Resolving the Tangled Identity of Croton Chrysodaphne Baill. (Euphorbiaceae) in Madagascar

Authors: Berry, Paul E., Van Ee, Benjamin, and Haber, Elizabeth A.

Source: Candollea, 66(1) : 113-118

Published By: The Conservatory and Botanical Garden of the City of Geneva (CJBG)

URL: https://doi.org/10.15553/c2011v661a10

8. BERRY, Paul E., Benjamin VAN EE, and Elizabeth A. HABER: Resolving the tangled identity of Croton chrysodaphne Baill. (Euphorbiaceae) in Madagascar

Introduction

Among the estimated 150 species of *Croton* L. *(Euphorbiaceae)* endemic to Madagascar (SCHATZ, 2001), there is a characteristic group of tree species that have large, penninerved leaves with a dense covering of silvery or coppery lepidote trichomes on the lower surface. LEANDRI (1972) published a short note about this group in which he recognized seven species from Madagascar and one from the Comoro Islands. Despite the similarities in habit and leaf characters among them, these species differ considerably in their floral and fruit characters, and we do not expect most of them to form a monophyletic lineage. The absence of mature fruits or of staminate and pistillate flowers in most specimens makes their determination problematic and has led to considerable confusion among botanists who have attempted to identify them. This is further complicated by the poor definition of some species, most notably the one described by BAILLON (1861) as *C. chrysodaphne* Baill. Here we reexamine the protologue and syntypes of *C. chrysodaphne* with the aim of establishing a clear understanding of how to circumscribe this species and relate it to more recent collections. We also provide an emended description of the species.

Croton chrysodaphne Baill. in Adansonia 1: 147. 1861. **Typus: MADAGASCAR.** [**Toamasina:** Foulpointe or near Tamatave], 21.VII.1794 [date on attached letter], *Chapelier s.n. [No. 2 on attached letter]* (lecto-: P [P00389522]!; isolecto-: P [P00133024]!) (designated by LEANDRI, 1972: 405). **Epitypus** (designated here): **MADAGASCAR. Toamasina:** Analalava Forest Reserve, 7 km west of Foulpointe, 17º42.586'S 49º27.175'E, 22 m, 2.III.2009, *Van Ee & al. 998* (epi-: MICH!; isoepi-: MO!, P!, TAN!).

= *Croton lepidotus* Aug. DC. in Bull. Herb. Boissier ser. 2, 1: 565. 1901. **Typus: MADAGASCAR. Prov. Toamasina:** Maroantsetra, forêts à l'intérieur de la baie d'Antongil, 1897, *Mocquerys 274* (holo-: G [G00018155]!).

Emended description. – Small to medium-sized trees 2.5-12 m tall, with a well-branched crown. *Twigs* densely ferrugineous-lepidote, coppery-brown or grey-brown, somewhat flattened or angled on new growth, becoming terete with age. *Stipules* lacking or vestigial. *Leaves* alternate to subopposite or whorled. *Petioles* 2-4(-6) cm long, adaxially canaliculate, with 2 subsessile or shortly cylindrically-stalked, dark, concave-discoid glands 0.5-0.6 mm diam. emerging laterally at the junction with the midvein on the abaxial side of the leaf. *Leaf blades* elliptic to elliptic-ovate, 5-15 × 2.5-7 cm, variable in size and considerably larger in trees growing in the shade or on sucker shoots, apex obtuse to acute, base cuneate to rounded, entire, thinly coriaceous; upper surface densely to sparingly lepidote when young, soon glabrescent, medium to dark green when fresh and drying gray-green to dark brown, lower surface densely silvery- or coppery-lepidote and ferrugineous-punctate, the ferrugineous scales superimposed and scattered over a denser and more uniform silvery-lepidote background, weakly penninerved, lateral nerves 7-16 pairs, prominent and darker brown against the silvery background below. *Inflorescences* racemose, 3-12 cm long, axillary or terminal, mostly staminate and usually with 1-2(-3) pistillate flowers at the base; axes densely rusty to coppery lepidote, somewhat flattened or angled; staminate bracts linear-lanceolate, 0.5-1.5 mm long, pistillate ones linear, 2-4 mm long. *Staminate flowers* with brownish-lepidote, subglobose buds 1.5-2.5 mm diam., pedicels elongating from bud to anthesis, 1.5-4 mm long; sepals 5, triangular-ovate, 2-2.5 × 1-1.5 mm, obtuse, thick, ferrugineous-lepidote without, greenish and sparingly

Addresses of the authors: PEB: University of Michigan Herbarium and EEB Department, 3600 Varsity Drive, Ann Arbor, Michigan, 48108, U.S.A. Email: **peberry@umich.edu**
BVE: Black Hills State University Herbarium, 1200 University Street, Spearfish, South Dakota 57799, U.S.A.
EAH: University of Michigan Herbarium and EEB Department, 3600 Varsity Drive, Ann Arbor, Michigan, 48108, U.S.A.

ISSN: 0373-2967 *Candollea* 66(1): 113-118 (2011)

lepidote within; petals 10, white, in 2 whorls of 5 each, subequal, 1.7-2 × 1 mm, obovate, recurved at anthesis, lepidote without, tomentose within at the base, margins ciliate; disc-glands 5, minute; stamens ca. 30, white when fresh, filaments 2-3 mm long, anthers elliptic, ca. 0.5 mm long; receptacle pilose. *Pistillate flowers*: pedicels stout, 3-5(-6) mm long, steadily thicker towards the receptacle; sepals 5, firm, narrowly triangular to ovate-lanceolate, spreading at anthesis, 3-5 × 2-2.5 mm, apex acute, shortly connate at the base, ferrugineous- to coppery-lepidote without and often with a darker central nerve, pale green within with whitish-lepidote or brown-flecked scales, persistent in fruit; petals 0; nectariferous disc surrounding the base of the ovary; ovary trilobate-subglobose, 1.5-3.5 mm diam., greenish-white and densely ferrugineous-lepidote; styles 3, 3-4(-5) mm long, thrice bifid, spreading, recurved at the apices, abaxially ferrugineous-lepidote, adaxially glabrous, pale green when receptive. *Capsule* subglobose, 7-8 × 8-9 mm, smooth, olive-green, evenly ferrugineous-lepidote; exocarp thin, not separating; endocarp thinly woody, 0.5 mm thick; columella 6-7 mm long, subcapitate, cornute. *Seeds* somewhat compressed-ellipsoid, 6 × 5 × 3 mm, smooth, shiny, dark brown; caruncle reniform, 1.25 × 0.5 mm.

Additional specimens examined. – **Madagascar. Antsiranana:** vallée de l'Antsahabe, affluent de la Lokoho, 100 m, 10.III.1949, *Humbert 23295* (P); Bemongo-Antalaha, 9.XII. 1950, *Service Forestier 2090* (P); Ambohitoara, Antalaha, 12.XII.1950, *Service Forestier 2648* (P); Sarahandrano, proche à Ratsianarana, au bord du ruisseau Maroserana, Ampanavoana Canton, Antalaha Distr., 8.IX.1958, *Service Forestier 19182* (P). **Prov. Toamasina:** Fiv. Maroantsetra, Comm. Anjahana, Fok. Ambodivangy, 15°25' 47"S 49°50' 07"E, 200 m, 19.VII.2002, *Antilahimena & al. 1215* (MO, P); Road to Analalava, W of Foulpointe (Mahavelona), 7.XII.1984, *Dorr & Barnett 3326* (K, MO, P); Analalava, 2.4 km W of the old fortress at Foulpointe (Mahavelona), 2.XII.1985, *Dorr & al. 4422* (K, MO, P); Andilampananima hill E of Sahavary, up Andranofotsy River from Maroantsetra, trail to headwaters of Sahafotra River, 350-450 m, 23.X.1986, *Lowry & al. 4229* (K, MO, P); Forêt d'Analalava, 8 km W of Foulpointe (Mahavelona), 17º42'33"S 49º26' 49"E, 26.X.1996, *Miller & al. 8825* (K, MO), 26.I.2005, *Randrianaivo & al. 1170* (P); Riv. Anove, 200 m, X.1912, *Perrier de la Bâthie 9713* (P); RN I, Tamatave, 21.II.1950, *Réserves Naturelles (Rakotoniaina) 2599* (P, TAN); Tamatave Distr., Ambodiriana Ct., RN I, 19.VIII.1952, *Réserves Naturelles (Rakotoniaina) 4254* (P); Anjiro, Distr. Tamatave, 8.XI.1955, *Réserves Naturelles* (*Rakoto) 7707* (P); Tamatave Distr., Ambodiriana Ct., Vohimangitra, 11.X.1957, *Réserves Naturelles (Razanaparany) 9044* (P); Masoala Peninsula, S of Androka River SE of Ambanizana, 15º38'S 49º59'E, 350-550 m, 12-13.XII.1990, *Schatz* & *Modeste 3054* (K, MO), 29.X.1992, *Schatz & al. 3365* (K, MO, P); 1-2 km E of Fampanambo, 100 m, 15°23'00"S 49°37'08"E, 27.I.1999, *Schatz & al. 3845* (K, MO, P); Analangavo, Tamatave, 2.V.1950, *Service Forestier 1347* (P).

Observations. – Besides Chapelier's collection (Fig. 1), which Leandri (1972) designated as the lectotype of *C. chrysodaphne*, Baillon (1861) cited two other syntypes for this species in his protologue, namely *Du Petit-Thouars s.n.* (P) and *Bojer s.n.* (P). As Leandri (1972) pointed out, each one of the three specimens probably represents a different species, and it is apparent that Baillon's protologue represents a juxtaposition of characters from all three. Dorr (1997) reports that Chapelier arrived in Madagascar in 1794 and lived on the east coast of the island in Foulpointe and near Tamatave (Toamasina Province), and that his collections were confined to that area. Leandri (1972) cited Chapelier's collection of *C. chrysodaphne* and listed it as coming from near Tamatave. *Bojer s.n.* comes from the northwest coast of Madagascar near Majunga and despite its poor condition, it agrees closely with the related *C. argyrodaphne* Baill. in leaf characters and geographical distribution. There is no locality listed for the Du Petit-Thouars specimen, but he was known to have collected in both eastern and far southeastern Madagascar in 1795 and 1796 (Dorr, 1997). His specimen has smaller leaves with more prominent petiolar glands than either of the other two, and it appears to represent a different species not yet matched to a published name. Other specimens of this taxon have been collected at a number of localities along the upper moist slopes of the eastern escarpment of Madagascar in Toamasina and Fianarantsoa Provinces.

In Baillon's protologue, he attributes the basic habit, wood, and stem characters of *C. chrysodaphne* to Chapelier's handwritten description of "Monguia lanceolata Chapel." [in sched.], which is attached to the lectotype (Fig. 1). Baillon's first two lines are essentially a direct translation into Latin of Chapelier's French description, even mentioning that the trunk of the tree has the thickness of a human thigh. From there on, however, most of the features described for the flowers are lacking on the Chapelier lectotype, which is sterile except for a few young staminate buds inside a packet. Likewise, the isolectotype at P lacks any reproductive structures at all. In the protologue, Baillon (1861) described the inflorescence as 10-20 cm long and nodding, the staminate flowers with 5 petals and 15 stamens, and the pistillate flowers with 5 well-developed and ciliate-margined petals, as well as a variable number of staminodes. It is relatively uncommon for *Croton* species to have petals in the pistillate flowers, and the only large-leaved lepidote Malagasy species we know of to consistently have pistillate petals is *C. multicostatus* Müll. Arg., but this latter species has much narrower leaves with more numerous divergent secondary veins and occurs in far southeastern Madagascar (Berry, 2011). Interestingly, however, some individuals of *C. argyrodaphne* produce petals in the pistillate flowers, although they are only seen in young flowers, and older flowers with developing fruits on the same trees show no sign of petals. On the *Bojer s.n.* syntype of *C. chrysodaphne*, which we now assign to *C. argyrodaphne,* there is a small packet on the left side of the sheet that bears an annotation in Baillon's handwriting indicating that it contains "flores [male], [female], et hermaphr.". Our conclusion is that this is where Baillon obtained the information he gave about the flowers of *C. chrysodaphne* in his protologue, and it can explain his description of petals in the pistillate flowers and

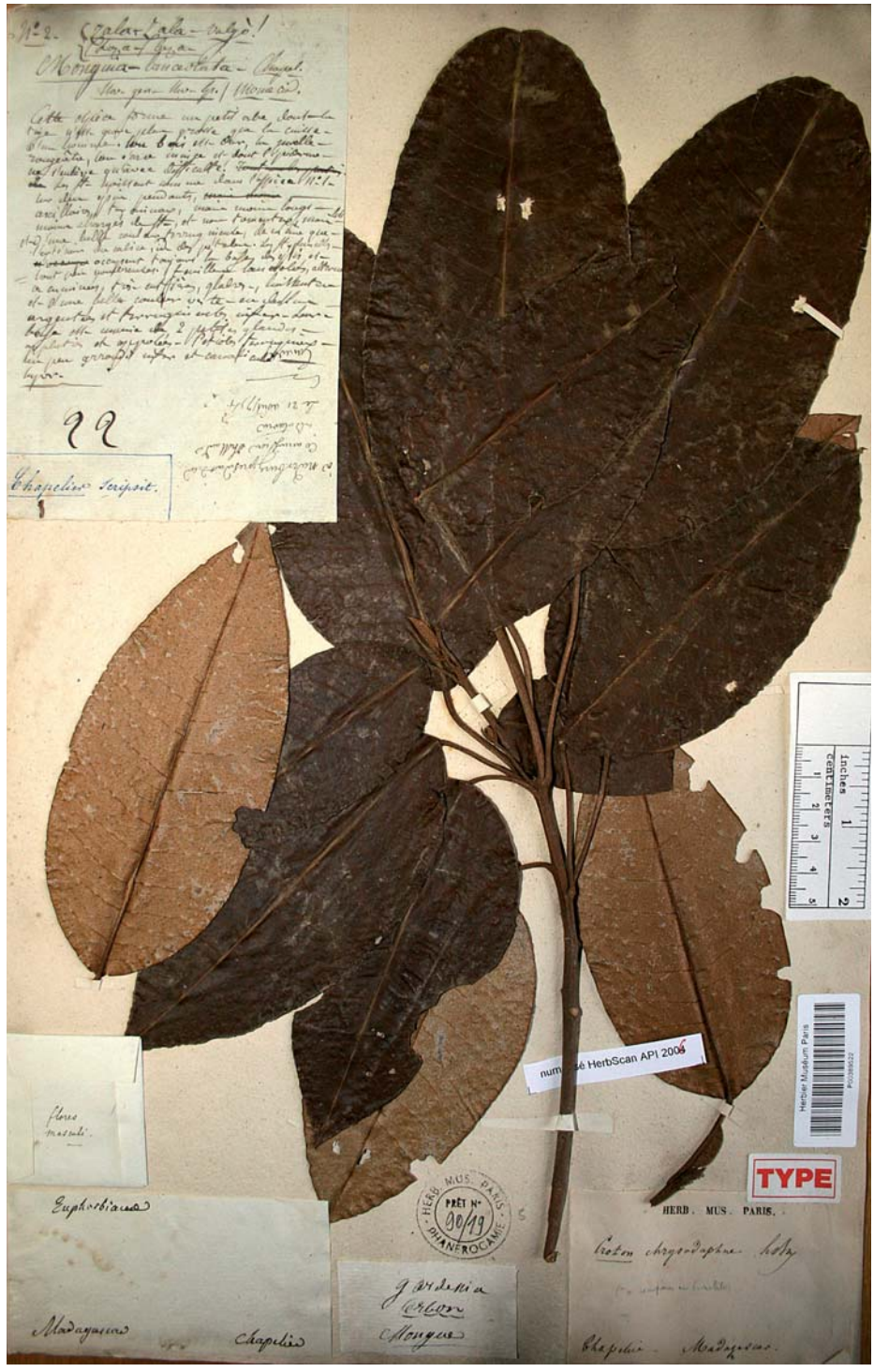

Fig. 1. – Lectotype of *Croton chrysodaphne* Baill. at P. On the upper left is the attached letter in Chapelier's handwriting where he proposes the name "Monguia lanceolata" for this species and provides a description of some of the characters of the plant.

even the nodding inflorescences. Revealingly, BAILLON (1861) himself was ambiguous about the presence of petals in the pistillate flowers of *C. argyrodaphne*, since he described the species as having "inconspicuous" petals in the pistillate flowers, yet at the same time he placed it in his *Croton* sect. *Monguia* Baill., which he described on the preceeding page as having pistillate flowers with petals.

There are actually very few possible candidates among Malagasy tree species of *Croton* with such large, broad, penninerved, brownish lepidote leaves that the Chapelier type could correspond to. These include *C. argyrodaphne*, which is a widespread species from northern Madagascar with unusual beaked fruits due to a stylar column topped by tightly congested stigmas, as well as 10-12 stamens in the staminate flowers, and generally narrower leaves. Another one is *C. nobilis* Baill., which appears to be restricted to southeasternmost Madagascar and is characterized by large fruits over 2 cm in diameter when mature, seeds 1 cm or more wide, and thick, reduplicate pistillate sepals. Lastly, there is *C. lepidotus* Aug. DC., a species from the eastern coastal forests of the island with the highly unusual combination of 10 petals and around 30 stamens in the staminate flowers, and highly bifurcating stigmas in the pistillate flowers. If we consider only the species from the eastern coast of Madagascar, particularly the part of Toamasina Province where the Chapelier type originated, the only one that matches the type material well, albeit vegetatively, is *C. lepidotus*. The protologue of this species is detailed and unequivocal, as it was based on a single, flowering type collection (CANDOLLE, 1901). We have reviewed all available herbarium specimens from this area and have collected material ourselves in forests close to Foulpointe. The only *Croton* tree species found there is distinctive not only in the large size of its leaves (Fig. 2a), although the size can vary considerably depending on the degree of exposure to the sun, but also in its male flowers, which have 10 petals and numerous stamens (Fig. 2c). The female flowers lack evident petals or staminodes, as with most *Croton* species, and they have distinctively spreading, successively bifurcating styles (Fig. 2b). The local common name of this plant is «Lazalaza,» and it was also recorded by Chapelier on the letter accompanying the lectotype. This common name, however, is rather loosely used througout Madagascar for any large-leaved lepidote tree species of *Croton*, including *C. argyrodaphne*.

With the unusual combination of floral features described in the protologue and the lack of diagnostic floral features on the lectotype and isolectotype, Baillon's description of *C. chrysodaphne* is likely an amalgamation based on collections from two or three different species. However, we believe that the location of the lectotype near Foulpointe and its distinctive, large leaves and tree habit are evidence enough to conclude that Chapelier's specimen belongs to the same species as *C. lepidotus*, and that being the case, *C. chrysodaphne* is the earlier name and must be taken up. Since neither name has been extensively used in the literature, and there are not a large number of specimens available, we believe that placing *C. lepidotus* into synonymy under *C. chrysodaphne* and clarifying here the critical floral characters and distribution of the species is preferable to proposing rejection of *C. chrysodaphne* due to the confusion among the syntypes and the lack of flowers or fruits in the lectotype. Furthermore, our epitypification of the species with modern material that is well documented, photographed, and sampled for molecular phylogenetic studies will allow this species to be reliably placed among other Malagasy *Croton* in a phylogenetic context (HABER & al., 2010).

An additional issue concerning the application of the name *C. chrysodaphne* is that WEBSTER (1993) used it to lectotypify *Croton* sect. *Monguia* Baill., which BAILLON (1861) described to include *C. chrysodaphne* and *C. argyrodaphne*. WEBSTER (1993) later placed several other species in the section, such as *C. bernieri* Baill. and *C. noronhae* Baill., but we believe these species are not closely related and thus make a paraphyletic grouping. We are currently conducting molecular phylogenetic studies that should soon allow us to better understand the relationships of these and other lepidote-leaved species of *Croton* in Madagascar.

Acknowledgements

We thank the National Geographic Society (grant # 8568-08) for their financial support to conduct field work, the Missouri Botanical Garden office in Antananarivo for their logistic support and assistance with permits, Hélène (Mavo) Razanatsoa and Hanta Razafindraibe for assistance in the field, and the curators of G, K, MO, P, and TAN for facilitating examination of their herbarium collections.

References

BAILLON, M. H. (1861). Euphorbiacées Africaines. 2e partie. *Adansonia* 1: 139-173.

BERRY, P. E. & B. VAN EE (2011). Recognition of Croton multicostatus Müll. Arg. (Euphorbiaceae) as native to Madagascar. *Candollea* 66: 109-112.

CANDOLLE, R. E. A. DE (1901). Plantae madagascarienses ab Alberto Mocquerysio lectae. *Bull. Herb. Boissier* ser. 2, 1: 549-587.

DORR, L. J. (1997). *Plant collectors in Madagascar and the Comoro Islands*. Royal Botanic Gardens, Kew.

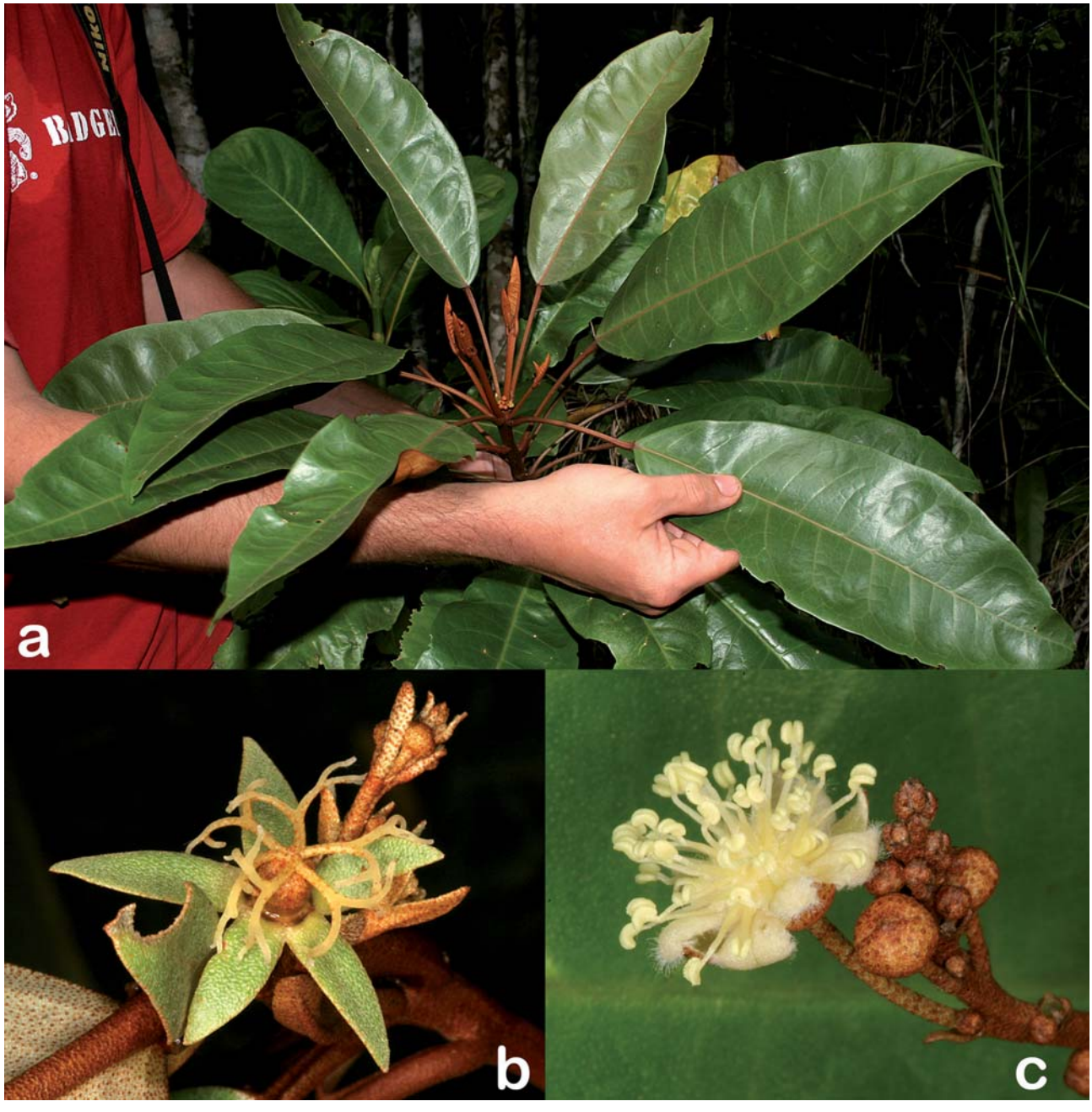

Fig. 2. – Photographs of *Croton chrysodaphne* Baill. collected in the forest understory at Analalava Forest Preserve west of Foulpointe, Toamasina Province. **A.** Leafy branch showing the large size and long petioles of shade leaves, comparable to those of the lectotype in Fig. 1; **B.** Pistillate flowers showing the lack of petals or staminodes, the repand, regularly bifurcating styles, and the externally lepidote but internally subglabrous sepals; **C.** Staminate flower, with 10 petals and close to 30 stamens.

[**A-C:** *van Ee & al. 999*]

HABER, E., B. VAN EE, B. OYSERMAN & P. E. BERRY (2010). *Origin and diversification of Croton (Euphorbiaceae) in Madagascar, the Mascarenes, and the Comores*. Botany 2010 Annual Meetings, 1-5.VIII.2010, Providence, Rhode Island [http://2010.botanyconference.org/].

LEANDRI, J. (1972). Contribution a l'étude des Croton Malgaches à grandes feuilles argentées. *Adansonia* 12: 403-408.

SCHATZ, G. E. (2001). *Generic tree flora of Madagascar*. Royal Botanical Gardens, Kew, & Missouri Botanical Garden, St. Louis.

WEBSTER, G. L. (1993). A provisional synopsis of the sections of the genus Croton L. (Euphorbiaceae). *Taxon* 42: 793-823.