

Three Critically Endangered new species of *Capurodendron* (Sapotaceae) from Madagascar

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Abstract

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Three new species in the Malagasy endemic genus *Capurodendron* Aubrév. (Sapotaceae) are described and illustrated. Their preliminary conservation status according to the criteria of IUCN is provided. *Capurodendron schatzii* L. Gaut. & Naciri is a large-leaved evergreen tree from the humid forest east of the Masoala peninsula. The new species is compared with the other large-leaved species of the genus. *Capurodendron sabafariense* L. Gaut. & Naciri is a deciduous small-leaved tree of medium size from dry forests on sandy soils in the extreme North. It shares with *Capurodendron costatum* Aubrév. a 5-ridged fruit, but differs by its much smaller leaves. As its name implies, *Capurodendron nanophyllum* L. Gaut. & Naciri has the smallest leaves encountered in the genus. It is a shrub found near Tsihombe in the extreme south, the driest part of the island, within the range of the variable *Capurodendron androyense* Aubrév. The differences between the two taxa are highlighted. All three species are preliminary assessed as “Critically Endangered”.

Résumé

GAUTIER, L. & Y. NACIRI (2018). Trois nouvelles espèces de *Capurodendron* (Sapotaceae) de Madagascar en danger critique d'extinction. *Candollea* 73: 121-129. En anglais, résumés anglais et français. DOI: <http://dx.doi.org/10.15553/c2018v731a13>

Trois nouvelles espèces du genre endémique de Madagascar *Capurodendron* Aubrév. (Sapotaceae) sont décrites et illustrées. Leur statut préliminaire de conservation est donné selon les critères UICN. *Capurodendron schatzii* L. Gaut. & Naciri est un arbre à grandes feuilles persistantes des forêts humides de l'est de la péninsule de Masoala. Cette nouvelle espèce est comparée aux autres taxons à grandes feuilles du genre. *Capurodendron sabafariense* L. Gaut. & Naciri est un arbre décidu à petites feuilles, et de taille moyenne, des forêts sèches sur sols sableux de l'extrême nord de l'île. Il partage avec *Capurodendron costatum* Aubrév. des fruits à 5 côtes, mais diffère par des feuilles bien plus petites. Comme son nom l'indique, *Capurodendron nanophyllum* L. Gaut. & Naciri présente les plus petites feuilles rencontrées dans le genre. C'est un arbuste poussant près de Tsihombe dans l'extrême sud, la partie la plus sèche de l'île, dans la zone de distribution du *Capurodendron androyense* Aubrév., espèce par ailleurs très variable. Les différences entre les deux taxons sont mises en évidence. Les trois espèces sont provisoirement assignées comme étant «en danger critique» d'extinction.

Keywords

SAPOTACEAE – *Capurodendron* – Madagascar – New Species – Taxonomy

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Introduction

In the corresponding treatment of the *Flore de Madagascar et des Comores* (AUBRÉVILLE, 1974), *Sapotaceae* are represented by 11 genera and 84 species. Following the large prospection efforts since its publication, numerous new taxa are suspected, some of them having been already described. This is the case of a new genus (GAUTIER et al., 2013) as well as six species: three *Mimusops* L. (FRIEDMAN, 1980; RANDRIANAIVO, 2013), one *Bemangidia* L. Gaut. (GAUTIER et al., 2013) and two *Donella* Pierre ex Baill. (SCHATZ & GAUTIER, 1996; MACKINDER et al., 2016).

The *Sapotaceae* in Madagascar belong to the two main sub-families (following ANDERBERG & SWENSON, 2003; SWENSON & ANDERBERG, 2005): *Chrysophylloideae* (*Donella*, *Gambeya* Pierre), and *Sapotoideae*. In the *Sapotoideae* three tribes are represented: *Sapoteae* (*Faucherea* Lecomte, *Labourdonnaisia* Bojer, *Labramia* A. DC., *Manilkara* Adans., *Mimusops*), *Sideroxyleae* (*Sideroxylon* L.), and the recently described endemic *Tsebonae* (GAUTIER et al., 2013) (*Bemangidia*, *Capurodendron* Aubrév., *Tsebona* Capuron).

With 23 described species, *Capurodendron* Aubrév. is considered the third largest endemic genus in Madagascar (CALLMANDER et al., 2011). Morphologically, it has been qualified as “exceptionally stable in flower structure” across the 23 species described so far (AUBRÉVILLE, 1974). It has been shown to be monophyletic on the basis of the 10 species analysed so far, and to form a highly supported clade in the Malagasy endemic tribe *Tsebonae*, together with the two monotypic genera *Tsebona* and *Bemangidia* (GAUTIER et al., 2013), both restricted to the rainforests of the Eastern Phytogeographical Domain (sensu HUMBERT, 1955). With only one third of its species inhabiting the former biome, *Capurodendron* represents an example of a genus that has achieved exceptional adaptation to dryer and contrasted climates. The remaining two thirds of its species indeed inhabit the deciduous forests of the Western Phytogeographical Domain, even reaching the dry spiny thicket of the Southwestern Domain (AUBRÉVILLE, 1974). With this respect, *Capurodendron* would be one of those endemic Malagasy genera that have recently and rapidly radiated in the island (BUERKI et al., 2013).

While revising the herbarium material for a project on the phylogeny of the genus *Capurodendron*, several specimens could not be identified with confidence using the treatment of AUBRÉVILLE (1974). On closer examination, some of these specimens appeared embedded in species complexes that will be further investigated with a molecular approach. In turn, three clearly morphologically distinct species were spotted. These three species are described and illustrated in this contribution, and their preliminary conservation status according to the criteria of IUCN (2012) is provided. Calculations of extent of occurrence (EOO) and area of occupancy (AOO) have been conducted with Geocat (BACHMANN & MOAT, 2012).

Systematics

Capurodendron schatzii L. Gaut. & Naciri, **spec. nova** (Fig. 1, 2).

Holotypus: MADAGASCAR. **Prov. Antsiranana:** Reg. SAVA, Remnant forest c. 1.5 km W of Cap Est, 15°16'26"S 50°27'27"E, 30 m, 23.I.1999, fl., *Schatz et al.* 3786 (G [G00418686]!; iso-: MO [MO-2163813], P [P04570980] image seen, TAN, S!).

Capurodendron schatzii L. Gaut. & Naciri differs from *C. antongiliense* Aubrév. by its flat leaf blades (vs bullate), its 8–10 pairs of secondary veins merely prominent below (vs 12–16, strongly raised below), presence of intersecondaries, 6 mm long staminodes (vs 3 mm) and 3 mm long anthers (vs 2 mm).

Tree, 15–20 m tall, 45 cm DBH, with white latex; ultimate twigs 8 mm in diam., brown-villous and rugose, with numerous scars of fallen leaves and pedicels, with red slash. Leaves coriaceous and persistent, alternate, spirally arranged at the end of the shoots; petiole 25–30 × 2.2–2.8 mm, rusty pubescent; blade ovate to obovate, base cuneate, apex obtuse to rounded, 12–20 × 4.8–9.5 cm, upper side glossy dark green when fresh, drying brown-grey, glabrous except for the brownish-pubescent midrib; lower side lighter green when fresh, drying rusty brown, glabrous except for midrib and secondaries; primary vein prominent below, level above, rusty-brown pubescent; 8–10 pairs of brochidodromous secondaries, ascending with an angle of c. 70°, and arching, forking at ¾ of the distance to margin and anastomosing with previous and following secondaries; intersecondaries present; tertiary venation laxly reticulate. Flowers clustered below the leaves; flowering pedicels 12 × 1.2 mm, densely brown-villous. Sepals 5, quincuncial, broader than long, apex obtuse; the two outer ones 9 × 12 mm, convex, glabrous inside and densely brown-villous outside, the three inner ones 8 × 8 mm, slightly keeled, glabrous inside and densely brown-villous outside except for a glabrous 1 mm margin, ciliate on the edge. Corolla gamopetalous with 5 lobes, glabrous, tube 3.8 mm long, lobes lanceolate, 7.0 × 2.3 mm, contorted in bud, spreading at anthesis. Stamens 5, filaments 2.2 mm long, attached to the top of the corolla tube; anthers pair medifixed, extrorse to latrorse, 3.0 × 1.4 mm at the broadest, connective prolonged in a short 0.3 mm mucro. Staminodes 5, alternate with respect to petals and stamens, 6 × 1.5 mm, densely villous with golden trichomes, carnos, connivent and concealing the ovary. Ovary 5-lobed, 2.0 mm high × 3.5 mm broad, densely hirsute with brownish trichomes, with 5 ovules, style 10–11 mm long, 0.6 mm diameter, glabrous, slightly 5-fluted, stigma faintly 5-lobed. Fruiting pedicels 20–25 × 1.8 mm, densely brown-villous, with a persistent calyx. Fruit at immature stage ovoid, 20–25 × 10–13 mm, mostly glabrous but with a pubescent apex with a 1.5–2 mm persistent style base; apparently only one seed develops.

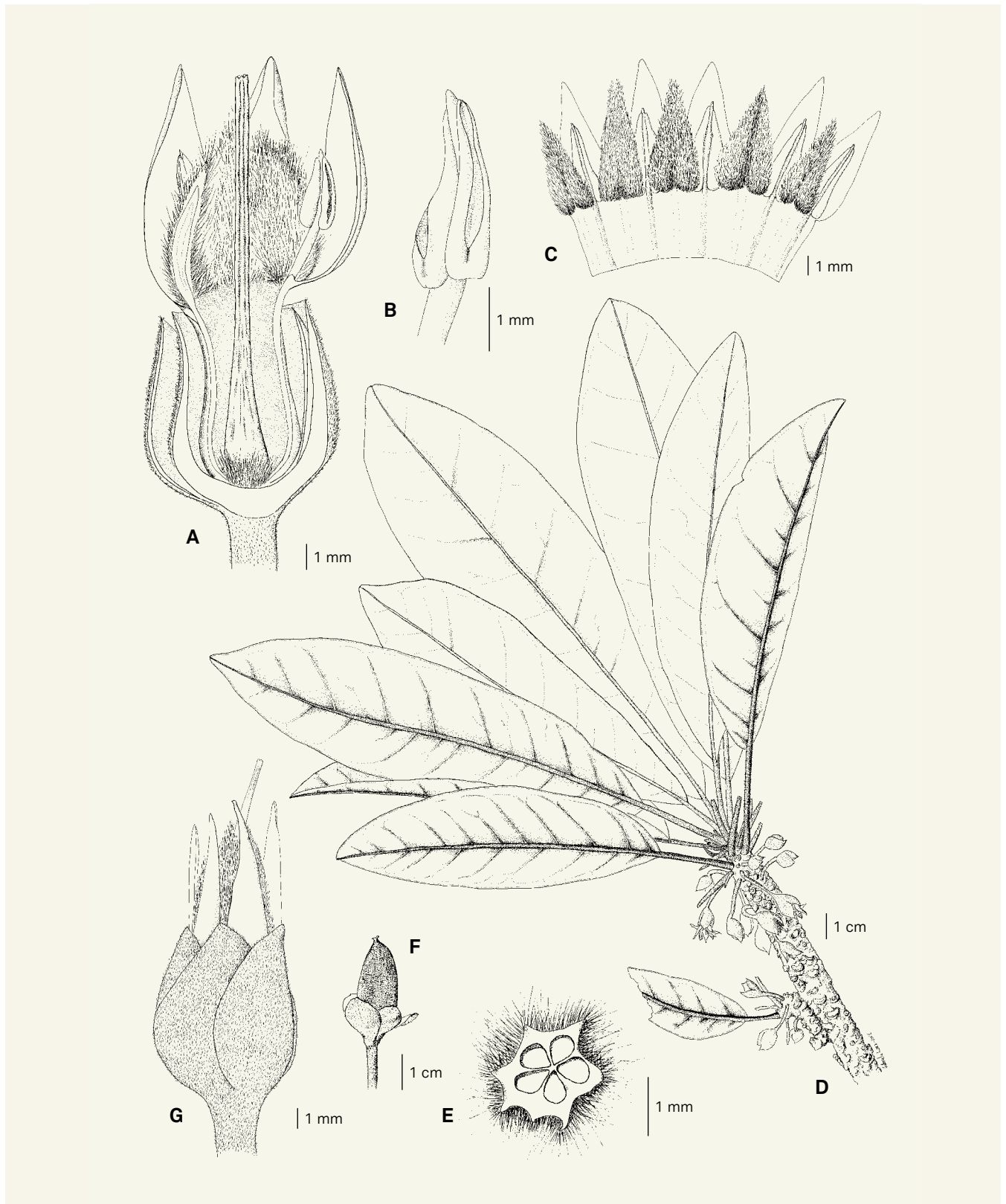


Fig. 1. - *Capurodendron schatzii* L. Gaut. & Naciri. **A.** Longitudinal section of flower; **B.** Stamen; **C.** Corolla opened seen from inside; **D.** Flowering branch; **E.** Transverse section of ovary; **F.** Young fruit; **G.** Flower. [Drawings: G. Loza]



Fig. 2. - Field photograph of the type collection of *Capurodendron schatzii* L. Gaut. & Naciri. [Photo: G.E. Schatz]

Etymology. – This species is dedicated to George Schatz from the Missouri Botanical Garden who collected the type specimen, in acknowledgement of his tremendous dedication to the knowledge of the flora of Madagascar.

Distribution, ecology and phenology. – *Capurodendron schatzii* is only known from two collections in the Eastern part of the Masoala Peninsula, region SAVA, Madagascar (Fig. 3), in the Eastern Phytogeographic Domain (HUMBERT, 1955). It is a medium to large tree growing in primary lowland moist evergreen forest and in the littoral forest. The flowering specimen was collected in January and the fruiting one in September.

Conservation status. – With only two locations known and an AOO of 8 km², one outside of the protected area network in a locality where the Lowland Evergreen Forest has been widely converted to agriculture, the other in the Masoala National Park in which forest has been widely damaged by hurricanes Hudah (2000) and Ihary (2002) and where we were not able to recover the species after the damage, *C. schatzii* is assigned a preliminary IUCN conservation status of “Critically Endangered” [CR B1ab(i,ii,iii)+2ab(i,ii,iii)].

Notes. – Within the large-leaved species of *Capurodendron* inhabiting the lowland rainforests of the Eastern Domain, *C. schatzii* is clearly vegetatively distinct from *C. antongiliense* by its leaf blades that are not bullate, by its less-numerous brochidodromous secondary veins, with intersecondaries, and its reticulate tertiary venation (vs distinctly oblique). It also differs by its larger flowers. Both species share however the same rufous pubescence on nerves, pedicels and calyx. Compared with *C. apollonioides* Aubrév., the new species has much thicker terminal twigs, and its leaf blades have less numerous secondaries and have intersecondaries. Its flowers are also much larger. *Capurodendron pseudoterminalia* Aubrév. is a species only known by its type collection. Although its leaves may look similar to the ones of the new species, they are not coriaceous, and its flowers are much smaller and borne on long and delicate pedicels.

Paratypes. – MADAGASCAR. Prov. Antsiranana: Reg. SAVA, presqu'île Masoala, Fiv. Antalaha, Fir. Ambohitralanana, aux env. de Sahafary, à 12 km env. à l'W d'Ambohitralanana et Cap-Est, 15°17'S 50°22'E, 10.IX.1997, fr., Randrianaivo & Bernard 123 (G, MO, P, TAN).

***Capurodendron sabafariense* L. Gaut. & Naciri, spec. nova** (Fig. 4, 5).

Holotypus: MADAGASCAR. Prov. Antsiranana: Reg. DIANA, Sadjoavato, forêt de Sahafary, 12°36'26"S 49°26'43"E, 280 m, 8.I.2007, fl. & fr., Ratovoson *et al.* 1217 (G [G00418681]!; iso-: CNARP, MO [MO-2108542], P [P04568840]!), TAN).

Capurodendron sabafariense L. Gaut. & Naciri shares a 5-ridged fruit with *C. costatum* Aubrév. from which it markedly differs by its much smaller leaves (6–25 × 2–7 vs 50 × 30 mm). Its venation pattern is similar to *C. ludiifolium* Aubrév. which also has much larger leaves. Its leaves are similar in size to that of *C. androyense* Aubrév. from which it differs by its winged fruits and its venation pattern.

Shrub 2 m to small tree 10 (–15) m tall, with white latex and creviced bark; ultimate twigs 1–1.5 mm in diam., greyish glabrous. **Leaves** coriaceous, caducous, spirally arranged at the tip of short 1.5–6.0 mm lateral branches (brachyblasts) with scars of fallen leaves and protuberances resulting from swollen stem below leaf insertion; blade 0.6–2.5 × 0.2–0.7 cm, obovate to narrowly obovate, brownish and clearly discolorous when dry with upper side darker, glabrous except for a few minute (0.2–0.3 mm) golden trichomes at base; apex obtuse to rounded, to retuse; base narrowly cuneate, indistinctly passing to a short petiole (max. 1.5 mm long, 0.8 mm in diam.); venation inconspicuous when fresh, especially on upper side, raised on both sides on dry specimens, reticulate, secondaries 3–4 on each side, almost indistinct from tertiaries, ascending at an angle of c. 20° from primary nerve, looping near margin.



Fig. 3. - Known distribution of (A-B) *Capurodendron sahafariense* L. Gaut. & Naciri (green), (A, C) *C. schatzii* L. Gaut. & Naciri (pink), and (A, D) *C. nanophyllum* L. Gaut. & Naciri (blue). Limits of protected areas in yellow. [Google Earth Images. Copyright 2018 DigitalGlobe. Reproduced per attribution guidelines]

Flowers grouped in clusters of 1-6 among the leaves or on leafless brachyblasts; flowering pedicels 1.5-3.5 × 0.5 mm, densely golden-villous. *Sepals* 5, quincuncial, glabrous inside, densely golden-villous outside, circular to ovate, apex rounded to obtuse, 2.4-3.0 × 2.4 mm, the three inner ones slightly keeled. *Corolla* gamopetalous with 5 lobes, glabrous, tube 1.8 mm long, lobes broadly lanceolate, 3.0 × 1.2 mm, contorted in bud, spreading at anthesis, cream-coloured when fresh. *Stamens* 5, filaments attached to the top of the corolla tube, the free part 0.9 mm long. Anthers pair medifixed, extrorse, 1.0 × 0.7 mm, villous, connective broad, prolonged above anthers in a triangular glabrous apex 0.9 mm long, 0.45 mm at base. *Staminodes* 5, alternate with respect to petals and stamens, 2.5 × 1.0 mm,

densely villous with golden trichomes, carnosely connivent and concealing the ovary, spreading at apex. *Ovary* spherical but tapering towards style base, 1.2 mm high and broad, slightly 5-lobed, villous with golden trichomes, with 5 ovules; style 5 mm long, glabrous, 0.2 mm in diam. *Fruiting pedicels* 3.5 × 1.1 mm, glabrescent, with a persistent calyx. *Fruit* ovoid and slightly beaked, 18-20 × 10-11 mm, 5-ridged, mostly glabrous but with a pubescent base; apparently only one seed develops.

Etymology. – The epithet is derived from the name of the forest where the majority of the specimens, including the type, have been collected.

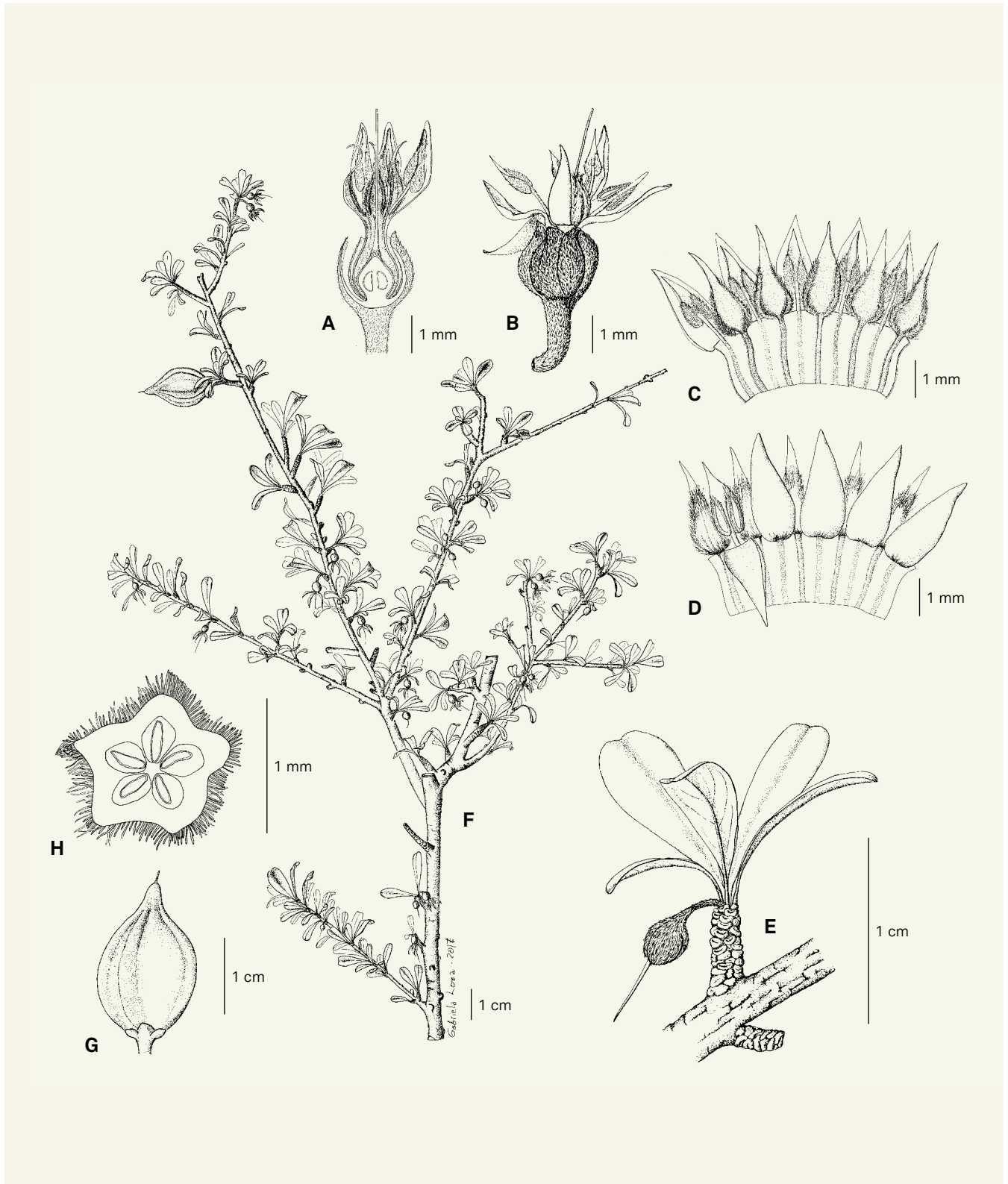


Fig. 4. - *Capurodendron sahafariense* L. Gaut. & Naciri. **A.** Longitudinal section of flower; **B.** Flower; **C.** Corolla opened seen from inside; **D.** Corolla opened seen from outside; **E.** Brachyblast with leaves and post-anthesis flower; **F.** Branch with flowers and fruit; **G.** Fruit; **H.** Transverse section of ovary. [Drawings: G. Loza]



Fig. 5. - Field photograph of the type collection of *Capurodendron sahafariense* L. Gaut. & Naciri. [Photo: F. Ratvoson]

Distribution, ecology and phenology. – The species is only known from the dense dry deciduous forest on sands, in Sahafary and its SE vicinity (Fig. 3), in the northern part of the Western Phytogeographical Domain (HUMBERT, 1955). The flowering and fruiting collections were gathered between November and February.

Conservation status. – The Sahafary forest has an area of c.12 km², and is well-known for being home of a range of narrow endemics, including another *Sapotaceae* species, *Manilkara sahafariensis* Aubrév. It is very unfortunate that this forest has not been included in the recent extension of Madagascar protected area network, as it is under threat of being converted to agricultural land. Under these conditions and with an EOO of 41 km² and an AOO of 16 km², *C. sahafariense* is assigned a preliminary IUCN conservation status of “Critically Endangered” [CR B1ab(i,ii,iii)].

Notes. – *Capurodendron sahafariense* has the remarkable feature of having a ridged fruit. In the genus, the only other species with ridged fruits is *C. costatum*, which has also leaves on brachyblasts, but with blades 2.5 times longer and 5 times broader, and which is only found in the western part of the island, from Bemaraha to Ankarafantsika, *i.e.* more than 450 km south-west from the Sahafary forest where the new species has been discovered. The two species might be related, but this still has to be confirmed by an undergoing molecular study. The venation pattern in *C. sahafariense* reminds *C. ludifolium*, which has unridged fruits and larger leaves.

Paratypes. – MADAGASCAR. **Prov. Antsiranana:** Reg. DIANA, forêt d’Analafondro, au pied SE du plateau de Sahafary (bassin inférieur du Rodo), 27.XII.1963, fl., *Service Forestier* 23087 (G, P, TEF); *ibid. loco.*, 7.II.1966, fl., *Service Forestier* 24517 (G, P, TEF); forêt de Sahafary (bassin de la Saharenena), 7.II.1966, fl., *Service Forestier* 24487 (G, P, TEF); Ambolobozobe, Ambo-

vomavo, à 1 km W du village d’Ambolobozobe, 12°31’13”S 49°31’21”E, 24.XI.2007, fl., *Rakotonandrasana* 1207 (CNARP, G, MO, P, TAN).

Capurodendron nanophyllum L. Gaut. & Naciri, **spec. nova** (Fig. 6).

Holotypus: MADAGASCAR. **Prov. Toliara:** Reg. Androy, près du village d’Ankorakosy, au SSE de Tsihombe, 17.XII.1968, fl., *Service Forestier* 28521 (G [G00418688]!; iso-: P [P04570991]!).

Capurodendron nanophyllum L. Gaut. & Naciri differs from *C. androyense* Aubrév. by its longer and more slender pedicels (4–5 × 0.3 mm vs 1–5 × 0.5 mm) that are sparsely white-ciliate vs densely golden-pubescent. Vegetatively, the leaves of *C. nanophyllum* are narrower (1.5–2.3 mm vs 4–11 mm) and have an inconspicuous venation (vs distinctly reticulate); they are almost sessile (vs with a distinct 2–3 mm petiole).

Shrub, height unknown, presumably with white latex; ultimate twigs 1 mm diameter, bark grey, rugose, longitudinally ridged, with short (2 to 4 mm long) lateral branches with numerous scars of fallen leaves and pedicels (brachyblasts). *Leaves* presumably caducous, 2 to 10 spirally arranged at the tip of the brachyblasts, sessile or indistinctly petiolate; blades spatulate, base acute, apex rounded, 0.45–0.9 × 0.15–0.23 cm; upper side glossy, olive green to brownish when dry, loosely pubescent when young, later glabrous, venation indistinct or shallowly impressed; lower side dull, greyish green when dry, loosely pubescent, venation inconspicuous, with 1–3 very weak secondaries on each side. *Flowers* at the apex of brachyblasts, among the leaves; flowering pedicels slender, 4–5 × 0.3 mm, broadening to 0.6 mm below the flower, with scattered malpighiaceus white trichomes 0.3 mm long. *Sepals* 5, quincuncial, convex, ovate, 2.6 × 1.2 mm with an acute apex; glabrous inside and densely white-ciliate outside. *Corolla* gamopetalous with 5 lobes, glabrous, tube 2.0 mm long,

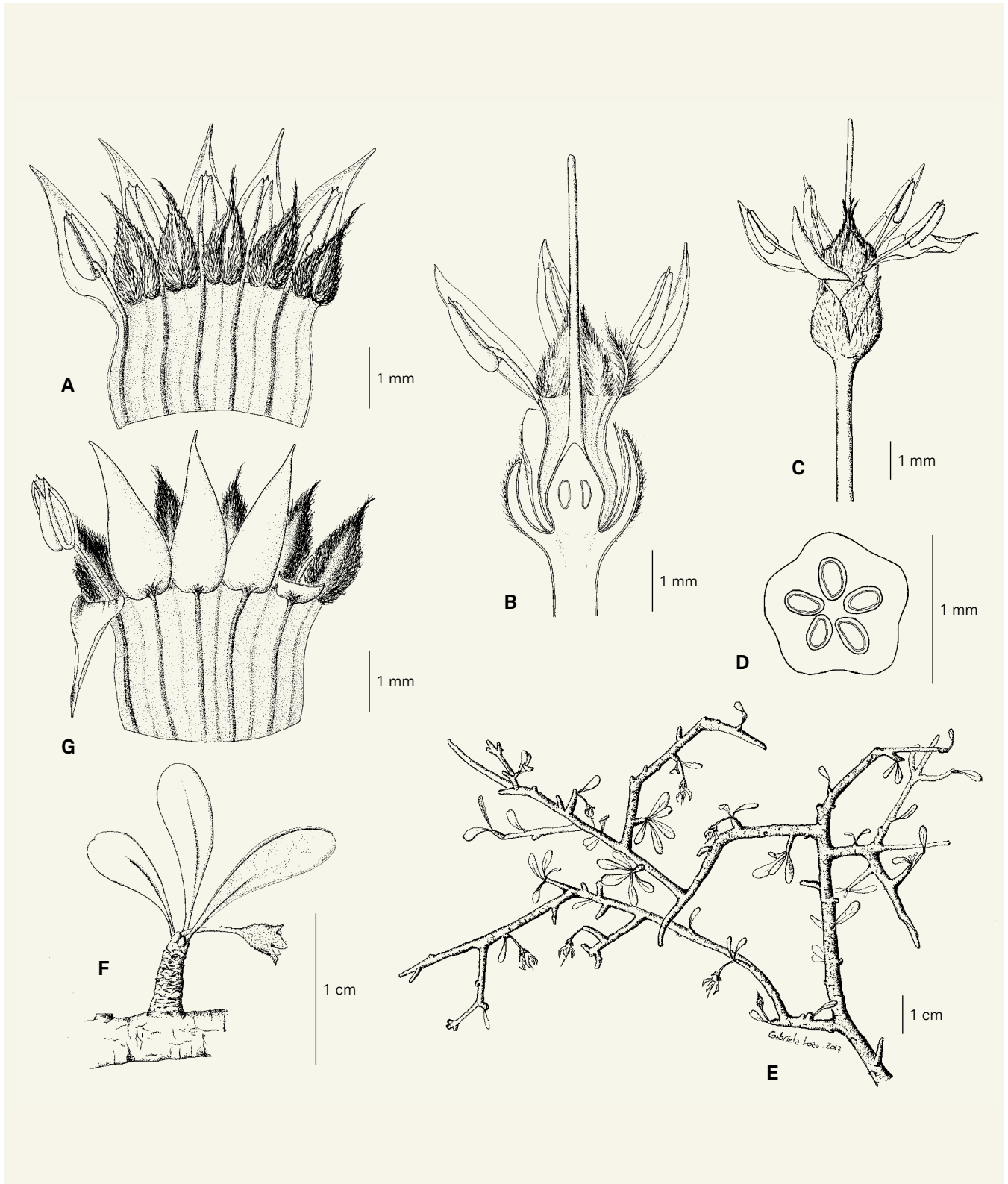


Fig. 6. - *Capurodendron nanophyllum* L. Gaut. & Naciri. **A.** Corolla opened seen from inside; **B.** Longitudinal section of flower; **C.** Flower; **D.** Transverse section of ovary; **E.** Flowering branch; **F.** Brachyblast with leaves and post-anthesis flower; **G.** Corolla opened seen from outside. [Drawings: G. Loza]

lobes broadly lanceolate, 2.5 × 0.9 mm, contorted in bud, spreading at anthesis. *Stamens* 5, filaments 0.8–1.0 mm long, attached to the top of the corolla tube. *Anthers* attached to the filament at 1/3 of their length, extrorse 1.2 × 0.7 mm at the broadest, connective and adjacent side of the anthers villous, prolonged in a 0.2 mm acute mucro. *Staminodes* 5, alternate with respect to petals and stamens, broadly lanceolate and long-acuminate, 2.0 × 0.8 mm, densely villous with creamy trichomes, connivent and concealing the ovary. *Ovary* shallowly 5-lobed, 1.4 mm high × 0.9 mm broad, glabrous to minutely papillose, with 5 ovules, style 5 mm long, glabrous, 0.18 mm diameter, stigma faintly 5-lobed. *Fruit* unknown.

Etymology. – The epithet refers to the very small leaves, the smallest in the genus.

Distribution, ecology and phenology. – The species is only known from a single collection in the xerophilous thicket in the extreme South of the island, in the Southwestern Phytogeographical Domain (HUMBERT, 1955). The flowering collection was gathered in December.

Conservation status. – With a single location known outside of the protected area network in a region where the xerophilous bush has been widely converted to agriculture and is subject to fire damage, *C. nanophyllum* is assigned a preliminary IUCN conservation status of “Critically Endangered” [CR B1ab(iii)+B2ab(iii)]. It should be further mentioned that recent attempts to collect the new species have failed, but this can be attributed to imprecise location of the type collection.

Notes. – *Capurodendron nanophyllum* has the smallest leaves in the genus and represents the most extreme adaptation of this humid forest group to arid habitats. It is only known by its type collection near Tsihombe, one of the driest parts in Madagascar, within the wide range of the relatively variable *C. androyense*. Although the latter may have leaves almost as small as those of the new species, they are never as narrow. The difference in venation is also striking with veins inconspicuous in *C. nanophyllum* whereas they are clearly visible on *C. androyense*. In the latter species, veins are conspicuous, especially on the lower side where they are highlighted by a dense golden indumentum, whereas the new species has scattered whitish trichomes only. Besides, *C. androyense* leaves are petiolate whereas *C. nanophyllum* leaves are sessile. Furthermore, the flowers of the new species are borne on distinctly longer and more slender pedicels.

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