



Voacanga madureirae (Apocynaceae), a new species from Atlantic Central Africa

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Summary. A new species of Apocynaceae from Atlantic Central Africa, *Voacanga madureirae* Paiva, O.Lachenaud & Covelo, is mapped, described and illustrated. It occurs on the Gulf of Guinea islands of Príncipe (São Tomé and Príncipe) and Bioko (Equatorial Guinea) and in the highlands of western Cameroon. The new species differs from other African *Voacanga* by its calyx distinctly exceeding the corolla (vs shorter or at most equalling it). It is further separated from *V. chatotiana* Pierre ex Stapf by the presence of a row of colleters in the upper half of the calyx (not near the base) and from other Central African species by its syncarpous fruits and almost straight (not strongly twisted) corolla tube. It is assessed as Near Threatened according to IUCN criteria.

Key Words. Bioko, Cameroon, Equatorial Guinea, Gulf of Guinea islands, São Tomé and Príncipe, Tabernaemontaneae.

Introduction

The genus *Voacanga* Thouars (Apocynaceae) occurs in the Old World tropics and includes trees and shrubs of rainforest areas. It belongs to tribe Tabernaemontaneae G.Don subtribe Tabernaemontaninae A.DC. (Endress *et al.* 2018) and is closely related to *Tabernaemontana* L. They have in common a dichotomous branching pattern, petioles connate at the base into a short ochrea, corolla lobes contorted to the left, absence of a corona, anthers tailed at the base and included (or with only the very tips exerted), fleshy fruits with two carpels and arillate seeds. The two genera differ by their corolla lobes, which are inflexed in bud in *Tabernaemontana* vs not inflexed in *Voacanga*; the pistil head which is free from the anthers vs coherent with the anthers and, therefore, shed with the corolla; and the calyx which is persistent vs caducous.

The genus as a whole was last revised by Leeuwenberg (1985), who recognised twelve species, with seven occurring in Africa (one of them also in Madagascar) and five in Asia. However, some of the African species were very broadly delimited in this revision. Five new species have recently been described and a further three resurrected from synonymy (Jongkind & Lachenaud 2022; Jongkind 2022). Taking into account the new species treated in this paper, *Voacanga* now includes 21 species, of which 16 are African. This number is likely to increase further, since some taxonomic issues remain among the Central African taxa (Jongkind 2022).

The new species, treated here, was initially discovered in south-western Cameroon, and recognised as new by Cheek *et al.* (2004: 245), but was not described at that time, since only fruiting material was available. In 2010, while conducting an ethnobotanical field survey in Príncipe Island, M. C. Madureira made another fruiting collection near Picos Mencorne (*Madureira & Equipa Proj. Pagué III 87*). Several later expeditions to the same locality resulted in additional specimens, but only in 2020 was a specimen with open flowers finally collected (*D. Dias & M. Sebastião 200*). It proved identical with earlier flowering collections from Bioko (Equatorial Guinea) and south-west Cameroon, which had been misidentified as either *Voacanga africana* Stapf or *V. psilocalyx* Pierre ex Stapf. The new species is here described as *V. madureirae* Paiva, O.Lachenaud & Covelo, and compared with its relatives. An assessment of its conservation status is also presented.

Materials and Methods

This paper is based on a study of herbarium collections in BM, BR, BRLU, COI, EA, K, LBV, MA, P, PRP, STPH, WAG and YA (herbarium acronyms according to Thiers 2023, continuously updated, except PRP – Herbarium of Príncipe, São Tomé and Príncipe). The species description is based on dried material, flowers preserved in spirit, field photographs, and collectors' notes. Specimens seen by the authors are denoted with a '!'. The following abbreviations are

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used: diam. – diameter; fl. – flowering; fl.b – flower buds; fr. – fruiting; imm. fr. – immature fruits; and st. – vegetative.

The conservation status of part of the species was assessed following the IUCN Red List Categories and Criteria and guidelines (IUCN 2012, 2019). The extent of occurrence (EOO) and area of occupancy (AOO) were calculated using GeoCAT (Bachman *et al.* 2011) with a cell size of 2 × 2 km. The number of ‘locations’ (as defined by IUCN 2012) was calculated with regard to the main threats, such that a single location may encompass several occurrences.

Taxonomic Treatment

Voacanga maduireirae Paiva, *O.Lachenaud & Covelo* sp. nov. Type: São Tomé and Príncipe, Príncipe, D. Dias & M. Sebastião 200 (holotype COI! [sheets, COI00100961 & COI00100962 + spirit collection, COI00100963]; isotypes BRLU!, MO!, PRP, STPH).

<http://www.ipni.org//urn:lsid:ipni.org:names:77336451-1>

Voacanga sp 1. auct.: Cheek & Leeuwenberg in Cheek *et al.* (2004: 245); Beentje & Harvey in Harvey *et al.* (2004: 84); Cheek *et al.* in Harvey *et al.* (2010: 110)

Shrub or small tree, 3 – 15 m high, up to 20 cm in diam., with abundant white latex in all parts; bark brown. *Branches* pale brown to greyish, inconspicuously lenticellate; branchlets terete, glabrous, 2 – 4 mm thick. *Leaves* opposite, those of a pair unequal or subequal, petiolate; petiole 0.5 – 3.8 cm long, glabrous, those of a pair connate into a short ocrea, with several colleters; leaf blade papyraceous, elliptic to slightly obovate, 2 – 3.5 × as long as wide, 9 – 28 × 3.2 – 11 cm, acute to acuminate at the apex, cuneate at the base, margin entire, glabrous on both sides; midrib flat or slightly depressed above, prominent below; secondary veins 6 – 16 pairs, 5 – 20 mm from each other, slightly prominent above and prominent below; tertiary veins invisible or very laxly reticulate. *Inflorescences* terminal (often becoming lateral due to sympodial growth of the twigs) and paired, umbellate to shortly cymose, 4.5 – 17 cm long, 3.5 – 8 cm in diam., 7 – 33-flowered, glabrous; peduncle 4.5 – 13 cm long; ramifications 0 – 1.3 cm long; bracts soon deciduous, narrowly elliptic, 5 × 1.5 – 2 mm, rounded at apex, glabrous. *Flowers* 5-merous; pedicel 8 – 18 mm long, glabrous. *Calyx* pale green to yellowish-white (paler inside), 9 – 15 mm long, 12 – 21 mm in diam., glabrous, deciduous in fruiting stage; tube campanulate, 1.5 – 4 (– 7) × 3 – 5 (– 8) mm, with a continuous row of thick colleters inside at the very apex or up to 1 (– 2) mm below; lobes elliptic to obovate, 6 – 12 × 2.5 – 9 mm, rounded at the apex, erect and completely enclosing the corolla in bud, patent

to recurved at anthesis. *Corolla* white or cream, smaller than the calyx, 10 – 16 mm in diam., tube 6 – 9 × 3 – 5 mm, 5-angled, constricted at the throat and a little below mid-height, only slightly twisted, glabrous outside, inside with a dense band of short appressed hairs 1 – 2 mm wide below the insertion of the stamens; lobes contorted to the left in bud, obovate, 4 – 8 × 1.7 – 6 mm, rounded at the apex, glabrous, patent at anthesis. *Stamens* included, or with the very tip exerted, attached on the corolla tube towards mid-height; anthers subsessile, narrowly triangular, 3 – 4.5 × 1.2 – 3 mm, acute at the apex, sagittate at the base, glabrous, coherent and forming a cone around the pistil head, slightly twisted with the corolla. *Pistil* included, shorter than the stamens, 5 – 6 mm long; carpels two, connected at the base, 1.5 mm long, 1 – 2 mm in diam., rounded, glabrous; disk annular, c. 0.8 mm long, glabrous; style not split at the base, 4 – 5 mm long, glabrous, more or less gradually thickened at the apex; clavuncula capitate, 1 – 1.5 × 1 – 1.2 mm, with a ring 1.7 – 2 mm in diam.; ovules numerous in each carpel. *Fruit* green, or green spotted yellow, drying black, ellipsoid and more or less heart-shaped, the apex usually slightly bilobed, 1.8 – 5 × 2.5 – 7 cm, smooth, glabrous, on a thickened accrescent pedicel 2 – 2.5 cm long, tardily dehiscent along a single terminal suture. *Seeds* brown, obliquely ellipsoid, 8 – 11 × 4 – 5 mm, strongly furrowed and minutely tuberculate. Figs 1, 2.

RECOGNITION. *Voacanga maduireirae* is easily recognised by its syncarpous fruits, its almost straight (not strongly twisted) corolla tube, and its calyx distinctly exceeding the corolla and bearing inside a dense row of colleters in the upper half of the tube. The first two characters are also found in *V. chalotiana* Pierre ex Stapf, which, however, has a smaller calyx, bearing a row of colleters near the base and much exceeded by the corolla. All other Central African species of *Voacanga* have apocarpous fruits, strongly twisted corolla tubes and a corolla usually exceeding the calyx, or equalling it in *V. diplochlamys* K.Schum., which, however, has puberulous stems and inflorescence while these parts are glabrous in *V. maduireirae*.

DISTRIBUTION. This species occurs in the western highlands of Cameroon (Mt Cameroon, Rumpi Hills, Bakossi Mts, Mt Kupe, Kagwene Hills, Tofala Hills (Lebaleme Highlands), Bali Ngemba) and on the islands of Bioko (Equatorial Guinea) and Príncipe (São Tomé and Príncipe); it may conceivably occur in south-eastern Nigeria, but has not been collected there so far. Map 1.

SPECIMENS EXAMINED. CAMEROON. South-West Region: Mt Cameroon, path from Likombe towards grassland and top of Mt Cameroon, 1060 m, 24 Feb. 1995, fl., Cable *et al.* 1356 (BR!, K!, MO, P, SCA, WAG!, YA); trail N of Likombe village, 850 m, 21 Feb. 1995, fl.b., Groves

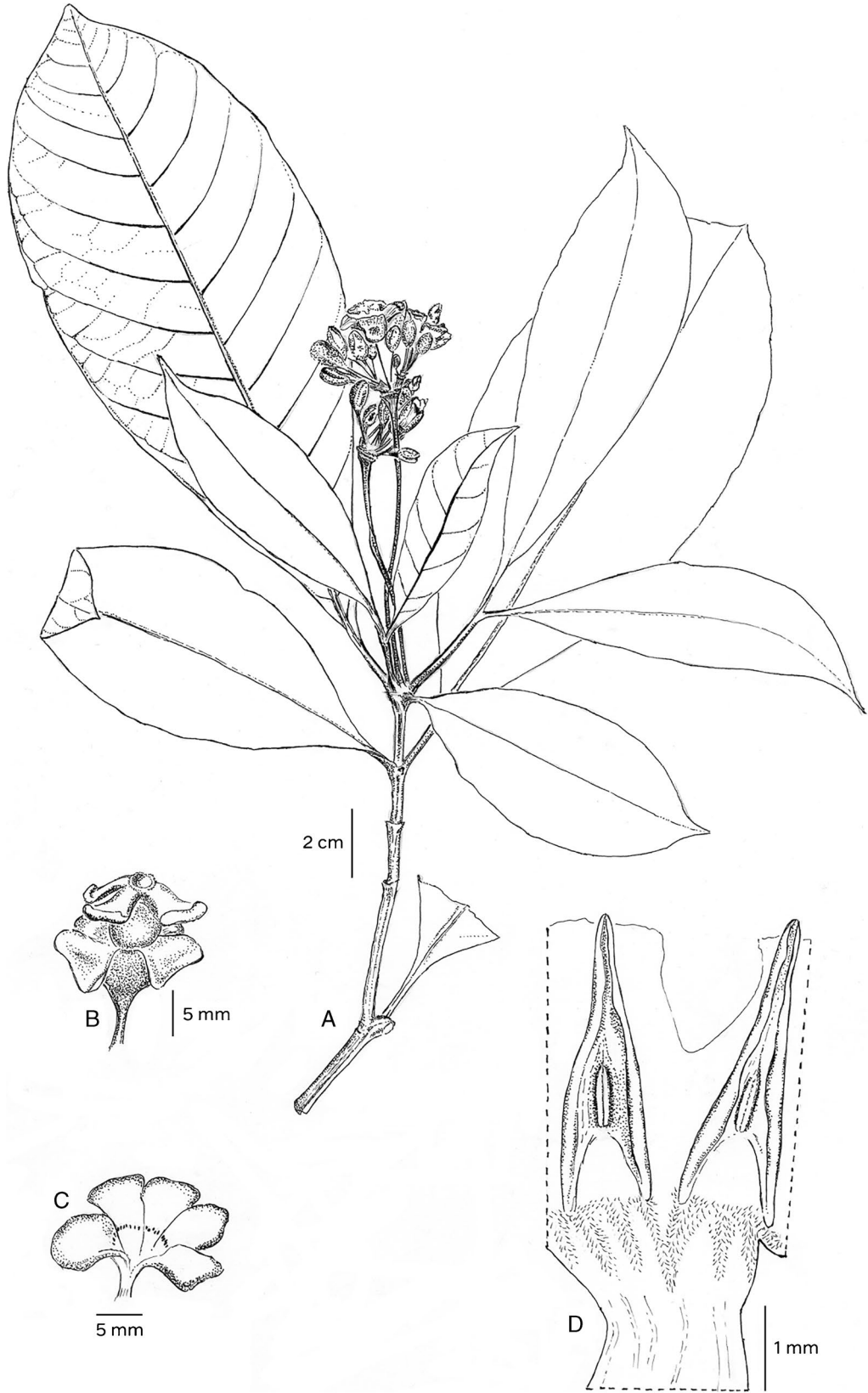


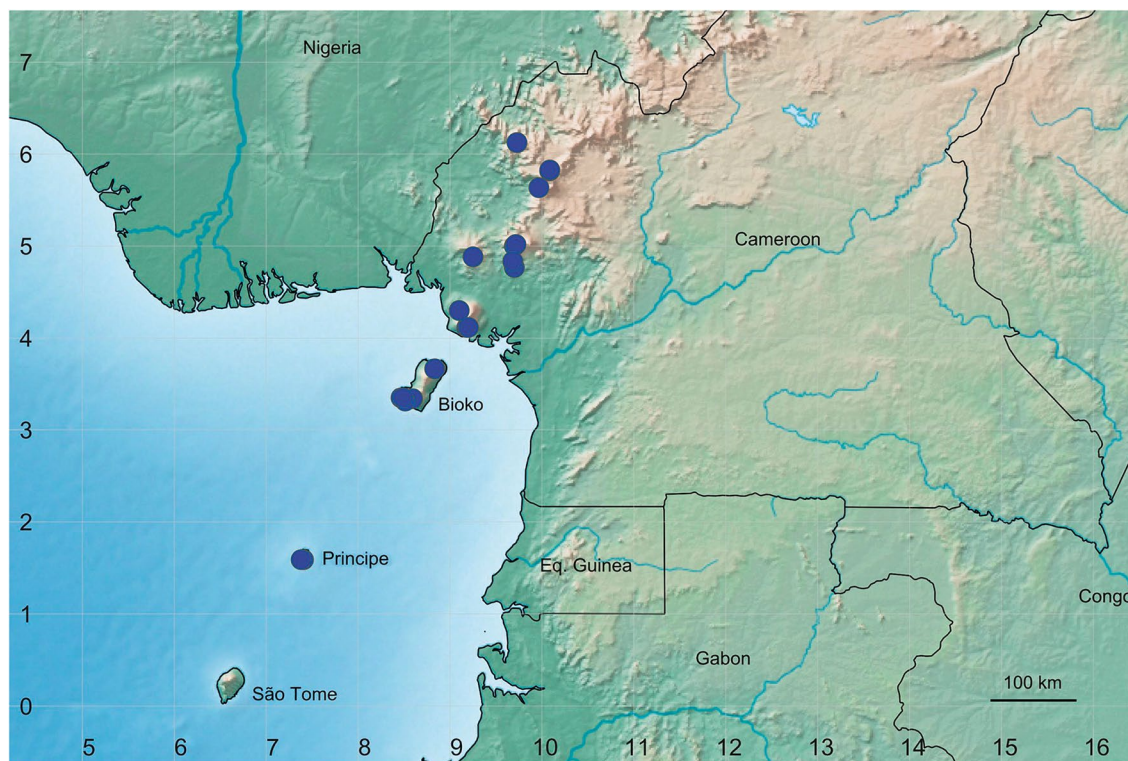
Fig. 1. *Voacanga madureirae*. **A** flowering branch; **B** flower; **C** open calyx with colleters; **D** section of corolla with two stamens. From D. Dias & M. Sebastião 200. DRAWN BY PAULA SILVA.



Fig. 2. *Voacanga madureirae*. **A** flowers, *Q. Luke* 13274; **B** fruit, *M. C. Madureira & Equipa Proj. Pagué III 87*; **C** fruit cut in two halves, showing the inside, *M. C. Madureira & M. Sebastião 3 MCM*. PHOTOS: **A** QUENTIN LUKE, **B – C** MARIA DO CÉU MADUREIRA.

114 (K!); Bwassa, 13 March 1992, fl., *Tchouto Mbachou* 42 (K!); Bwassa, 13 March 1992, fl., *Nkeng* 59 (K!, SCA, YA); above small Koto village, 700 m, 6 March 1985, fl., *D. W. Thomas* 4462 (BR!, K!, WAG! YA!). **Mt Kupe**, around Nyasoso, at the base of Mt Kupe, 856 m, 6 Feb. 1984, fl., *D. W. Thomas* 3046 (BR!, K!, LBV!, WAG! YA!); *ibid.* above Kupe Village, 1400 m, 17 July 1996, fr., *Etuge* 2861 (K!, YA); *ibid.* 950 m, 10 July 1996, fr., *Etuge* 2711 (K!, MO, P, SCA, WAG, YA); Mbulle village, 1100 m, 26 June 1996, fr., *Cable* 3365 (K!, YA); **Bakossi Mts**, Kodmin, 1300 m, 19 Nov. 1998, fr., *Gosline* 179 (K!, YA); *ibid.*, 1350 m, 19 Jan. 1998, fr., *Gosline* 69 (K!, YA!); **Rumpi Hills**, near Dikome Balue, 1500 m, March 1984, fl., *D. W. Thomas* 3294 (BR!, K!, WAG! YA!); **Kagwene Hills**, Abibi path, 1650 m, 25 May 2009, fr., *Ashwoorth* 249 (K!, P!, WAG!, YA); Tofala Hills (Lebiale Highlands), 1700 m, 17 April 2004, fr., *Tchiengué* 1939 (K!, MO, SCA, WAG, YA); **Northwest Region: Bali Ngemba Forest Reserve**, above Mantum village, 1310 m, 10 April 2002, fr., *Zapfack* 2002 (K!, SCA, YA); *ibid.* 1400 m, 20 April 2002, fr., *Pollard* 1045 (K!, YA); *ibid.* 1310 m, 11 April 2002, fr., *Onana* 1992 (K!,

YA!); *ibid.* 1500 m, 5 Oct. 2001, fr., *Onana* 1837 (K!, SCA!, YA!). **EQUATORIAL GUINEA. Bioko Norte**: carretera del Pico Basilé, 1190 m, 5 July 1986, fr., *Fernandez Casas* 10194 (MA [image!], WAG!). **Bioko Sur**: Belebú Balachá, camino de Ureca, 1310 m, 28 Feb. 1989, fl., *Fernández Casas* 12181 (BM!, BR!, K!, MA [image!], P!, WAG!); C. Ureca/Fondo Caldera, 930 m, 13 March 2007, fr., *Galán & Barberá* 4685 (BR!, MA); Badja N Trail, 1040 m, 20 Jan. 2009, fl., *Q. Luke* 13100 (EA!, K!, MA [image!]); Hormiga Camp, 800 m, 1 Feb. 2009, fl., *Q. Luke* 13274 (K!). **SÃO TOMÉ AND PRÍNCIPE. Príncipe**: Base do Morro do Leste, 01.88905°N; 007.40551°E, 467 m, 22 Jan. 2021, fl., *D. Dias & M. Sebastião* 200 (holotype COI!; isotypes BRLU!, MO!, PRP, STPH); entre Morro de Leste e no caminho para Picos Mencerne, Príncipe, 10 Aug. 2010, fr., *M. C. Madureira & Equipa Proj. Pagué III 87* (PP III) (COI! [COI00100964]); subida para os Picos Mencerne, Príncipe, 27 Jan. 2011, fl. (fallen), *M. C. Madureira & M. Sebastião* 22 MCM (2011) (COI! [COI00103113]); entre Morro de Leste e no caminho para Picos Mencerne, Príncipe, 4 Aug. 2011, fr., *M. C. Madureira & M. Sebastião* 3 MCM (Salk



Map 1. Distribution of *Voacanga madureirae* (blue dots).

I.) (COI! [COI00103114]); Assentada antes do Pico Príncipe, 1°35'21"N 7°22'50"E, 642 m, 16 Feb. 2018, st., *Príncipe Transects* 118 (BRLU!, COI! [COI00103198], PRP, STPH).

HABITAT. Mid-altitude forest, sometimes secondary, or rarely in farmland (*Groves* 124) at elevations of 467 – 642 m in Príncipe, 800 – 1310 m in Bioko, and 700 – 1700 m in Cameroon.

CONSERVATION STATUS. *Voacanga madureirae* occurs in mid-altitude forest (467 – 1500 m) in western Cameroon and on the Gulf of Guinea islands of Bioko (Equatorial Guinea) and Príncipe (São Tomé and Príncipe). It is known from 26 specimens representing 18 occurrences. None of these is considered extirpated since forest cover is still present in the collection areas. Its EOO is calculated as 22,511 km², above the threshold for “Vulnerable” status under Criterion B1. Based on a 2 × 2 km cell size, its AOO is estimated as 72 km², within the range for “Endangered” status under Criterion B2. The 18 occurrences represent 10 – 11 sub-populations. The 11 occurrences in Cameroon are all threatened by deforestation for small-scale agriculture (which is important in the region, especially in the lower part of the species’ altitudinal range) with the possible exception of one occurrence that is protected within the Tofala Hill Wildlife Sanctuary. This occurrence represents one location in the sense of IUCN (2019). One

occurrence is in Mount Cameroon National Park, but very close to its limits and consequently at risk from illegal deforestation; it represents a second location. One occurrence in the Rumpi Hills Forest Reserve and another in the Bali Ngemba Forest Reserve, both of which have only weak levels of protection (essentially none at the moment, due to political troubles in the region), represent two additional locations. The remaining occurrences are not protected, one in the Kagwene Hills represents a fifth location, two on the southern flank of Mt Cameroon (outside the national park) a sixth, two on Mt Kupe a seventh and two in the Kodmin area an eighth location. Four of the occurrences in Bioko are in the same protected area (the Reserva Científica de la Caldera de Luba) and represent a ninth location; the last one, in the north of the island, is unprotected and is a tenth location. The two occurrences in Príncipe are in a protected area (the Zona Ecológica de Príncipe) and seem relatively safe for the moment, they represent an eleventh location. The species is thus known from eleven locations with regard to the most serious plausible threat, small-scale agriculture, and, because of that, a past, present and future continuing decline in habitat extent and quality is inferred. The number of locations is just above the threshold for Vulnerable status (IUCN 2012) under criterion B2ab(iii) and considering that some of them are likely to

Table 1. Differences between *Voacanga madureirae* and similar species.

	<i>V. africana</i>	<i>V. chalotiana</i>	<i>V. diplochlamys</i>	<i>V. madureirae</i>	<i>V. psilocalyx</i>
Indumentum of petioles, leaf veins (below) & inflorescences	glabrous/ puberulous	glabrous	puberulous	glabrous	glabrous
Secondary leaf veins (pairs)	8 – 22	10 – 25	(8 –) 10 – 16	6 – 16	(4 –) 6 – 12
Bracts	caducous	caducous	persistent (rarely caducous)	caducous	persistent
Calyx length (mm)	7 – 19	5 – 7.5	9 – 14	9 – 15	10 – 19
Calyx lobes (at anthesis)	spreading or recurved	recurved	spreading or recurved	spreading or recurved	erect
Position of colleters inside calyx tube	variable	dense band near the base	sparse band around mid-height	dense band near the apex	dense band in lower half
Corolla	>> calyx (both in length & diameter)	>> calyx (both in length & diameter)	± equalling calyx in length (but smaller in diameter)	< calyx (both in length & diameter)	> calyx (both in length & diameter)
Corolla tube	strongly twisted	almost straight	strongly twisted	almost straight	strongly twisted
Fruits	apocarpous, obliquely subglobose	syncarpous	apocarpous, obovoid	syncarpous	apocarpous, ovoid to half-moon-shaped
Altitude (m)	0 – 1100	470 – 630	150 – 760	467 – 1700	0 – 600
Distribution	Senegal to Mozambique (incl. Bioko & São Tomé)	SE Gabon to NE Angola	Nigeria to Gabon	W Cameroon, Bioko, Príncipe	Nigeria to D. R. Congo

Bold characters are diagnostic for these species.

disappear in the near future, the species is provisionally assessed as Near-Threatened [NT].

PHENOLOGY. Flowers have been collected from January to March; fruits in January, March, April, July, August and October.

LOCAL NAMES. Cata d’obo (Príncipe), name also used for *Tabernaemontana* spp.

NOTES. *Voacanga madureirae* is a rather distinctive species, at least when fertile. In flower characters (especially the large size of the calyx in relation to the corolla) it resembles *V. diplochlamys*, which is partly sympatric in Cameroon (but which usually occurs at lower altitudes). In fruiting characters it resembles *V. chalotiana*, which has a widely separate range, south of the Equator. Differences with these species are summarised in the diagnosis and in Table 1 above. Although Leeuwenberg (1985) included *V. diplochlamys* in the synonymy of *V. bracteata* Stapf, the two species are clearly different (Jongkind & Lachenaud 2022).

As noted in the introduction, flowering collections of *Voacanga madureirae* have also been confused with *V. africana* and *V. psilocalyx*. The earliest collection of the new species, D. W. Thomas 3046, was cited under *V. africana* by Leeuwenberg (1985: 76) in his revision of the genus, and subsequently by Cheek *et al.* (2004: 245), while Cable & Cheek (1998) cited other specimens under both *V. africana* (Groves 124, Nkeng 59) and *V. psilocalyx* (Cable 1356, Tchouto 42). These two species are easily separated

from *V. madureirae* by their corolla distinctly exceeding the calyx (greatly so in *V. africana*), their strongly twisted corolla tube, their calyx tube with ± scattered colleters inside (never forming a dense row near the apex) and their fruits with separate carpels (Table 1).

While at least five species of *Voacanga* occur in south-western Cameroon: *V. africana*, *V. diplochlamys*, *V. lanceolata* (Stapf) Jongkind, *V. madureirae* and *V. psilocalyx*; only two are known from the Gulf of Guinea islands: *V. africana* and *V. madureirae*. Both species occur in Bioko, only *V. madureirae* in Príncipe and only *V. africana* in São Tomé. The São Tomé population of *V. africana*, originally described as *V. lemosii* Philipson, has very large fruits and could possibly represent a separate taxon, but the material seen is too fragmentary for a definite conclusion on the matter.

The seeds of *Voacanga madureirae* are reportedly eaten by giant rats (*Etuge* 4698).

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Declarations

Conflict of interest The authors declare they have no conflicts of interest relevant to this paper.

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