

TAXONOMIC REVISION OF THE GENUS *MANILKARA* (*SAPOTACEAE*) IN MADAGASCAR

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A revision of the five Madagascan species of the genus *Manilkara* (*Sapotaceae*) is presented, including a key, descriptions, diagnostic characters, ecological notes and a distribution map. Of the seven species originally described by Aubréville, *Manilkara tampoloensis* is placed in synonymy with *M. boivinii*, and *M. sohiy* is removed from the genus and placed within the existing *Labramia boivinii* (Pierre) Aubrév.

Keywords. Madagascar, *Manilkara*, *Sapotaceae*, taxonomic revision.

INTRODUCTION

The genus *Manilkara* Adans., probably best known for American species such as *M. zapota* (sapodilla) and *M. chicle* (chicle), is a pantropical genus comprising c.82 species (Govaerts *et al.*, 2001). Of these, approximately one third are found in Africa (Plana, in prep.) and Madagascar. Although the Madagascan species of *Manilkara* share some characteristics with mainland African species, none are found in Africa. Afro-Madagascan species can be divided, according to their gross morphology, into three broad biogeographic regions: Madagascar, East and South Africa, and Central and West Africa. Malagasy species share characteristics with species in both regions, where they are commonly constituents of evergreen forest.

Manilkara is one of six genera constituting the subtribe *Manilkarinae* H.J.Lam (tribe *Mimusopeae* Hartog) (Pennington, 1991) which also includes *Labramia* A.DC., *Faucherea* Lecomte, *Northia* Hook.f., *Labourdonnaisia* Bojer and *Letestua* Lecomte. These genera are predominantly from Madagascar, the Seychelles or the Mascarenes. Only the West African monotypic genus *Letestua* falls outside this distribution. Although the question of generic boundaries in *Sapotaceae* has long been a matter of debate, recent molecular analyses (e.g. Swenson & Anderberg, 2005; Smedmark *et al.*, 2006) fundamentally agree with Aubréville's (1974) and Pennington's (1991) circumscription of the tribe *Manilkarinae*, and with a monophyletic *Manilkara*.

The seven species included in *Manilkara* in the *Sapotaceae* volume of the *Flore de Madagascar et des Comores* (Aubréville, 1974) were all described as recently as 1971

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(Aubréville, 1971). Despite increased collecting in this region, few collections of *Manilkara* have been made since then and this group of species remains little known.

TAXONOMIC REVISION

Manilkara Adans., *Fam. Pl.* 2: 166 (1763), nom. cons.; Dubard, *Ann. Inst. Bot.-Géol. Colon. Marseille*, sér. 3, 3: 1–62 (1915); Hemsley, *Fl. Trop. E. Africa*, Sapotaceae 62–73 (1968); Aubréville, *Adansonia*, n.s., 11(2): 251–300, 267–295 (1971). – Type: *Manilkara kauki* (L.) Dubard (typ. cons.). For a full synonymy and catalogue of other important publications see Pennington (1991) and Govaerts *et al.* (2001).

Trees, rarely shrubs; white latex present. *Shoot apex* often covered with a shiny exudate. *Stipules* absent or present in the apical portion of stems. *Leaves* crowded at stem apex, spirally arranged or whorled; appressed puberulent beneath giving leaves a golden or silvery sheen, rarely tomentulose. *Venation* brochidodromous with a marginal vein, sometimes percurrent, frequently obscure. *Secondaries* straight and parallel, intersecondary venation often present. *Tertiary venation* reticulate. *Infloriscences* axillary or in the axils of leaf scars. *Flowers* fasciculate, bisexual. *Calyx* of two whorls of 3, united at the base. *Corolla* glabrous; tube much shorter than the lobes; lobes 6, divided to the base into three segments; median segment remaining erect at anthesis, clawed, boat-shaped, commonly clasping the style; lateral segments equal, reflexed. *Stamens* 6, in a single whorl inserted at the apex of the corolla tube and opposite the corolla lobes; filaments free; anthers extrorse, glabrous. *Staminodes* 6, glabrous, alternating with the stamens, narrow, truncate or large and petaloid, the apex bifid to deeply lacinate. *Ovary* 6–10-locular, appressed puberulent. *Style* glabrous. *Fruit* 1–2-seeded, subglobose to ellipsoid, appressed puberulent to glabrous, fleshy; seed elliptic to obovate, strongly laterally compressed, with a hard, usually dark brown testa, scar narrowly elongate to almost circular, basi-ventral.

Key to the Madagascan species of Manilkara

- 1a. Flowers 1 cm long; pedicels 12–16 mm; anthers 3 mm long; leaves coriaceous _____ **2. *M. capuronii***
 1b. Flowers 5–8 mm long; pedicels up to 10 mm long; anthers 1–1.75 mm long; leaves subcoriaceous _____ 4
 2a. Short shoots present at the apex of stems, commonly possessing numerous leaf scars; leaves never longer than 5.5 cm _____ **4. *M. sahafarensis***
 2b. Short shoots absent; leaves 2.5–25 cm, leaves exceeding 5.5 cm always present on a single specimen _____ 3
 3a. Leaves densely ferruginous tomentose, glabrescent or greying with age; secondary veins of variable length, branching up to 7 mm from the leaf margin; flowering pedicels 2–3 mm long _____ **3. *M. perrieri***

- 3b. Leaves appressed puberulent, never tomentose; secondary veins of more or less even length; flowering pedicels 3–10 mm long _____ 4
- 4a. Leaves 2.5–7.5 cm long; lower leaf venation conspicuous, marginal vein percurrent; tertiary venation pronounced, loose, areolate, extending beyond the marginal vein _____ **5. *M. suarezensis***
- 4b. Leaves 7–25 cm long; lower leaf venation obscure or faintly raised, marginal vein not percurrent; tertiary venation obscure or fine, small, reticulate, not extending beyond the marginal vein _____ **1. *M. boivinii***

1. *Manilkara boivinii* Aubrév., *Adansonia*, n.s., 11: 274 (1971). – Type: Madagascar, Ste. Marie de Madagascar [16°53'S (± 10'), 49°54'E (± 6')], iii 1846 (st), *L.H. Boivin* 1823 (holo P!). **Fig. 1, Map 1.**

Manilkara tampoloensis Aubrév., *Adansonia*, n.s., 11: 274 (1971). – Type: Madagascar, Toamasina, Fénériver-Est, Tampolo, [17°22'S, 49°25'E], 10 iv 1954 (fl), *Service Forestier* 10050 (holo P!; iso K!, P (2 sheets)!, TEF!).

Tree up to 20 m tall; young branches brown to black, densely puberulent to scurfy or glabrous, ridged, minutely to conspicuously lenticellate, turning grey to black, fissured and glabrous with age; older branches dark brown to greyish, more or less smooth to very rough and rugose, cracked and fissured, often with prominent leaf scars; short shoots absent. *Stipules* absent or quickly caducous, c.2 mm long, ligulate, ferruginous tomentose. *Leaves* alternate or crowded at the stem apex, 7–25 × 2–11.5 cm, subcoriaceous, elliptic to oblong or narrowly oblanceolate, apex shortly acuminate or mucronate to rounded, frequently retuse, base acute to briefly attenuate; leaves glabrous above, densely appressed ferruginous or less frequently grey puberulent beneath, but appearing glabrous, commonly giving leaves a ferruginous or greyish sheen, margin undulate, sometimes minutely recurved; midrib canaliculate above; secondary venation c.10–16(–27) pairs, inconspicuous or faintly impressed above, obscure to very finely raised beneath, brochidodromous, marginal veins regular or irregular, tertiary venation obscure, reticulate, sometimes extending beyond the marginal vein; petiole 0.6–2 cm long, ratio to lamina 1:5–13.5, subterete, with a short adaxial channel towards the base of the lamina, glabrous to ferruginous puberulent. *Flowers* 1–5 per fascicle, 6–7 mm long; pedicels 3–8(–10 in fruit) mm long, shorter than mature petioles, densely appressed light ferruginous or beige puberulent to tomentulose. *Calyx* open, not cup-shaped, not swollen at the base; sepals 4–5 mm long, fused at the base, recurving at anthesis, acute, narrow ovate to oblong. *Corolla* 4.5–5.5 mm long, tube c.1 mm long; median segment 3–4 mm long, boat-shaped, clawed, apex round, remaining erect or semi-erect at anthesis; lateral segments 3.5–4 mm long, strongly reflexed, lanceolate. *Stamens* 6, glabrous; filaments 2–3 mm long; anthers 1.25–1.5 mm long. *Staminodes* 6, glabrous, 1.5–3 mm long, half the length or equalling the stamens, short and truncate to oblong or ovate, apex simply bifid to bifid-laciniate, erect or curved at anthesis. *Ovary* 6–10-locular,

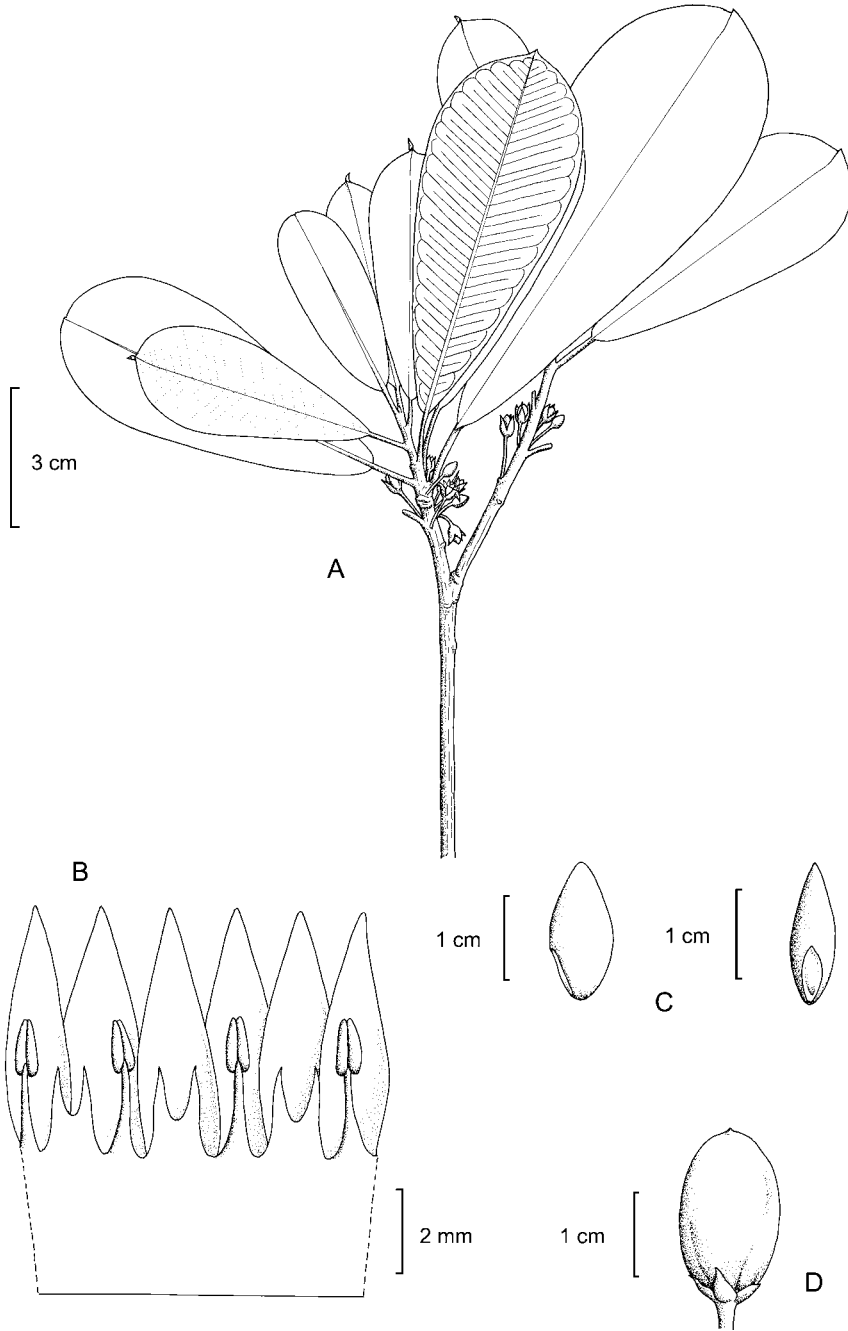
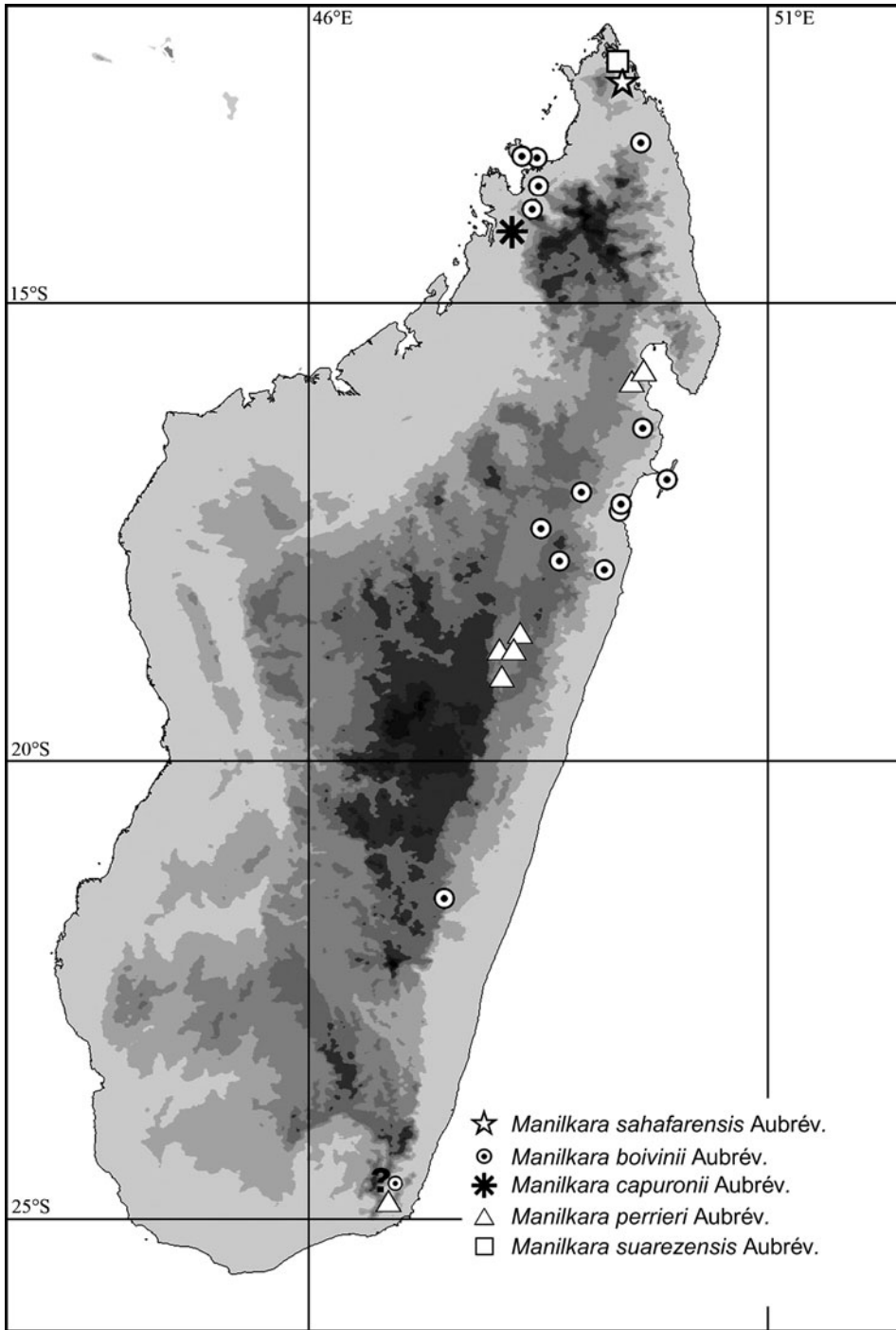


FIG. 1. *Manilkara boivinii* Aubrév. A, habit; B corolla showing stamens and staminodes; C, seed; D, fruit. From *Gautier* 3274. Drawn by Anna Dorward.



MAP 1. Distribution map of Madagascan *Manilkara*. Background grey scale reflects altitude.

appressed puberulent; style 4.5–5 mm long after anthesis, glabrous. *Mature fruit* 1.8–2.5 cm long, ellipsoid to subglobose, smooth, appressed puberulent to glabrous, apex obtuse to round, not bearing a persistent style, base obtuse to round. *Seed* 1, 1.5–2.5 cm long, laterally compressed, obliquely elliptic, apex obtuse to round, base obliquely acute, testa smooth and shiny, beige to dark brown, sometimes weakly veined; seed scar 7×2.5 mm, elliptic.

Diagnostic characters. This species has medium to large elliptic to oblanceolate leaves. The lower leaf surface appears either glabrous to the naked eye or possesses a golden or silvery sheen. The staminodes vary from being short, broad and lacinate at the apex to longer and narrower with a clearly bifid apex.

Field characters. Evergreen tree to 20 m tall; abundant white latex present. Bark greenish or whitish, 1 cm thick, rugose with cracks or fissures. Leaves grouped at the end of stems. Sepals greenish, indumentum ferruginous. Flowers light yellow, scented. Young fruits ovoid, green.

Distribution. Provinces of Antsiranana (regions of Sambirano and Daraina), Toamasina, Fianarantsoa and possibly Toliara (presumably continuously distributed along the Eastern escarpment south to Manakara, possibly to Tolanaro-Fort Dauphin).

Habitat. Commonly found in lowland to montane evergreen (occasionally semi-deciduous) forest on slopes between sea level and 900 m altitude, sometimes growing on sandy or yellow iron-rich soils, or found amid rocky boulders.

Local names and uses. Nanto helatrazina or helatrozona, nanto, nato. Used in construction.

Proposed IUCN conservation assessment. Vulnerable (VU D1+2). Found in highly vulnerable mid-altitude eastern and Sambirano moist evergreen forest in small fragmented populations.

Additional specimens examined. MADAGASCAR. **Antsiranana:** Nosy Be, Reserve Integrale de Lokobe, 24 iii 1994 (fl), *Antilahimena* 65 (G, MO, WAG); Ambobaka, 28 ii 2005 (fl), *Buerki* 32 (G, MO (n.v.)), NEU, TEF (n.v.); Manongarivo, Ambahatra, cours supérieur, crête entre les deux bras de l'Ambahatra, 5 iii 1999 (fl), *Gautier* 3477 (G, K, MO, P, TEF, WAG); Vohémar, Daraina, Ankijabe, forêt de Binara, camp I, 8 xi 2001 (st), *Gautier* 4112 (E, G); Nossi-Be, RN 6 [Lokobe], 28 ix 1951 (fl), *Réserves naturelles* 2996 (TEF); Col du Bekaka, à l'Est d'Ambanja, 19 iii 1954 (fl bud), *Service Forestier* 9266 (P, TEF); Massif du Bekaka, à l'Est d'Ambanja, 27 x 1954 (fr; old fl), *Service Forestier* 11377 (P, TEF); Nossi-Be, Lokobe, 2 xi 1954 (fr), *Service Forestier* 11413 (TEF); Nossi-Be, Lokobe, 13–15 iii 1964 (fl), *Service Forestier* 23449 (G, K, P, TEF). **Fianarantsoa:** Environs de Siranana, Anosimparihy, Mananjary, 12 i 1952 (fl), *Service Forestier* 5617 (P, TEF). **Mahajanga:** s.d. (y fr), *Service Forestier* 36001 (TEF). **Toamasina:** Anjiro, Ambodiriana, Tamatave, 9 xi 1957 (fr), *Service Forestier* 9155 (P); Tanambao Tampolo, Ampasina, Fenerive, 11 i 1955 (fr), *Service Forestier* 12537 (G, P); Tampolo, Ampasina, Fenerive, 14 xii 1958 (fr), *Service Forestier* 19227 (BR, K, P, TEF); Fenerive, Tanamarina, 3 x 1963 (st), *Service Forestier* 21421 (TEF); Tanambao-Tampolo, Ampasina, Fenerive, 29 vii 1955 (st), *Service Forestier* 297-R-107 (TEF); Befody-Alaotra, 1 x 1952 (st),

Service Forestier 506-R-56 (TEF). **Locality not traced:** Varaina, à l'Est de Sahamalaza, Manakambanihy-Est, 12 x 1978 (fr), *Service Forestier* 29416 (TEF); Varary, Forêt relictuelle de Varary, au SW du village, 5 xi 1990 (st), *Raharimalala* 2536 (P).

Specimens identified with doubt. MADAGASCAR. **Antsiranana:** Manongarivo, Manongarivo, Bekolosy, chemin d'Ambalafary au vallon supérieur de la Bekolosy, 15 xi 1994 (st), *Gautier* 2550 (G); Bekolosy, chemin d'Ambalafary au campement France, 10 ix 1997 (y fr), *Gautier* 3274 (G, K (n.v.), MO (n.v.), P (n.v.), TAN (n.v.), TEF (n.v.), WAG (n.v.)); Manongarivo, Besinkara, en contrebas d'Ambalafary, sur le chemin d'Anabotoaka, 10 ix 1997 (st), *Gautier* 3278 (G). **Toliara:** Environs Nord du col de Maningotry (Fort-Dauphin), 12 i 1963 (st), *Service Forestier* 22352 bis (TEF).

Manilkara tampoloensis has been placed in synonymy with this species. The main difference between the species was the presence of an appressed reddish or silver indumentum on the lower leaf surface of specimens placed in *Manilkara boivinii*. This character is not always consistent and similarities in leaf shape and size range make it difficult to tell the species apart. The difference in lower leaf indumentum may reflect different forms of the same species.

The specimens *Gautier et al.* 2550, 3274 and 3278 (G) from Manongarivo all possess large leaves with an appressed ferruginous indumentum on the lower side. Although similar to other specimens of *Manilkara boivinii*, these fall outside the range of this species and have been left determined as *M. cf. boivinii*. A sterile specimen from Toliara province, *Service Forestier* 22352 bis (TEF), is also putatively attributed to this species.

2. *Manilkara capuronii* Aubrév., *Adansonia*, n.s., 11: 269 (1971). – Type: Madagascar, Est du village de Maromandia (Ambanja), [14°13'S (± 1'), 48°15'E (± 2')], 9 viii 1952 (fl), *Service Forestier* 5583 (holo P!; iso P!, TEF!).

Map 1.

Tree up to 10 m tall; young branches unknown; older branches brown, smooth or rough with prominent inflorescence scars; short shoots absent; lenticels numerous, minute, inconspicuous, not apparent in older stems. *Stipules* absent. *Leaves* 21–28.5 × 5–10 cm, coriaceous, narrowly obovate to oblong, apex shortly attenuate, sometimes minutely retuse at tip, base acute; grey appressed puberulent beneath, forming a pellicle, glabrous above, margin undulate, weakly recurved; midrib canaliculate above; secondary venation 15–20 pairs, finely impressed above, raised and conspicuous beneath, evenly or unevenly brochidodromous, sometimes percurrent, intersecondaries well developed or absent, tertiary venation obscure; petiole c.1.5 cm long, ratio to lamina 1:6–6.5, semiterete with a small adaxial channel towards the base of the lamina, glabrous. *Flowers* 5–7 per fascicle, densely crowded, c.1 cm long; pedicels 12–16 mm long, shorter than mature petioles, indumentum light beige, densely appressed puberulent. *Calyx* cup-shaped, swollen at the base leading to a marked distinction between the pedicel and the base of the calyx; sepals 5–5.5 mm long, fused at the base, the apical half recurving at anthesis. *Corolla* c.9 mm long, tube c.2 mm long; median segment 6 mm long, boat-shaped, clasping

the anther, short-clawed, apex round, remaining erect at anthesis; lateral segments 4–5 mm long, strongly reflexed, lanceolate. *Stamens* 6, glabrous; filaments 3 mm long; anthers 3 mm long. *Staminodes* 6, glabrous, 3–4 mm long, almost as long as the stamens, petaloid, ovate to oblong, apex bifid or bifid-laciniate, erect at anthesis. *Ovary* 7-locular, appressed puberulent; style 5–10 mm long after anthesis, glabrous. *Fruit* unknown.

Diagnostic characters. This species can be identified by its large leathery leaves, large flowers (1 cm long), its numerous closely positioned flower fascicles, and by the almost circular seed scar, quite different to the more narrowly elliptic scar so typical of *Manilkara*.

Field characters. Tree to 20 m tall and 60 cm diameter at breast height.

Distribution. Endemic to the southwest of Ambanja.

Habitat. Not given on specimen, but most likely to be found in transitional semi-deciduous forest at low altitude.

Local names and uses. None recorded.

Proposed IUCN conservation assessment. Endangered (EN B1ab(iii)). Restricted distribution of less than 5000 km². Number of individuals probably low. Known from only a single specimen; uncollected for 50 years.

Specimens examined. Known only from the type.

Two immature specimens from the Massif du Bekaka, *Service Forestier* 9266 (P, TEF) and *Service Forestier* 11377 (P, TEF), are vegetatively very similar to *Manilkara capuronii* in their general robustness and coriaceous leaves, but differ significantly by the fewer and laxer inflorescences and by the presence of a brownish reddish indumentum on the calyx and pedicels (*M. capuronii* has a light beige indumentum on these parts). These specimens were originally placed by Aubréville (1971) in *Manilkara capuronii*. A recent mature collection from the same area, *Bürki* 32 (G, MO (n.v.), NEU, TEF (n.v.)) sharing the same vegetative characteristics (i.e. broadly ovate leaves with lamina slightly raised between secondary nerves) has the typical flowers of *Manilkara boivinii* and allows us to confidently assign these three collections to this latter species.

3. *Manilkara perrieri* Aubrév., Adansonia, n.s., 11: 271 (1971). – Type: Madagascar, Centre, Marovoay, lisière et des alluvions lacustres du Mangoro, [18°44'S, 48°14'E], 800 m, ix 1912 (fl), *Perrier de la Bâthie* 5289 (holo P!; iso P!). **Fig. 2, Map 1.**

Tree up to 30 m tall, rarely a shrub; young branches red-brown, appressed ferruginous puberulent, glabrescent, conspicuously lenticellate; older branches grey or brown, rough, lenticels obscure or still prominent; short shoots absent; lenticels

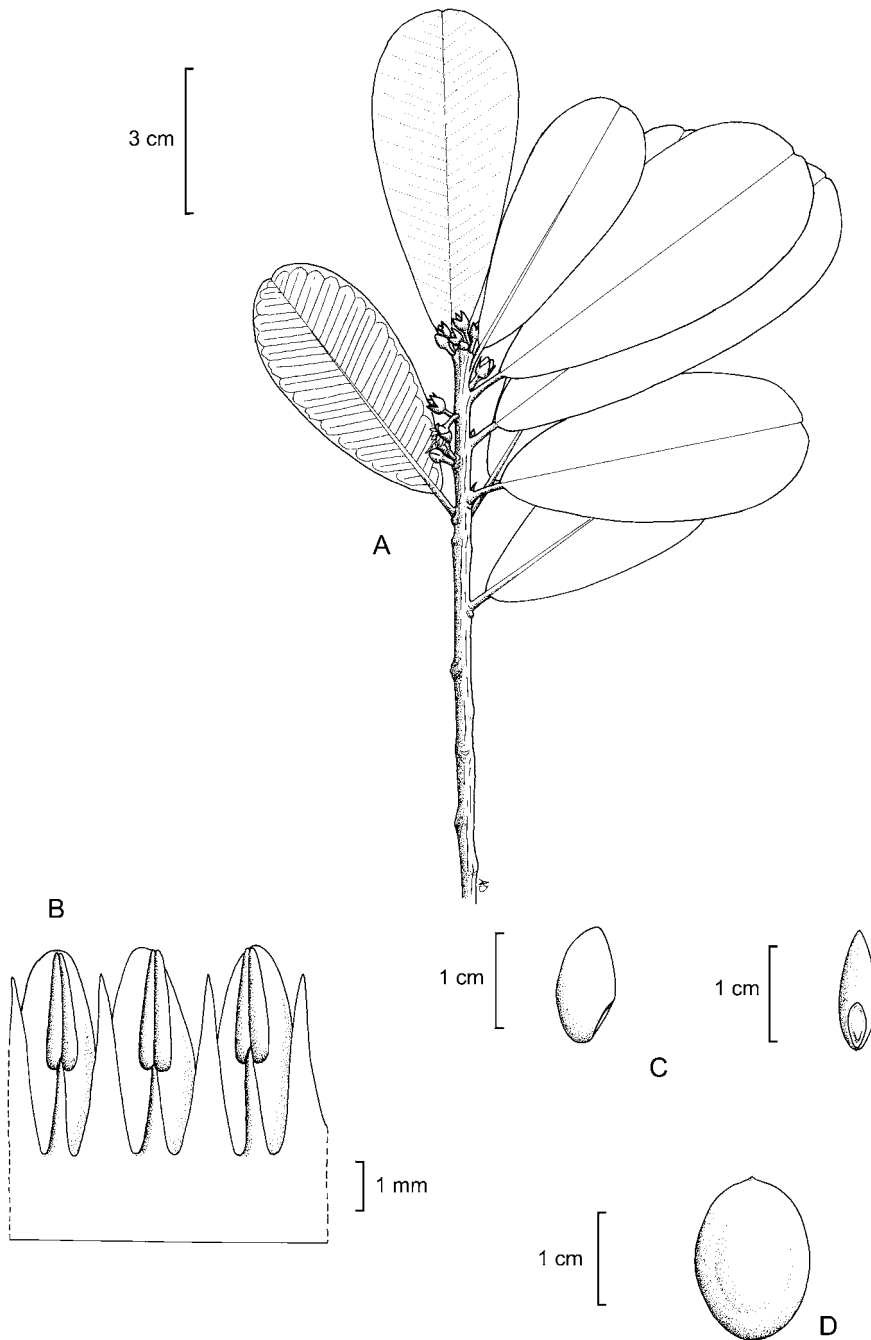


FIG. 2. *Manilkara perrieri* Aubrév. A, habit; B, corolla showing stamens and staminodes; C, seed; D, fruit. From *Perrier de la Bâthie* 5289. Drawn by Anna Dorward.

numerous and very prominent on young stems, fading or still conspicuous in older stems. *Stipules* absent. *Leaves* concentrated at the end of stems, 5.5–10.5 × 2–4.5 cm, coriaceous to subcoriaceous, narrowly obovate to obovate, sometimes oblanceolate, apex obtuse to rounded, retuse, base acute, sometimes attenuate; younger leaves densely ferruginous tomentose beneath, glabrescent, leaving a thick silvery-grey pellicle, glabrous above, margin undulate, weakly to strongly recurved; midrib canaliculate above; secondary venation 10–16 pairs, fine and weakly impressed above, raised and conspicuous beneath, red-brown, unevenly brochidodromous, secondary veins of variable length (sometimes branching up to 7 mm from the leaf margin), percurrent, tertiary venation reticulate and continuing beyond the marginal vein, but often obscure; petiole 0.3–0.9(–1.4) cm long, ratio to lamina 1:8.7–12.4, semiterete with a broad shallow adaxial channel, grey appressed puberulent to glabrous. *Flowers* solitary or in pairs, 5–8 mm long; pedicels 2–3(–8) mm long, shorter than mature petioles, densely ferruginous tomentulose. *Calyx* cup-shaped, not swollen at the base; sepals 4–5 mm long, basal third fused, ovate, obtuse, recurving at anthesis. *Corolla* c.4 mm long, tube c.1 mm long; median segment 3–4 mm long, boat-shaped, clawed, apex acute, remaining erect or reflexing somewhat at anthesis; lateral segments 3–4 mm long, strongly reflexed, lanceolate. *Stamens* 6, glabrous; filaments 1 mm long; anthers 1–1.3 mm long. *Staminodes* 6, glabrous, 2–3.5 mm long, reaching half way up the anther to almost as long as the stamens, oblong to lanceolate, apex bifid (rarely simple, long attenuate) or bifid-laciniate, erect at anthesis. *Ovary* 8-locular, appressed puberulent; style 3–4 mm long after anthesis, glabrous. *Mature fruit* 1.7–1.8 cm long, obovoid, smooth, densely ferruginous tomentulose, glabrescent, apex rounded, not bearing a persistent style, base rounded; seeds 1–2, 1.3 cm long, obliquely elliptic, apex acute, base obliquely acute, testa smooth and shiny, dark brown, weakly veined; seed scar 5 × 2 mm, narrow obovate.

Diagnostic characters. This characteristic species is recognisable by the dense ferruginous tomentum covering the lower surface of the leaves. When this indumentum is shed the leaf underside becomes grey but retains a conspicuous venation. The venation in this species is also strongly percurrent, the marginal loops often bridged by a single fine vein. This percurrentness is compounded by secondary veins commonly branching some distance from the margin, creating an overall veiny, uneven appearance.

Field characters. Evergreen tree to 30 m tall and 1 m or more in diameter, less commonly a shrub up to 5 m. Bark smooth to fissured; latex present.

Distribution. Provinces of Toamasina, Fianarantsoa and Toliara (along the Eastern escarpment, presumably evenly distributed from Baie d'Antongil south to Tolanaro-Fort Dauphin).

Habitat. Growing in lowland to montane evergreen or semi-deciduous forest between 100 and 1000 m altitude. Apparently absent from coastal forests.

Local names and uses. Natoboronkahaka, natovoraka, natoboka. Used in construction.

Proposed IUCN conservation assessment. Vulnerable (VU D1+2). Known from only five specimens in three localities at very close proximity; uncollected for 40 years.

Additional specimens examined. MADAGASCAR. **Antsiranana:** Environs de la baie d'Antongil, bassin de la Fanahehena, massif de l'Androrona, ii 1954 (fl), *Service Forestier* 8983 (P, TEF); Environs de la baie d'Antongil, restes de forêt à l'Ouest de Tenina, iv 1954 (fl), *Service Forestier* 9180 (P, TEF). **Toamasina:** Moramanga, Marovoay, Ambohidray, Analabe, 18 iv 1967 (y fr), *Service Forestier* 26597 (MO, P, TEF); Moramanga, Marovoay, Nangaranana, ii 1970 (st), *Service Forestier* 26946 (TEF); Berges du Mangoro (r. droite), au Nord d'Ambodimanga, 21 i 1968 (fl), *Service Forestier* 28132 (BR, G, K, P, TEF). **Toliara:** Andohahela, Parcelle 1, Isaka Ivondro, 16–24 iii 1993 (fl), *Randriamampionona* 248 (G, MO, P).

Specimen identified with doubt. **Toliara:** Rives de la Volobe, près de Volobe, Mahatalaky, Ft. Dauphin, 8 iv 1954 (fl), *Service Forestier* 9740 (TEF).

Aubréville (1971) remarked that both *Manilkara tampoloensis* (in this revision considered a synonym of *M. boivinii*) and *M. boivinii* were very similar to *M. perrieri* and that in the case of *M. boivinii* could be identical. The ferruginous tomentulose indumentum found on the lower leaf surfaces in *Manilkara perrieri* is very distinctive and there can be little confusion between these species.

4. *Manilkara sahafarensis* Aubrév., *Adansonia*, n.s., 11: 273 (1971). – Type: Madagascar, forêt de Sahafary, bassin de la Saharenena, plateau d'Analamby, [12°34'S, 49°26'E], 1 v 1966 (fr), *Service Forestier* 24698 (holo P!; iso P!, TEF!).

Map 1.

Tree up to 10 m tall; young branches brown, glabrescent, minutely lenticellate; older branches greyish, smooth, fissured; short shoots present but not swollen, commonly possessing numerous leaf scars; lenticels minute, inconspicuous, fading in older stems. *Stipules* absent. *Leaves* concentrated at the tips of short shoots and stems, 1.2–5.5 × 1–3 cm, subcoriaceous, obovate to narrowly obovate, apex round to obtuse, retuse, base acute; light ferruginous to grey appressed puberulent beneath, appearing glabrous or with a velvety sheen beneath, glabrous above, margin undulate, not recurved; midrib canaliculate above; secondary venation 8–9 pairs, finely impressed above, very fine to obscure beneath, evenly brochidodromous, tertiary venation obscure; petiole 3–8 mm long, ratio to lamina 1:6.5–9.5, semiterete with an adaxial channel, sparsely puberulent. *Flowers* solitary or in pairs, 5.5–6.5 mm long; pedicels 1–3(–5 in fruit) mm long, equal or shorter than mature petioles, densely appressed ferruginous puberulent. *Calyx* open, not cup-shaped or swollen at the base; sepals 3–3.5 mm long, fused at the base, ovate to narrow ovate, apex acute. *Corolla* c.5 mm long, tube c.1 mm long; median segment 3.5–4 mm long, boat-shaped, clawed, apex round, remaining erect at anthesis; lateral segments c.3 mm long, strongly reflexed, lanceolate. *Stamens* 6, glabrous; filaments 2 mm long; anthers 1.5–1.75 mm long. *Staminodes* 6, glabrous, 2 mm long, reaching half way up

the anther, ovate, apex lacinate, erect at anthesis. *Ovary* 6-locular, appressed puberulent; style c.4.5 mm long after anthesis, glabrous. *Immature fruit* 0.9 cm long, ellipsoid, smooth, sparsely puberulent, apex round, bearing a persistent style, base round. *Seed* unknown.

Diagnostic characters. This small-leaved *Manilkara* (leaves up to 5.5 cm) has slender shoots arising at the apex of the branches. The leaves are concentrated in whorls at the apices of these shoots. Below the leaves, the stems have a short rough region resulting from the many leaf and inflorescence scars.

Field characters. Tree to 10 m tall. Bark finely fissured.

Distribution. Endemic to the Sahafary Forest in northern Antsiranana province.

Habitat. Growing in dry deciduous forest on sand at 200 m altitude.

Local names and uses. None recorded.

Proposed IUCN conservation assessment. Endangered (EN B1ab(iii)). Restricted to the relictual forest of Sahafary. Extent of occurrence much less than 5000 km², and known from only two localities within the same forest fragment. Known from two specimens; uncollected for 45 years.

Additional specimen examined. MADAGASCAR. **Antsiranana:** Forêt de Sahafary (sur sables), bassin de la Saharaina, 20 ii 1962 (fl), *Service Forestier* 20965 (P, TEF).

The leaves of this species closely resemble those of *Manilkara boivinii* in colour and indumentum, leading to suggestions by Aubréville (1971) that *M. sahafarensis* is but a small-leaved form of *M. boivinii*. There is, however, an important main distinction between the species: the presence of fertile short shoots at the apex of the main branch axis in *Manilkara sahafarensis*. This character is rare in the genus. In the African region only one other species, *Manilkara mochisia* from eastern and southern Africa, displays short scarred branches crowned by a whorl of leaves. In *Manilkara mochisia* these short shoots are well defined by their pronounced swelling, a feature absent from *M. sahafarensis*.

5. *Manilkara suarezensis* Aubrév., *Adansonia*, n.s., 11: 274 (1971). – Type: Madagascar, Antsiranana, Montagne des Français, à l'Est de Diego Suarez [12.22°S, 49.21°E], 15 x 1954 (fr), *Service Forestier* 11310 (holo P!; iso K!, P!, TEF!). **Fig. 3, Map 1.**

Tree up to 20 m tall; young branches brown to grey, glabrous, usually rough, inconspicuously lenticellate; older branches dark brown to greyish, rough with numerous prominent leaf scars, fissured; short shoots absent; lenticels present on young stems, inconspicuous. *Stipules* absent. *Leaves* concentrated at the very tips of the apical branches, 2.5–7.5 × 1–3 cm, subcoriaceous, narrowly obovate, sometimes oblong-elliptic, apex rounded, retuse, base acute; leaves glabrous above, densely

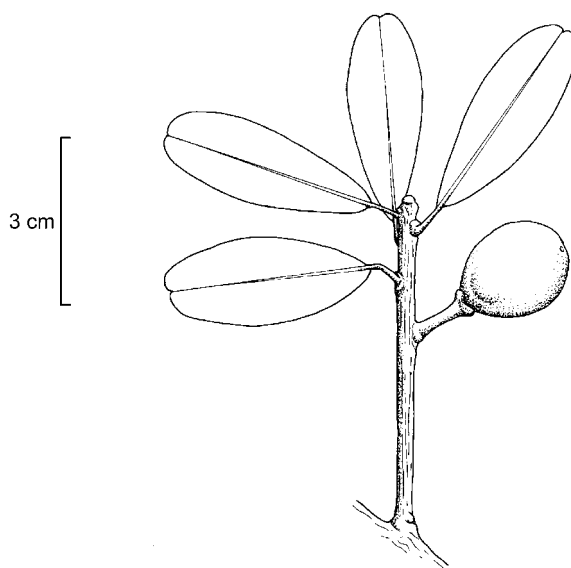


FIG. 3. *Manilkara suarezensis* Aubrév. Fruiting shoot. From *Service Forestier* 11310. Drawn by Anna Dorward.

appressed puberulent beneath, forming a ferruginous to greyish pellicle, usually appearing glabrous, margin not or weakly undulate, weakly to strongly recurved; midrib canaliculate above; secondary venation 12–13 pairs, obscure or very finely raised above, very finely raised beneath, marginal vein commonly irregular, percurrent, tertiary venation pronounced, reticulate, extending beyond the marginal vein; petiole 0.5–1.3 cm long, ratio to lamina 1:5–6, more or less terete with a very narrow adaxial channel, sparsely puberulent, glabrescent. *Flowers* unknown. *Mature fruit* 1.5–2 cm long, on a 8 mm pedicel, globose to ellipsoid, smooth, glabrous, apex round, with or without a persistent style, base round; seed (description from Aubréville, 1971: 271) 1, 1.3 × 0.9 cm long; scar small.

Diagnostic characters. The leaf venation in this species is conspicuous, irregularly brochidodromous, with the secondary veins sometimes branching some distance from the margin. The tertiary venation is loose and commonly extends beyond the marginal vein. Leaves are also concentrated at the very tip of the branches, subtended by the infructescence.

Field characters. Tree to 20 m tall, 60 cm in diameter; bark fissured; leaves alternate; fruits green, hairy.

Distribution. Endemic to the Montagne des Français in northern Antsiranana.

Habitat. Dry deciduous forest at lower altitude.

Local names and uses. None recorded.

Proposed IUCN conservation assessment. Endangered (EN B1ab(iii)). Restricted distribution of less than 5000 km². Number of individuals probably low. Known from only a single specimen; uncollected for 50 years.

Specimens examined. Known only from the type.

This species falls within the morphological range of *Manilkara boivinii*, but the leaves are overall smaller than in *M. boivinii*, and particularly crowded at the stem apices. The inflorescences occur almost exclusively beneath what appear to be flushes of newer leaves, in the axils of old leaf scars.

A flowering specimen from Toliara province, *Service Forestier* 9740, which was attributed by Aubréville (1974) to *Manilkara suarezensis* is here identified as *M. cf. perrieri*. As a consequence, the flowers of *Manilkara suarezensis* are unknown.

EXCLUDED SPECIES

Manilkara sohihy Aubrév., *Adansonia*, n.s., 11: 270 (1971). – Type: Madagascar, Dist. Fort Dauphin, Canton Mahatalaky, bord rivièrè Ambiatoka, forêt Andongolo [24°48'S, 47°06'E], (flower), *Service Forestier* 10575 (holo P!). = *Labramia boivinii* (Pierre) Aubrév.

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