Check List the journal of biodiversity data

NOTES ON GEOGRAPHIC DISTRIBUTION

Check List 19 (6): 1013–1020
https://doi.org/10.15560/19.6.1013

PENSOFT

Matisia gentryi and *M. tinamastiana* (Malvaceae), two species newly recorded from Panama and an updated key to *Matisia* species in this country

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Abstract. *Matisia* Bonpl. is a genus of Malvaceae (Matisieae) that is distributed from Nicaragua to Brazil. Twelve species of *Matisia* have been recorded in Panama. In this article, we add two species to the Panamanian flora, *Matisia gentryi* Fern.Alonso and *M. tinamastiana* A.Estrada & Cascante, and provide for both species full descriptions, images, a distribution map, taxonomic notes, and conservation status. Additionally, we provide an identification key for *Matisia* in Panama and propose the synonymization of *Matisia* sect. *Tuberculatae* Fern.Alonso under *Matisia* sect. *Matisia*.

Keywords. Biodiversity, Central America, geographical distribution, South America, taxonomy

Academic Editor: Luana S.B. Calazans
Received 27 July 2023, accepted 26 November 2023, published 13 December 2023

Fernández-Alonso JL, Campos-Pineda E (2023) *Matisia gentryi* and *M. tinamastiana* (Malvaceae), two species newly recorded from Panama and an updated key to *Matisia* species in this country. Check List 19 (6): 1013–1020. https://doi.org/10.15560/19.6.1013

Introduction

In the *Flora of Panama*, Robyns (1964) included *Matisia* Bonpl. in his treatment of the genus *Quararibea* Aubl. However, based on the correlated characters of locule number in the ovary and the degree of division of the distal staminal column, Alverson (1989) proposed that *Matisia* and *Quararibea* form two clearly distinct groups that should be maintained as separate genera. Thus, *Matisia* differs by its 5-locular ovaries, its staminal tube, which is typically zygomorphic and deeply lobed at the apex—with lobes longer than 4 mm—and the absence of the characteristic fenugreek- or licorice-like smell in dry samples. The latter attribute is usually characteristic of *Quararibea*, a genus that is further differentiated because it has 2–4 locular ovaries, a radially symmetrical staminal column, and distally toothed or lobed, lobes shorter than 4 mm, or rarely torn-digitated with lobes longer than 4 mm (Fernández-Alonso 1996, 1999; Alverson and Steyermark 1997; Fernández-Alonso 2021).

The genus *Matisia* (Matisieae Benth.) is distributed from Nicaragua to Brazil, with 50 taxa known (Fernández-Alonso 2011). According to Correa et al. (2004), 11 *Matisia* species occur in Panama and include two endemic species, *M. exalata* W.S.Alverson and *M. jefensis* (A.Robyns & S.Nilsson) W.S.Alverson. Subsequently, Fernández-Alonso (2011) described *M. pacifica* Fern.Alonso, which is distributed from Nicaragua to Colombia and Ecuador, and this name applies to specimens previously determined as *M. bracteolosa* Ducke, a species now restricted to the northern Amazon (Brazil, Colombia, Ecuador, and Peru).

Condit et al. (2019) listed 11 *Matisia* species from Panama, but they did not include *M. lomensis* (Cuatrec.) Cuatrec. and *M. idroboi* Cuatrec. s.l., although some specimens were determined with these names at COL, PMA, and SCZ herbaria (acronyms according to Thiers 2023) in the last two decades. The Panamanian materials from section *Calyculatae*, treated as *M. lomensis* s.l. and *M. idroboi* s.l., are being revised and includes two new undescribed species (Fernández-Alonso in prep.). In this study, in the identification key, they are given

the provisional name *M.* aff. *idroboi*.

Currently, Panama has 14 species of *Matisia*, which are assignable to the four of the five sections recognized in this genus (Fernández-Alonso 2001a). Among these 14 species are *M. gentryi* Fern.Alonso and *M. tinamastiana* A.Estrada & Cascante (first reported here), and the two species belonging to section *Calyculatae*, which are currently being described as new to science (Fernández-Alonso in prep.). In this work, we report the first records of *Matisia* species from Panama and provide an updated identification key. We also include additional materials examined (see Appendix) and comments on *M. bicolor* Ducke, *M. gentryi* (Panama), *M. palenquiana* (A.Robyns) W.S.Alverson (Ecuador), and *M. tinamastiana* (Costa Rica).

Methods

Our review of the herbarium specimens housed at PMA and SCZ (acronyms according to Thiers 2023) uncovered specimens of the genus *Matisia* previously unreported in the literature from Panama. We carried out a field trip to Altos de Campana National Park and Biological Reserve and collected a tree of the genus *Matisia*; the specimens were preserved and deposited in the PMA and SCZ herbaria. Plant determinations were confirmed by comparing our specimens with identifications made in the COAH, COL, CR, GUAY, PMA, QCA, QCNE, R, SCZ, and USJ herbaria (acronyms according to Thiers 2023). Similarly, these herbarium specimens were used to build the identification key. We also examined type specimens by consulting the JSTOR Global Plants database (JSTOR 2023). Our morphological descriptions of the treated species are extensive, and they were not based only on the materials examined from Panama. The descriptive terminology used here follows that of previous works (Fernández-Alonso 2001a, 2001b, 2002). To create the geographical distribution map, we used ArcGIS Pro v. 3.1.1 and data from GBIF (2023) and Valois-Cuesta and Fernández-Alonso (2010). The conservation assessments follow B criteria of the International Union for the Conservation of Nature (IUCN Standards and Petitions Committee 2022). The values used in IUCN criteria were calculated using the GeoCAT tool (Bachman et al. 2011).

Results

***Matisia gentryi* Fern.Alonso**, Novon 12(3): 343–344 (Fernández-Alonso 2002)

Figure 1

Type. COLOMBIA – **Chocó** • ca. 50 km al E de Las Ánimas, 4 km al E del río Pato, Carretera Panamericana; 250 m alt.; 11.I.1979; A. Gentry and E. Rentería 23984; holotype: COL 204320, isotype: HUA: 11533, MO (BC:MO-1442639/A-2719936).

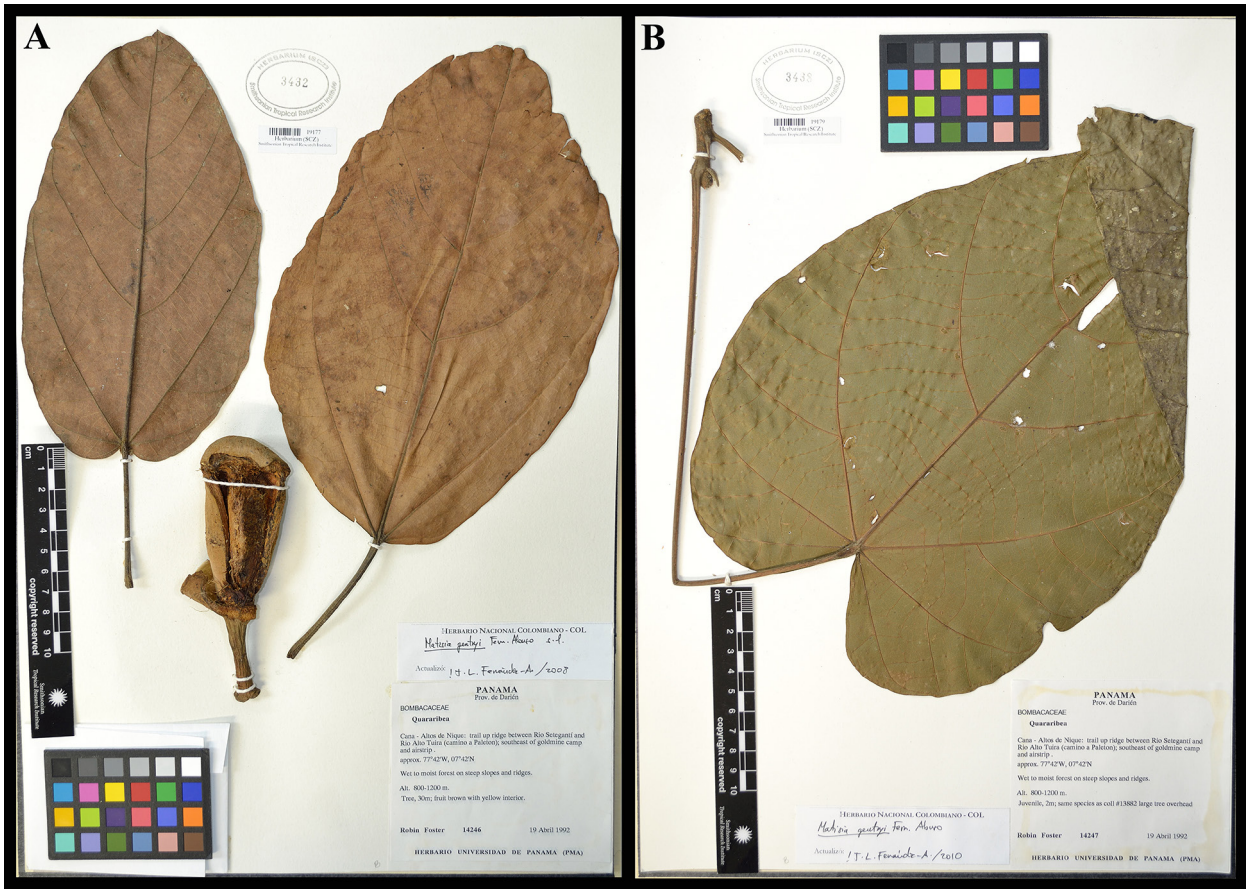

Figure 1. *Matisia gentryi.* **A.** Adult leaves and fruit (R. Foster 14246). **B.** Young leaf, larger than mature ones (R. Foster 14247).

New records. PANAMA – **Darién** • Cana, Altos de Nique: trail up ridge Rio Seteganti and Río Alto Tuira (camino a Paletón), SE of goldmine camp and airstrip; 77°42′W, 007°42′N; 800–1200 m alt.; 19.IV.1992; R. Foster 14246; SCZ 19177, SCZ 19178 • ibid.; R. Foster 14247; F 2123803, SCZ 19179.

Global distribution. Colombia and Panama. Previously, it was recorded as endemic for Colombia (Valois-Cuesta and Fernández-Alonso 2010; Fernández-Alonso 2016, 2023) (Fig. 2).

Conservations status. *Matisia gentryi* was believed to be endemic to Colombia and assessed as Least Concern (Lopez-Gallego and Morales 2020). Our newly found subpopulation in Panama, which is within a protected area (Darien National Park) with minimal human intervention, increases the area of occupancy to 12 km^2 and the extent of occurrence to 73,703 km^2, but we suggest keeping this species as Least Concern.

Description. Trees to 30 m; terminal buds with thickened bracts, subcoriaceous, triangular or widely triangular, 3.0–4.0 (7.0) × 2.5–3.0 mm, indumentum very fine, equinate-tuberculate. Leaves loosely grouped at tips of young branches; stipules triangular, up to 7.0 mm long; petiole (4.5) 5.5–12.0 cm × 2.0–3.0 mm, proximal and distal pulvinus evident, 3.0–4.0 mm in diameter; blades widely obovate to orbicular, (11–)13–23 × (9–)10–20 cm; bases cordate, with short sinus, up to 1.5 cm long (deep); apex obtuse, rounded, sometimes emarginate; margin slightly sinuate-ondulate; basal nerves 3; central vein most developed and two adjacent veins shorter in blade, generally with other 2 veins submarginal, which are not well developed; second nerves 5–8 (9) on each side of main vein; tertiary venation parallel and perpendicular to secondary venation; quaternary venation of a polygonal-reticulate type, slightly highlighted. Indumentum on petiole and abaxial surface minutely equinate-tuberculate, disperse, adaxial surface subglabrate. Inflorescences ramiflorous in nodes; floral pedicel 15–18 mm long, with 3 bracteoles on basal half of pedicel, early caducous; calyx obconic, 2.0–2.2 cm long and 1.5–1.7 cm in diameter at distal margin, with irregularly ripped margin; pedicel and outside calyx (when dry) brown, with indumentum finely echinate-tuberculate; inside of calyx sericeous, whitish; petals creamy, suberect in anthesis, widely spatulate, 3.5 × 1.2 cm, apex obtuse, densely covered with short, stellate trichomes on outside and dense, sericeous, adpressed indumentum on inside; staminal column 2.3–2.8 cm long, with stellate, shortly radiate indumentum; staminal branches

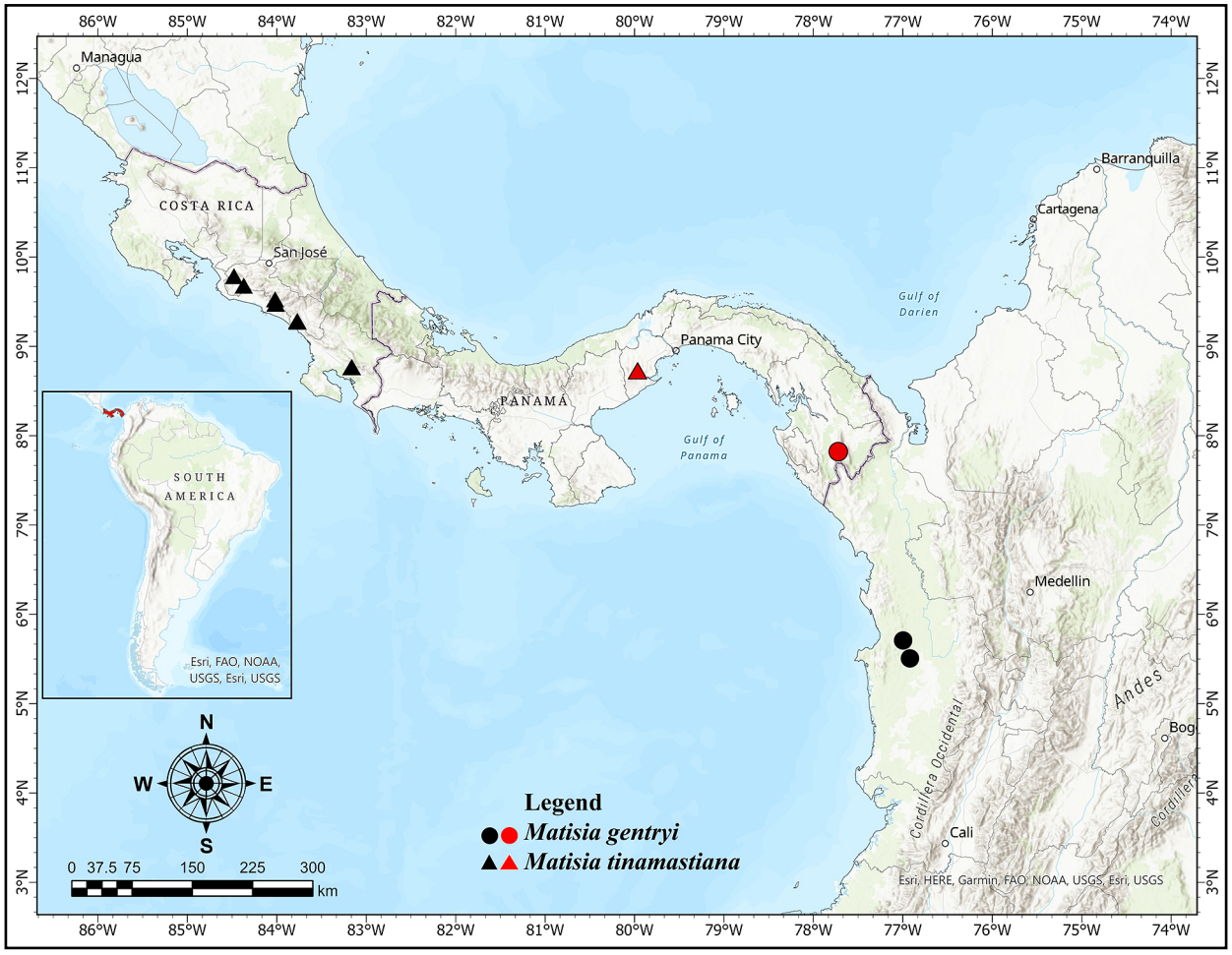

Figure 2. Distribution map of *Matisia gentryi* and *Matisia tinamastiana*; black symbols = previous records; red symbols = new records.

to 1.2–1.4 cm long × 2 mm wide; indumentum large, glandular; trichomes long, sinuose-arachnoid. Pedicel in fruits 1.8–2.0 cm × 5.0–7.0 mm; calyx in fruit, cupular, close to fruit in the 1/3–1/4 basal part, ca. 2.0 cm long × 4.0–4.5 cm in diameter, with a uniformly (4) 5-sinuate-lobate margin; fruits brown, ovoid to ovoid-fusiform, 6.0–7.0 × 4.5–5.0 cm, with slightly truncate apex; central apiculus non-obvious; pericarp covered with fasciculate-stellate indumentum; mesocarp fibrous-fleshy, reniform, ca. 3 × 1.5 × 1.0 cm; seed farenocotilar.

Identification. *Matisia gentryi* differs from *M. cordata* Bonpl. and other species from the section *Matisia* by the following combination of characters: leaves subcoriaceous, longer than broad, broadly obovate to suborbiculate, base cordate, with short basal sinus (lobes), generally 10–25(35) mm long (deep); blades with three basal nerves and two more submarginal nerves, poorly developed; corolla with 35 × 12 mm petals, short staminal column, 23–28 mm long; calyx persistent with the fruit, accrescent, cupuliform, with sinuate-lobed margin; fruit ovoid or ovoid-fusiform, not apiculate.

***Matisia tinamastiana* A.Estrada & Cascante**, Brenesia 49–50: 79–85 (Estada and Cascante 1998)
Figure 3

Type. COSTA RICA – **San José** • Pérez Zeledón, Tinamaste, Finca Tinamaste (17 km de San Isidro en camino a Dominical), bosque residual al pie de la Fila Tinamaste; 09°17′54″N, 083°46′20″W; 650 m alt.; 24.III.1998; A. Estrada et al. 1484; holotype: CR 217110, isotype: K, MO 5194725, USJ 69582! (photo), WIS.

New records. PANAMA – **Panamá Oeste** • Parque Nacional Altos de Campana, at the base of Cerro Chato; 08°43′15.8″N, 079°59′51.0″W; 503 m alt.; 19.V.2015; E. Campos et al. 420; PMA 120855 • ibid., foothills of Cerro Trinidad, very stony terrain; 08°44’23” N, 079°58’01” W; 560 m alt.; 29.V.2019; E. Campos et al. 1189; PMA 132506, SCZ 19257 • ibid.; 11.IV.2023; E. Campos et al. 1333; PMA 133454, SCZ 20024 • ibid.; J. Sumich et al. 150; PMA 133453.

Global distribution. Costa Rica and Panama. Previously, it was believed to be endemic to Costa Rica. (Estrada and Cascante 1998; Cascante-Marín 2020) (Fig. 2).

Conservation status. *Matisia tinamastiana* was believed to be endemic to Costa Rica and assessed as Endangered (Zamora 2020). The addition of this newly discovered subpopulation from Panama in a protected area (Altos de Campana National Park and Biological Reserve) increases the area of occupancy from 36 km^2 to 44 km^2 and the extent of occurrence from 980 km^2 to 20,382 km^2. However, with the number of locations changing to six, and the new locality being at the edge of the protected area, which is also threatened by deforestation for agricultural land transformation, we have evaluated this species as Vulnerable, B2ab(ii,iii,iv).

Description. Tree to 40 m tall and up to 1 m in diameter. Trunk straight and cylindrical but with buttresses. Branches verticillate and horizontal. Bark non-exfoliating, greyish; wood yellowish. Young branches (twigs) densely tomentose, with stellate trichomes and brown-gold, becoming glabrous over time. Stipules triangular, elongate, quickly falling, densely pubescent, with stellate trichomes golden in color. Leaves alternate, entire, simple; petiole terete, 20–35 mm long, 1.2–1.4 mm thick, 2-pulvinus (distal and proximal) with gold trichomes. Leaf-blade slightly asymmetric, bicolor (when dry), dark above, shining, very variable in form and size in same branch, 10.0–16.5 × 5.0– 8.7 cm, narrow to widely obovate, asymmetric, and base cordate, a lobule usually longer than the other by up to 1.1 cm, apex apiculate. Blade glabrous above; pubescent below; trichomes echinate-stellate, mainly pale yellow and some dark brown. Venation palmate, with 7–8 main veins emerging from petiole top. Leaves of young and sterile trees (*Campos 420, Estrada 1994*) with petiole, blade, sinus, and basal auricles remarkably larger than mature leaves. Flowers usually solitary and opposite leaves in terminal part of branches, rarely in short branches, with 1–2 flowers in axillary buds; pedicel pubescent, 24–30 mm long, with echinate-stellate golden trichomes; bracteoles 2–3 in half pedicel, pubescent, absent in fruit. Calyx green-yellowish, dehiscent, conic-elongate, outer surface with gold pubescence and echinate-stellate trichomes, inner surface sericeous pubescence with simple trichomes, with 5 irregular, rounded lobules. Petals 5, grayish-greenish, free and reflex, with pubescence on both sides (abaxial and adaxial), trichomes pale stellate. Staminal column whitish, straight or slightly curved, exserted 27–29 mm beyond corolla, divided into 5 lobules, 6.0–7.5 mm long. Fruit drupaceous, greenish, oblate, ca. 22–25 × 35–40 mm; inside yellow, fibrous; calyx absent. Peduncle fruit thickened, 3–4 mm thick, lenticellate (Estrada and Cascante 1998).

Identification. This species is distinguished from other *Matisia* species in Mesoamerica by its calyx. After pollination, the calyx separates from the flower, through a suture (not visible at anthesis) at the top of the ovary. Thus, the fruit is not covered by an accrescent calyx. Another characteristic is its oblate fruit.

Discussion

Matisia gentryi is a rarely documented in the field; it was previously only known from two collections from western Colombia. Flowering was recorded in June and fruiting in January and June (Valois-Cuesta and Fernández-Alonso 2010).

The new country record of *M. gentryi* in Panama is composed of the two collections in Altos de Nique, Darién Province at 800–1200 m alt. and were identified in 2008 and 2010 by one of us (JFLA) in the PMA Herbarium. Detailed data from these records are included above, which represent the only locations of this species in the Panamanian portion of the Chocó bioregion.

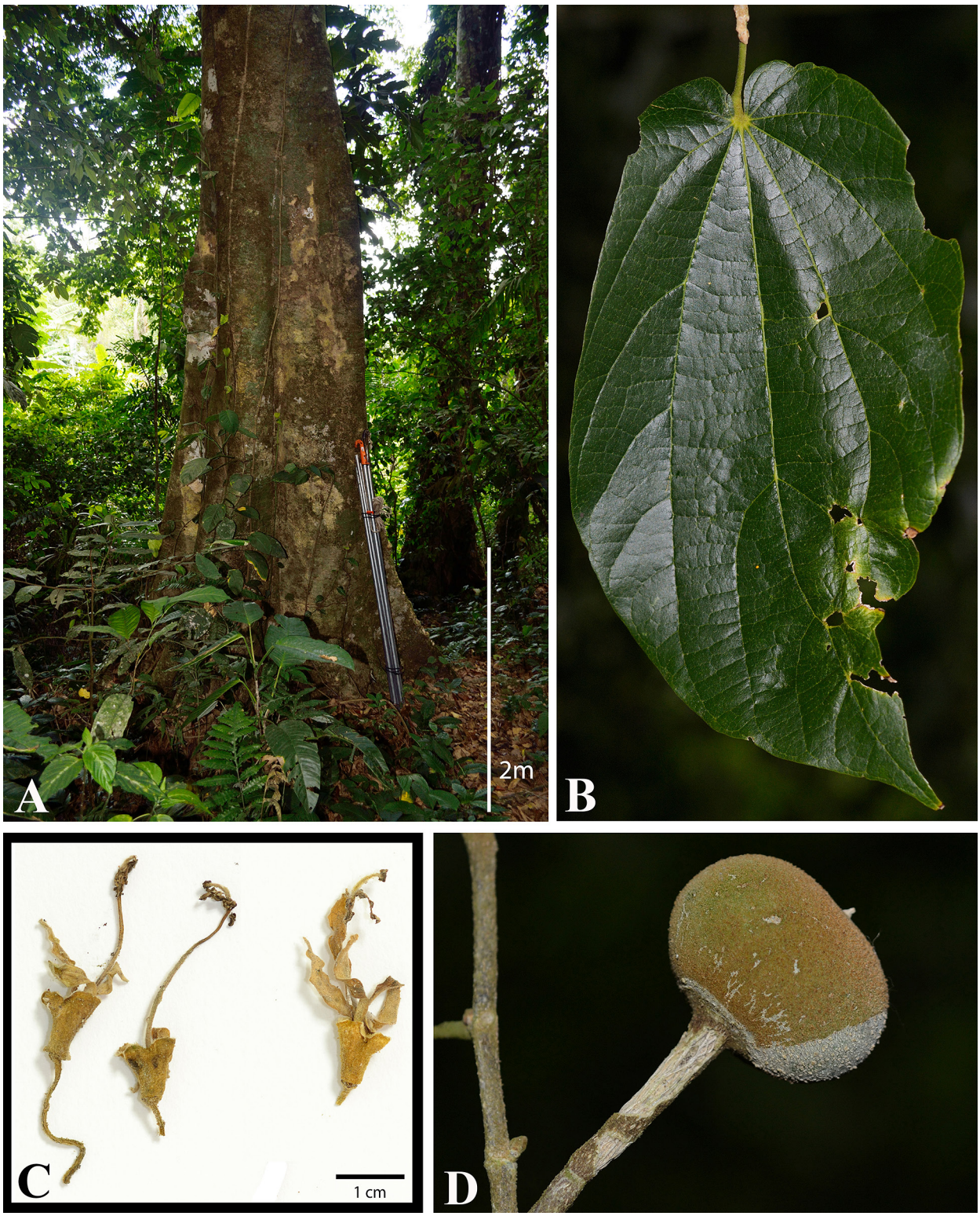

Figure 3. *Matisia tinamastiana* **A.** Trunk base. **B.** Leaf. **C.** Flowers, collected from ground. **D.** Fruit. (A, C from E. Campos et al. 1189; B, D from E. Campos et al. 1333).

Matisia gentryi belongs to the section *Matisia* and has edible fruits, as does *Matisia cordata* Bonpl. This species is widely distributed in northern South America and is also cultivated elsewhere for its edible fruits. The section *Matisia* also includes two species native to the Amazonia of Peru and Ecuador: *Matisia longitubulosa* (A.Robyns) Cuatrec. and *Matisia uberrima* Fern. Alonso (Robyns 1968; Fernández-Alonso 2001a). In the section *Matisia* s.l., these species share many characteristics, primarily in their leaves, with *Matisia gentryi*.

New synonym. *Matisia* sect. *Matisia*; = *Matisia* sect. *Tuberculatae* Fern.Alonso, Rev. Acad. Colomb. Ci. Exact. 25(95): 187, 2001, **syn nov.** It should be noted that *M. cordata* as type species of the genus, is also type of the nominal section (sect. *Matisia*), which has priority over the alternative sectional name, sect. *Tuberculatae*

(Fernández-Alonso 2001a), which here proposed as a synonym.

Matisia tinamastiana is similar in leaf and flower morphology to the South American *M. palenquiana* (A.Robyns) W.S.Alverson from Ecuador (Robyns 1976) and *M. bicolor* Ducke, which is widespread in the Amazonia of Brazil, Peru, Ecuador, and Colombia (Ducke 1922; Cuatrecasas 1954). However, although they all have a dehiscent calyx in fruiting, they differ in the color of the corolla. *Matisia palenquiana* and *M. bicolor* have pink-purplish petals, while the petals of *M. tinamastiana* are gray-greensish or white-greenish. Furthermore, *M. bicolor* has flowers grouped in ramiflorous inflorescences, and its leaf blade is larger than those of *M. tinamastiana* and *M. palenquiana*.

The oldest field record is of a young infertile plant (Campos et al. 420) which presents leaves with larger blades (up to 24 × 19 cm) and longer petioles (up to 60 mm) than indicated for mature trees in the original description; this is typical for small trees that grow in the shaded understory during their early stages. We have also observed this characteristic in other species with cordate-based leaves such as *M. bullata* Fern. Alonso, *M. cordata*, and *M. sclerophylla* Cuatrec. (Fernandez-Alonso 2001a).

The data presented here represent the first records of the genus *Matisia* in Altos de Campana National Park and Biological Reserve. This discovery is significant as it expands our understanding of the botanical diversity within this park. Despite Altos de Campana National Park being one of the botanically well-documented parks in Panama, as noted by Ortiz et al. (2019), our study reveals that there are still regions within this park that hold undiscovered plants.

Identification key for *Matisia* in Panama

1a. Leaf-blade with base clearly cordate, with basal sinus or lobes generally > (10) 40 mm long (deep); basal veins generally 5–7 or more; flowers usually grouped in nodes of branches, rarely solitary and located opposite to leaves (*M. tinamastiana*) **2**

1b. Leaf-blade with base attenuate, rounded or slightly cordate; basal sinus or lobes, if present, usually <10 (20) mm long (deep); basal veins generally 3–5, with laterals submarginal, usually smallest; flowers usually solitary opposite to leaves, inflorescences rarely cauliflorous on branches (*M. dolychosiphon*) **6**

2a. Flowers on twigs, usually opposite to leaves (flower solitary, or rarely in pairs), calyx caducous after anthesis and fruit without accrescent calyx . . . . . ***M. tinamastiana***

2b. Many flowers grouped in fascicles produced in callosity or bumps, in branches without leaves, calyx persistent and accrescent after anthesis, even in fruit **3**

3a. Leaf-blade strongly asymmetric, base unequal, with 1 sinus or lobe more developed. . . . . ***M. obliquifolia***

3b. Leaf-blade not strongly asymmetric or slightly asymmetric and base unequal, with both sinuses or lobes equal **4**

4a. Small tree branching or not, to 10–12 m tall, leaf-blade ovate-oblong to elliptical, 55–100 × 25–50 cm, often bullate, petioles usually 20–55 cm long . . . . . ***M. arteagensis***

4b. Tree very branching, to 30–40 m tall, leaf-blade orbicular, suborbicular, obcordate, and widely obovate, 15–30 × 9–26 cm, smooth, petioles usually 5–20 (25) cm long **5**

5a. Leaf-blades cordate to orbicular, base widely cordate, basal sinus 15–80 mm deep from apex petiole, blade 5–7-nerved in adult leaves, fruit broadly ellipsoid to globose . . . . . ***M. cordata***

5b. Leaf-blades in general widely obovate, longer than wide, with basal sinus shorter, usually 10–25 (35) mm deep, blade 5-nerved in adult leaves, the 2 submarginal nerves frequently very reduced; fruits ovoid to ovoid-fusiform . . . . . ***M. gentryi***

6a. Floral pedicel with 3 distal bracteoles, whorled or subwhorled in calyx base, persistent in fruits. **7**

6b. Floral pedicel without bracteoles or with bracteoles in distal half of pedicel (not whorled) and usually caducous in fruits **11**

7a. Floral pedicel twice or more as long as the calyx, calyx without ribs or rarely with 3(–5) slightly marked ribs . . . . . ***M. sanblasensis***

7b. Floral pedicel shorter than the calyx or up to 1.5 times the length of the calyx; calyx with or without ribs . **8**

8a. Calyx in flower and fruit without ribs or with 5 marked ribs **9**

8b. Calyx in flower and fruit with 10 marked ribs **10**

9a. Bracteoles ever whorled close to calyx base, calyx in flower and fruit without ribs or wings. . . . . ***M. exalata***

9b. Bracteoles whorled or subwhorled (1 slightly below of calyx base), calyx in flower and fruit with 5 evident wings. . . . . ***M. pacifica***

10a. Leaves chartaceous or subcoriaceous, abaxial surface scabrid, calyx in fruit covering less than ½ fruit, with stiff, sinuate wings; fruits ellipsoid or largely ovoid, 40–55 × 20–30 mm . . . . . ***M. jefensis***

10b. Leaves membranaceous or sub-chartaceous, abaxial surface glabrescent, calyx in fruit with 10 wings,

slightly sinuate or not, covering half or more than half of the fruit; fruit ovoid to ellipsoid 25–35 × 20–25 mm ..... ***M.* aff. *idroboi***

11a. Inflorescences cauliflorous or ramiflorous, flowers grouped into racemose, paniculate inflorescences ..... ***M. dolychosiphon***

11b. Inflorescences not as above, flowers solitary, opposite to leaves **12**

12a. Floral pedicel usually yellowish, with bracteoles, fruit ovoid, (36) 40–58 × 35–45 mm, without grooves or lobes longitudinal; calyx in fruit close to the fruit ..... ***M. ochrocalyx***

12b. Floral pedicel usually deep brown, without bracteoles, fruit oblate, compress in upper and strongly 5-lobate when dry; calyx slightly recurved and lobate, and not closely attached to the surface of the fruit ..... ***M. dolychopoda***

Acknowledgements

Fernández-Alonso thanks to the Institute of Natural Sciences of the National University of Colombia and Real Jardín Botánico-CSIC from Spain, for supporting travel to herbaria in Costa Rica (2017, 2019), Panama (1998, 2001, 2014, 2015), COAH, COL, CR, GUAY, PMA, QCA, QCNE, R, SCZ, and USJ. Campos-Pineda thanks the Smithsonian Tropical Research Institute (STRI) for supporting field- and lab work; he also to Carmen Galdames, Joana Sumich, and Jorge Valdés for assistance during the field trips, the PMA and SCZ herbaria staff for access to the collection, and the Panamanian Ministry of Environment (MiAmbiente) for support with collection permits. We give special thanks to Bente Klitgaard, Luana S.D. Calazans, and anonymous reviewers for revisions of the English language and general suggestions on the manuscript.

Author Contributions

Conceptualization: JLFA, ECP. Data curation: JLFA, ECP. Formal analysis: JLFA. Funding acquisition: JLFA, ECP. Investigation: JLFA, ECP. Methodology: JLFA, ECP. Project administration: JLFA, ECP. Supervision: JLFA. Validation: JLFA. Visualization: JLFA, ECP. Writing – original draft: JLFA, ECP. Writing – review and editing: JLFA, ECP.

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Appendix

Specimens examined of *M. bicolor*, *M. palenquiana*, and *M. tinamastiana*.

Matisia bicolor **Ducke**, Arch. Jard. Bot. Rio de Janeiro 3: 210. (Ducke 1922)

PERU – **Huanuco** • Leoncio Prado, Rupa Rupa, Bosque alto, al oeste de Tingo María; 700–800 m alt.; 22.VIII.1978; J. Schuncke-Vigo 10513; COL 473362, MO • Puerto Inca, Yuyapichis, DANTAS; 09°40′S, 075°02′W; 270 m alt.; 15.VI.1986; Kroll 54; COL 369909, MO – **San Martin** • Mariscal Cáceres, Tocache Nuevo, Quebrada de Tananta; 17.IX.1970; J. Schuncke-Vigo 4413; P 6664174.

Matisia palenquiana **(A.Robyns) W.S.Alverson**, Taxon 38(3): 386 (Alverson 1989)

ECUADOR – **Esmeraldas** • Cantón Quininde, Bilsa Biological Station. Reserva Ecológica Mache Chindul, Premonane Wet Forest; 00°21′N, 079°44′W; 500 m alt.; 13.V.1998; J.L. Clark and C. Pallis 5549; COL, MO, QCNE – **El Oro** • Hacienda Daucay, Limón-Playa; 03°29′N, 079°45′W; 500 m alt.; 20.XI.1994; X. Cornejo and C. Bonifaz 3622; GUAY, COL – **Los Rios** • Hacienda Clementina, Cerro Mumbe; 01°40′N, 079°21′W; 150 m alt.; 23.III.1998; C. Bonifaz and X. Cornejo 3754; GUAY, COL • Centro Científico Rio Palenque, entre Santo Domingo de los Colorados y Quevedo; 00°30′N, 079°20′W; 120–150 m alt.; 07.VI.2003; J. Santiana et al. 113; COL, QCA • Hacienda Clementina, Cerro Samama, between Destacamento Pita and La Torre; 01°39′N, 079°20′W; 650 m alt.; 11.V.2001; B. Sthal et al. 5722B; COL 513372.

Matisia tinamastiana A.Estrada & Cascante, Brenesia 49–50: 80–82, figs. 1, 2 (Estrada and Cascante 1998)

COSTA RICA – **Puntarenas** • Cantón de Golfito, Valle de Coto Colorado; 08°46′N, 083°10′W; 500–600 m alt.; 14.VII.1995; N. Zamora and R. Aguilar 2311; CR – **San José** • Perez Zelendón, Tinamaste; 09°17′N, 083°46′W; 650 m alt.; 03.XII.1998; A. Estrada et al. 1994; CR 217111 • Dota, Santa Maria R-.F. Los Santos, Cerro Nara; 09°29′N, 085°0′W; 950 m alt.; 21.VII.1998; O. Valverde 1057; CR 217114.