA*

The inflorescence, flowers and fruit clearly show *Voanioala* to be a member of tribe *Cocoeae*. There are only two major bracts in the inflorescence, the prophyll which remains hidden among the leaf sheaths, and the peduncular bract which is enlarged and cowl-like. The inflorescence branches to one order only and the rachillae bear triads basally and paired or solitary staminate flowers distally. Pistillate flowers have three fertile ovules. Most importantly, the endocarp is very heavily sclerified and has three basal pores. The absence of spines, the insertion of the peduncular bract near the base of the peduncle, the absence of pits on the rachillae and the presence of flowers of both sexes in the same inflorescence clearly indicate that the relationships of *Voanioala* are with subtribe *Butiinae*, rather than with the other cocoid subtribes—*Beccariophoenicinae*, *Attaleinae*, *Elaeidinae* and *Bactridinae* (Uhl & Dransfield 1987). This represents the first record for the subtribe in Madagascar. Although the endocarp is more reminiscent of those of subtribe *Attaleinae*, the presence of flowers of both sexes in the same inflorescence emphasizes the affinity with *Butiinae*.

There are nine other genera in *Butiinae* (Dransfield & Uhl 1986), viz: *Butia*, *Jubaea*, *Jubaeopsis*, *Cocos*, *Syagrus*, *Lytocaryum*, *Parajubaea*, *Allagoptera* and *Polyandrococos*. Some of these genera have been the subject of a recent synopsis by Glassman (1987), and all are discussed, at the generic level in detail in Uhl & Dransfield (1987). The differences between these genera tend to be rather small, and it is clear that the subtribe is a very natural one. *Voanioala* has unusual features in common with more than one genus. The presence of more than six stamens is a character shared with *Jubaea*, *Jubaeopsis*, *Parajubaea*, *Allagoptera* and *Polyandrococos*. The irregular excrescences on the inner surface of the endocarp are shared also by some species of *Syagrus* and *Polyandrococos*. The latter genus however has an unusual spicate inflorescence and staminate flowers of very different form and with a very large number of stamens (60–100). The habit of *Voanioala*, superficially like that of tree members of other genera in the subtribe, is nevertheless distinctive in the paucity of fibres on the extraordinary rectangular leaf base. The genus nearest to *Voanioala* in geographical terms is *Jubaeopsis* which is confined to a very small part of Pondoland (Transkei) in southern Africa; however *Jubaeopsis* differs greatly in habit, leaf sheath, flowers and fruit.

Subtribe *Butiinae*, although concentrated in South America, also has members occurring in southern Africa, the eastern Indian Ocean and the western Pacific, with a recently extinct member on Easter Island (Dransfield *et al.* 1984) and older fossils in New Zealand and India (see Uhl & Dransfield 1987, for further details and discussion of the distribution). That the subtribe should also be present in Madagascar is without doubt exciting, but perhaps not altogether unexpected.

Voanioala *J. Dransf.* gen. nov. Palma solitaria robusta pleonantha monoeca inermis ad tribum *Cocoearum*, subtribe *Butiinarum* pertinens. Folium reduplicato-pinnatum foliolis numerosis. Inflorescentia solitaria axillaris interfoliaris in unum ordinem ramificans, prophylo brevi inter bases foliorum occulto, bractea pedunculi conspicua rostrata longitudinaliter sulcata; rachillae numerosae prope basin triades prope apicem flores masculos solitarios vel binatos ferentes; flos masculus sepalis imbricatis, petalis valvatis, staminibus

12(-13), pistillodio nullo; flos femineus sepalis petalisque imbricatis, annulo staminodiali 9-dentato, gynoecio triloculari triovulato. Fructus 1-spermus, breviter rostratus, vestigio stigmatico apicali; epicarpium dense squamosum; mesocarpium tenue; endocarpium crassissimum, basi 3-poratum, longitudinaliter sulcatum, intus protuberationibus cerebriformibus semen penetrantibus; semen endospermio homoganeo, embryo basali. Genus madagascariense monotypicum.

Robust solitary unarmed pleoanthic monoecious tree palm. Stem erect, basally with a large root boss, distally the stem bare, very conspicuously 'stepped' and ringed with oblique leaf scars.

Leaves pinnate, reduplicate, cleanly abscissing; leafsheath tubular at first, fibrous, apparently soon disintegrating to leave a massive elongate rectangular leaf base, forming an apparent petiole with sparsely fibrous margins, abaxially densely covered with caducous brown indumentum; leaf base suddenly contracting into rachis, true petiole absent, the rachis more or less rectangular in cross section in the mid leaf region, abaxially densely covered with caducous brown indumentum as the leaf base; leaflets numerous, rather stiff, scarcely pendulous, very coriaceous, concolorous, unevenly bilobed at the tips.

Inflorescences solitary, interfoliar, apparently protandrous, branching to one order, erect in bud, later horizontal; prophyll tubular, 2-keeled, fibrous, remaining hidden among the leaf bases; peduncular bract bright green and strictly tubular in bud, later splitting longitudinally, flattening and becoming somewhat cowl-like, abaxially deeply and closely longitudinally grooved, bearing scattered brown scales on the ridges between the grooves, adaxially smooth, glabrous, pale cream-coloured; peduncle \pm circular in cross section; rachis bearing spirally arranged rachillae, each subtended by a small triangular rachis bract; rachillae numerous, most with a basal bare portion, the rachillae bearing 0-7 triads near the base and paired or solitary staminate flowers distally, the flower groups \pm spirally arranged, or becoming somewhat distichous by close-packing. Staminate flowers asymmetrical, broadly or narrowly triangular in outline; sepals 3, distinct, slightly to strongly imbricate at the base, triangular, acute to acuminate, membranous, glabrous; petals 3, distinct, unequal, valvate, glabrous, thinly coriaceous except at the thick angular tips, broadly and irregularly triangular-ovate, with acute or acuminate tips, abaxially smooth, adaxially marked with the impressions of the stamens and papillose near the thick tips; stamens 12 (-13), filaments subulate, very short to moderate in length, anthers basifixed, basally sagittate, apiculate at the tips, latrorse; pollen circular or elliptic in polar view, monosulcate (see Harley 1989). Pistillate flowers only known as buds, much larger than the staminate, irregularly triangular; sepals 3, distinct, unequal, strongly imbricate, broadly ovate, with triangular, keeled tips, coriaceous, glabrous, the margins minutely toothed; petals 3, distinct, longer than the sepals, basally irregularly imbricate, conspicuously valvate at the triangular tips, abaxially with scaly indumentum towards the apex, adaxially strongly papillose towards the tip; staminodial ring high with 9 irregular, triangular teeth, 0.1-0.5 mm; gynoecium syncarpous, tricarpellate, triovulate, stigmas 3, angled, papillose and scaly, ovules with axile placentation.

Immature fruit green covered with dense chestnut brown scaly indumen-

tum. Mature fruit one-seeded, somewhat irregularly ellipsoid, tipped with a short beak and stigmatic remains; epicarp purplish-brown, densely covered with brown scaly indumentum; mesocarp with an outer fibrous zone just below the epicarp, and an inner fleshy zone; endocarp \pm ellipsoid, apically pointed, basally truncate, very heavily thickened, pale brown when fresh, becoming grey with age, very deeply and irregularly longitudinally grooved, with 3 very deep basal impressions each with a central germination pore, in section the body of the endocarp traversed by longitudinal irregular vertical canals and fibres, inner surface of the endocarp with numerous irregular rounded excrescences intruding into the cavity. Seed irregularly ellipsoid, filling the endocarp cavity, laterally attached with a narrow irregular hilum, endosperm homogeneous but irregularly intruded by the endocarp protuberances, very hard, white, with a narrow, irregular central lacuna; embryo basal, top-shaped, positioned opposite an endocarp pore. Germination remote-tubular; eophyll entire, lanceolate.

Voanioala gerardii *J. Dransf.* sp. nov. Palma insignis solitaria trunco conspicue articulato, foliis magnis ad 5 m longis regulariter pinnatis, foliolis ad 1.5 m longis concoloribus. Inflorescentia ad 1.5 m longa, rachillis c. 60, floribus masculis c. 10–12 \times 7–9 mm, femineis 18–20 \times 10 mm. Fructus 7–8 \times 4–5 cm, endocarpio 10–15 mm crasso. Typus: Madagascar, Masoala, *J. Dransfeld et al.* JD6389 (holotypus K; isotypi AAU, BH, MO, NY, P, TAN, US).

Robust, solitary, tree palm. Stem erect, 15–20 m tall, d.b.h. c. 35 cm, basally with a large root boss to 1 m diam., distally the stem bare, very conspicuously 'stepped' and ringed with oblique leaf scars, c. 10 cm distant, the distal portion of the internodes projecting c. 5 cm outwards from the proximal part of the following internode.

Leaves c. 15–20 in the crown, c. 5 m long; leaf base elongate rectangular, apparent petiole c. 150 \times 30 cm, c. 8–10 cm thick, with sparsely fibrous margins, abaxially densely covered with caducous brown indumentum; rachis in cross section in the mid leaf region, c. 4 \times 3 cm; leaflets numerous, c. 70 on each side of the rachis, regularly arranged, rather stiff, scarcely pendulous, very coriaceous, shining mid-green when fresh, drying pale, concolorous, c. 150 \times 7 cm, unevenly bilobed at the tips, mid vein prominent adaxially, abaxially bearing a few brown rammenta near the base, c. 8 longitudinal veins besides the mid vein, transverse veinlets obscure but lamina minutely transversely striate, portion of leaflet exposed in the sword leaf bearing caducous chocolate scales, thin wax also present on both surfaces.

Inflorescences c. 1.5 m long, erect in bud, later horizontal; prophyll c. 70 \times 13 cm, bearing caducous brown scales; peduncular bract c. 120 \times 18 cm, abaxially deeply (c. 2.5 mm) and closely longitudinally grooved, bearing scattered brown scales on the ridges between the grooves; peduncle c. 90 cm long, c. 4–5 cm diam., \pm circular in cross section, pale cream-coloured at staminate anthesis, becoming bright green in fruit, brown scaly when newly emerged, becoming glabrous; rachis c. 60 cm long; rachillae c. 60 in number, those near the base the longest to c. 50 cm, decreasing in length towards the inflorescence tip, most with a basal bare portion, 2–5 cm long, c. 7 mm diam. near the base, decreasing to 1.5 mm diam. near the tip, the rachillae somewhat zig-zag due to close packing, especially near the base, and bearing 0–7