

Chrysalidocarpus canaliculatus and its Relatives

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The three species of *Chrysalidocarpus* discussed in this paper are among the largest species of palm in Madagascar and perhaps not surprisingly are poorly represented in herbarium collections.

These *Chrysalidocarpus* species share a highly distinctive seed type. The seed is black and marked with deep, sinuous grooves except at the rounded hilum. In one species, *C. bejofa* (Beentje) Eiserhardt & W.J.Baker, cross section of the seed displays almost regular deep grooves penetrating the otherwise homogeneous endosperm. In the other two species, not only is the endosperm regularly penetrated by the grooves in the black seed coat, but it is also irregularly ruminant. In the recent phylogenetic analysis of the Dypsidinae (Eiserhardt et al. 2022), the three taxa form a well-supported, monophyletic group that is most closely related to a group comprising *C.*

lastellianus (Baill.) Eiserhardt & W.J.Baker, *C. leptocheilos* (Hodel) Eiserhardt & W.J.Baker, *C. mijoroanus* (Eiserhardt & W.J.Baker) Eiserhardt & W.J.Baker and *C. nauseosus* (Jum. & H. Perrier) Eiserhardt & W.J.Baker. The distinctive seed type, not known elsewhere in the genus appears thus to be a phylogenetically robust character. According to the phylogenetic analysis, all *Chrysalidocarpus* with deeply grooved seeds could in principle be viewed as a single morphologically variable species, *C. canaliculatus* (Jum.) Eiserhardt & W.J.Baker. However, we argue that there are three distinct morphological entities within this group, which we recognize as separate species including one which is newly described in this paper.

Deeply grooved seeds imported from various sources have entered cultivation mostly under the name of *Dypsis bejofa*, but also as *Dypsis aff. bejofa* and *Dypsis* “bejoufa” and *Dypsis* “bejouf.” Now that collections have reached maturity it has been possible to assess their identity. Many cultivated specimens do indeed seem to match *Chrysalidocarpus bejofa* (as *D. bejofa* is now correctly known), a species that is becoming better understood now that more collections have been made from the wild. Of

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1. Soejatmi Dransfield beneath a mature tree of *Chrysalidocarpus titan* outside the property of Jerry and Cindy Andersen, Lelani Estates, Hawai'i (Photo: J. Dransfield).



2. *Chrysalidocarpus titan* at Floribunda Palms and Exotics, Hawai'i (Photo: W.J. Baker).



3 (top). *Chrysalidocarpus titan*, detail of basal part of leaf . 4 (bottom). Detail of mid part of leaf (Photos: W.J. Baker).

C. canaliculatus, we still have only three verified herbarium collections, and the palm has not been seen recently in the wild. It is unknown in cultivation. A third taxon, known under the moniker *Dypsis* “bejoufa,” is represented by several individuals in cultivation in Hawai’i (Back Cover; Figs. 1 & 2) and it has become apparent that it is distinct from *C. bejofa* and *C. canaliculatus* in a number

of characters that have provided justification for the description of a new taxon, *C. titan*.

Chrysalidocarpus titan J.Dransf., Marcus & W.J.Baker, sp. nov.

Massive palm with black deeply sinuously grooved seeds, differing from the other species in the genus with such seeds (*C. canaliculatus* and *C. bejofa*) in the subregular moderately



5. *Chrysalidocarpus titan*, crown with mature infructescence (Photo: W.J. Baker).

plumose leaflets (rather than strongly grouped highly plumose leaflets), ramenta on the abaxial midrib surface very sparse or absent,

the midleaf leaflets up to 8 cm wide (rather than to 4 cm) and the staminate flowers with 12 rather than six stamens (stamen number



6. JM struggles to hold a complete infructescence of *Chrysalidocarpus titan* with ripe fruit (Photo: W.J. Baker).

not known for *C. canaliculatus*). Type: USA. Hawai'i, Island of Hawai'i, Mountain View, Floribunda Palms, Jan 2023, *W.J. Baker with J. Marcus and S. Marcus WB1475* (Holotype K).

Massive single-stemmed palm to 15 m tall in cultivation (so far). Stem 35–40 cm diam., internodes 15–25 cm, green in lower part of stem, covered in dense white wax distally. Crown of 8–12 leaves, held \pm porrect, not drooping; crownshaft massive, 2–2.5 m long, ca. 60–70 cm diam., densely white-waxy over a buff surface; leaf sheath to 2 m long, abaxially white waxy and with scattered brown scales in exposed parts, shiny bright red brown at the base and adaxially; petiole 30–60 cm long, 10 cm wide, deeply channeled and with very sharp margins, abaxially covered in brown indumentum and white wax; leaf rachis 6.0–6.9 m long, deeply channeled in lower third, ridged distally, the margins sharp, distally rachis surface glabrescent; leaflets ca. 140–188 on each side of the rachis, irregularly arranged and plumose towards the base (Fig. 3), in distal 60% of blade \pm regularly arranged (Fig. 4) and not plumose but held in different planes, acute, mid-leaf leaflets 104 \times 8 cm, concolorous, glabrous adaxially and abaxially, with very few inconspicuous brown ramenta towards the base, absent on some leaflets, short

inconspicuous sinuous transverse veinlets visible adaxially. Inflorescence infrafoliar (Figs. 5 & 6), spreading and somewhat hippuriform, ca. 110–220 cm long and with a spread of 90 cm, branched to two orders with ca. 40 first order branches, orange-yellow when newly emerged, basal-most first order branch the longest, to 120 cm long; peduncular bract 150 \times 36 cm when open, fibrous, woody to 20 mm thick, with a prominent beak to 20 cm long; rachillae to 10 cm long, 4–5 mm diam. bearing triads throughout except towards the tips where bearing paired or solitary staminate flowers. Staminate flowers cream-colored at anthesis, 8 \times 5 mm; calyx with 3, distinct imbricate sepals 4 \times 5 mm, irregularly keeled, thick; petals 3, 3 \times 1.5 mm, coriaceous; stamens 12, filaments 0.6 mm long, 0.2 mm wide at base tapering to very slender connective, fleshy, connective dark-colored in preserved material, anthers versatile 1 \times 0.4 mm; pistillode columnar 1.3 \times 0.3 mm. Pistillate flower globular ca. 5 \times 5 mm; sepals 4 \times 4 mm; petals ca. 4 \times 4 mm; staminodes minute, irregular, \pm triangular or toothlike, 9–12. Fruit ovoid (Fig. 7), 30–35 \times 26–30 mm; epicarp greenish orange at maturity, \pm smooth or slightly pebbled, splitting to expose the mesocarp (Fig. 7), mesocarp ca. 2–5 mm thick, slightly spongy with longitudinal fibers. Seed



7. *Chrysalidocarpus titan*, close-up of ripe fruit showing splitting pericarp (Photo: W.J. Baker)



8. Fruits and seeds of the holotype of *Neodypsis canaliculata* in the carpological collections in the Paris Herbarium. (<https://mediaphoto.mnhn.fr/media/16534712311028sEwLxcTbeK3JyWQ>). Cross section (9A) and vertical section (9B) of seed of *Chrysalidocarpus titan* (Baker et al. WB1475). 10a. Cross section (10A) and vertical section (10B) of seed of *Chrysalidocarpus bejofo* (Dransfield JD6405).

26 × 23 mm, black, ovoid with a short apical beak, the seed surface deeply and sinuously grooved, apart from at the circular hilum; endosperm deeply, irregularly ruminate; embryo sub-basal.

Specimens examined: USA. Hawai'i, Island of Hawai'i, Mountain View, Floribunda Palms, Jan 2023, W.J. Baker with J. Marcus and S. Marcus WB1475 (Holotype K); 15 Feb 2015, J. Dransfield with J. Marcus and S. Dransfield JD7801 (K). Pahoia, near Hilo, Andersen Garden, 16 Feb. 2015, J. Dransfield and S. Dransfield JD7844 (K).

This enormous palm, one of the most robust in the genus, has been traded as *Dypsis* aff. "bejoufa." Individuals in cultivation have

begun to flower and fruit, and the differences between it and *Chrysalidocarpus bejofo* and *C. canaliculatus* can now be more clearly appreciated.

The seed of *C. titan* is black and deeply channeled with sinuous grooves apart from at the rounded hilum. As mentioned above this unusual seed form occurs in *C. bejofo* and, we now know, also in *C. canaliculatus*. These are the only species in the genus to display such an unusual seed type. When *Palms of Madagascar* was published in 1995, the palm now known as *Chrysalidocarpus canaliculatus* was known from just three specimens, none of which apparently had fruit. Recently images of carpological specimens in the Paris



11. Mature individual of *Chrysalidocarpus bejofo* showing the highly plumose leaves with narrow leaflets, Analalava, eastern Madagascar (Photo: J.Dransfield).

Herbarium have become available online, including fruit of the type of *Neodypsis canaliculata* (= *C. canaliculatus*) (<https://mediaphoto.mnhn.fr/media/16534712311028sEwLxcTbeK3JyWQ>) (Fig. 8). The black seeds

with sinuous grooves are clearly shown and it seems highly likely that Jumelle was referring to the grooved seed when he coined the species epithet rather than the deeply channeled petiole as was suggested in *Palms of Madagascar*

(Dransfield & Beentje 1995). These seeds are, measured from the image, globose, about 21 mm diam. and the endosperm appears to be deeply penetrated by the grooves but also runcate. The endosperm of all three taxa is deeply penetrated by the grooves in the surface of the black seed coat (Figs. 8–10).

Chrysalidocarpus canaliculatus remains very poorly known and based on very imperfect herbarium specimens. Nevertheless, it can be separated from *C. bejofa* by vegetative characters. *Chrysalidocarpus titan* also has distinctive vegetative features which allow easy separation, but in addition the 12, rather than six, stamens are unique among all species of the genus where we have data on stamen number.

Thus, we believe we have ample evidence for recognizing *C. titan* as undescribed. The species epithet obviously refers to the very large size of this magnificent palm.

These three species of *Chrysalidocarpus* with black, deeply grooved seeds can be keyed out as follows:

- 1. Abaxial surface of the leaflet midrib with an almost uninterrupted row of conspicuous ramenta. Petiole lacking *C. canaliculatus*
- 1. Abaxial surface of leaflet midrib with sparse ramenta or ramenta lacking. Petiole present. 2.
- 2. Leaflets strongly plumose in arrangement throughout the leaf, arranged in groups, in mid leaf up to 4 cm wide. Inflorescences at anthesis greenish white. Stamens 6. Seed 17–23 × 15–21 mm, the endosperm deeply grooved, slightly runcate . . . *C. bejofa* (Fig. 11).

- 2. Leaflets irregularly arranged near the leaf base, ± regularly arranged in mid leaf, not conspicuously plumose, in mid leaf 5–8 cm wide. Inflorescences at anthesis golden yellow. Stamens 12. Seed to 26 × 23 mm, the endosperm deeply grooved and also irregularly runcate *C. titan*

Seeds of *C. titan* were originally bought by JM from the late Australian nurseryman Rolf Kyburz under the name of *Neodypsis* sp “Bejoufa.” Kyburz’s main contact in Madagascar was the seed merchant Gunther Gottlieb. JM bought a further 75 plants from Australian nurseryman Stan Walkley in 1995 and 1996, legally imported into Hawai’i. These plants were sold and distributed in Hawai’i and represent the source of all mature *C. titan* in cultivation in Hawai’i.

Chrysalidocarpus titan grows much faster than *C. bejofa*. The eophyll of *C. titan* is bifid whereas that of *C. bejofa* is pinnate.

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