



New and Noteworthy Records of Angiosperms from Pacific Biogeographical Region at Department of Chocó in Colombia, Including Four New Records for the Country

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Authors' contributions

This work was carried out in collaboration between both authors. Authors AMTL and YLE developed the conceptualization of this study, work on specimen determinations, review of literature and herbariums, and wrote the manuscript. Author YLE made the geographical distribution map and digital plates. Both authors read and approved the final manuscript.

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ABSTRACT

Six new or noteworthy records of Angiosperms from Colombia are presented based in herbarium specimens from the Chocó department in Colombia. Four are first records for the country, one is the first record for the Chocó department and one is the most recent record after 28 years of an

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endemic species to the Chocó Biogeographical region in Colombia. *Cynometra dwyerii* (Fabaceae), *Pouteria fossicola* (Sapotaceae) and *Tachigali panamensis* (Fabaceae) were heretofore known as restricted to Central America; *Mosquitoxylum jamaicense* (Anacardiaceae) was previously known from Central America, Caribbean and Ecuador, but no record for Colombia had been found; *Casearia thamnia* (Salicaceae) was recorded from Colombia through a specimen of the year 1916 from the Bolivar department, here its first record from the Chocó department is presented; *Cre mastosperma chococola* (Annonaceae) is a endemic species to the biogeographic Chocó in Colombia, only known through three specimens and not collected since the year 1990. Information about protologue, type specimens, distinctive morphology, current geographical distribution, common names, and uses are provided for each record, besides notes about the relevance of the novel records are here presented. A geographical distribution map for these species in Colombia is presented, as well as digital plates composed by photographs of herbarium vouchers. Continue inventoring the biodiversity in the biogeographic Chocó as one of the global biodiversity hotspots is imperative. These records presented here provide useful information for future biological research and conservation actions for their respective species or their habitats.

Keywords: *Caesalpinioideae; laetia; leguminoseae; lowland rainforest; neotropical trees diversity; new chorological records.*

1. INTRODUCTION

The Chocó Biogeographical Region extending in general terms from Southern Nicaragua to Northwestern Ecuador is Earth's ninth most biodiverse hotspot [1], it is mainly named Pacific Biogeographical Region in Colombia being defined as the area comprising lowlands adjacent to the Pacific Ocean coast at west to the Andes [2]. One of its particularities is the high rates of precipitation reaching to ca. 11,700 mm per year in some places, giving the category of the Earth's second rainiest place [1]. The northern Chocó region besides comprises the Central and South America junction, a geological event considered as one of the main factors for the high Neotropical biodiversity [3]. About plants diversity, this area is considered as the most biodiverse in the Earth, while only some forest near to Iquitos (Peru) and in the Southeastern Asiatic Forest reach to similar but lesser diversity [4]. Other studies indicate that the plants endemism for this area reach to ca. 25 % [5], a proportion relatively high among the Earth's hotspot endemism [6,7]. The region was also considered as the most unknown for botanist and has high proportion of undescribed plant species [5].

The department of Chocó comprises the most area for the Pacific Biogeographical Region in Colombia. Even though its biological importance, it is one of the focus areas of environmental disturbs such mining and selective logging, which are known as the main economic activities of the people who inhabit there [8,9], furthermore, this region is one of the more inaccessible areas for biological researchers in Colombia, mainly as

consequence of long-term armed conflicts [10], thus many species still unknown or scarcely recorded [5]. The species account for this department and the Pacific region have been continuously increasing in the last decades, by means of new species descriptions or new chorological records derived mainly from taxonomical reviews based in herbarium vouchers [11,12,13].

The biodiversity inventory is one of the main steps for any conservation action or ecological study, it being a basic tool for biodiversity management [14,15]. This study aims give novelty information about four Angiosperms species previously unknown for Colombia and expand the information about two species previously reported for the country but scarcely recorded and little known, thus, become it accessible for further biological studies or conservation planning, as well as contribute to the floristic checklist for Colombia, department of Chocó and Chocó biogeographical region. All records are based in herbarium vouchers collected in the Chocó department in Colombia. The protologue information, type specimens and comments about geographical distribution, diagnostic morphological features, common names, uses and relevance of each record are provided. A geographical distribution map, digital plates composed by photographs of herbarium vouchers are presented, as well as live photographs when available.

2. MATERIALS AND METHODS

Herbarium specimens from the Chocó department were consulted in the herbarium

HUA, along to review of digital images of representative specimens at the herbaria COL, F, MEXU, MO, NY, U, UDBC and US, acronyms according to Thiers [16]. For each species, the taxonomy at genus and species level follows their respective taxonomic literature [17-23], along to review of their heterotypic synonyms and similar species through the Tropicos Data Base (tropicos.org), type specimens and protologues in Jstor Global Plants Project, protologues, and respective virtual herbaria when available. For first records were checked their absence of records for the country in the above mentioned herbaria, as well as in the ongoing checklist of Bernal et al. [24].

The morphological descriptions were based in the most recent literature or the broadest study of each species. For biogeographical regions of Colombia followed the definition by Bernal [2], climate types are according to the classification of Kottke et al. [25], the composite digital plates were made using GIMP 2.10.32. The geographical distribution map was made using ArcGIS 10.5. Data on locality or georeferencing not included in the specimen labels and thus deduced in this study, are placed in square brackets in the specimen citation.

3. RESULTS AND DISCUSSION

3.1 First Records for Flora of Colombia

3.1.1 Anacardiaceae

***Mosquitoxylum jamaicense* Krug & Urb., Notizbl. Königl. Bot. Gart. Berlin 1: 79. 1895. Figs. 1, 2.**

Type: Jamaica. District of Hanover: 1886 (fr), *J. H. Hart* 1287 (C barcode 10005504 [digital image!]; US accession 1364996 [digital image!]).

Distinctive morphology: *Trees* up to 30 m tall, exudate whitish. *Leaves* odd-pinnate, 11 to more foliolate, glabrous to puberulous, rachis unwinged, leaflets petiolulate, without a distinctive marginal secondary vein (e.g., present in the genus *Spondias* L.), margin entire. *Flowers* sessile, hypogynous, haplostemonous, petals present, carpels 3. *Fruits* as drupes, 1-locular, reddish in vivo, glabrous, the seeds occupying a little portion of the locule, locule otherwise empty [17].

Distribution and habitat: Southern Mexico and Jamaica to western Ecuador [17]. In Colombia its

occurrence is here documented for first time, where it was recorded from the western slopes of the Baudó Mountain Range (Serranía de Baudó), in the municipality of Bahía Solano (Fig. 3). *Mosquitoxylum jamaicense* in Colombia, occurs in lowland rainforest, at an elevation nearly to 205 m, under equatorial rainforest climate type (Af).

Notes: *Mosquitoxylum* Krug & Urb is a monotypic genus. The unique species, *Mosquitoxylum jamaicense* is widely distributed from Caribbean basin in Mesoamerica to Pacific basin in Northwestern South America. Although its occurrence in Panama and Ecuador suggested its presence in Colombia, any field record or specimen were known heretofore from the country [26]. The specimen *Y. Londoño* 257 is the unique and first documented record from Colombia.

Common names and uses: Mosquito wood (Jamaica) [from the protologue]; Jobillo, Carbonero (Panamá) [27]; Chichemeca (Nicaragua) [28]; Aceituno negro, Cedro negro, Cirrí blanco, Cirrí colorado (Costa Rica) [29]. Used as medicinal in Mexico for menstrual problems, hemorrhages, and gonorrhoea [30]; reported as valuable for building in "Flora of Panama" [31]. No common names or uses are reported by indigenous people from Colombia.

Additional specimens examined: Colombia. Chocó: Mun. Bahía Solano, el Valle del Chocó, cuenca de la quebrada Mutatá, cerca a la comunidad indígena Boroboro, 205 m, 6°2'27.80"N, 77°18'35.57"W, 2 November 2018 (fr), *Y. Londoño* 257 (HUA accession 221807 [!], HUA accession 221808 [!]).

3.1.2 Fabaceae (leguminosae)

***Cynometra dwyerii* Rados., PhytoKeys 127: 21, f. 6, 7. 2019. Fig. 4.**

Type: Panama. Darién: [now Comarca Emberá-Wounaan], vicinity of Campamento Buena Vista, Río Chucunaque above confluence with Río Tuquesa, [08°23'N, 77°47'W] 5 July 1959 (fr), *W. L. Stern* 941 (holotype: US accession 2396799 [digital image!]; isotype: MO accession 1759925 [n.v.]).

Distinctive morphology: *Trees* up to 30 m tall; leaves alternate, bifoliate, leaflets blade 3.1-3.9 × 1.4-1.9 cm, pubescent toward the midvein and secondary veins abaxially, pubescent toward midvein adaxially, blade isolate pubescent,



Fig. 1. Digital plate of *Mosquitoxylum jamaicense*. A) specimen at HUA. B) fruit manually open, showing locule mainly empty. C) fruit, showing outer surface. A-C from Y. Londoño 257 (HUA accession 221807 [!]). Digital plate by Y. Londoño



Fig. 2. Live photograph of *Mosquitoxylum jamaicense* from the chocó department in Colombia, showing a fruiting branchlet. Photograph from Y. Londoño 257 (HUA accession 221807 [!]). Photographed by Y. Londoño

acrosopic side with 3-6 glands between the margin and midvein; midvein and secondary veins raised abaxially, slightly less so adaxially. *Racemes* axillary or ramiflorous. *Flowers* unknown. *Fruits* up to 4.7 cm diam., surface of valves rugulose, globose, indehiscent, 1-seeded [18].

Distribution and habitat: Panamá in the Darién region [18]. In Colombia it is recorded from the Darién region, in the municipality of Acandí (Fig. 3), inhabiting lowland rainforest nearly to the sea level, under equatorial rainforest climate type (Af).

Common names and uses: No common names or uses were reported.

Notes: *Cynometra dwyerii* was known only from the type collection, near to frontier between Colombia and Panama. The specimen *R. Fonnegra et al. 2851* is the second record of the species after of type, and the first record for Colombia. The geographical range of *C. dwyerii* stills nearly equal because the Colombian record locality is very near to the frontier with Panama.

Cynometra dwyerii is easily recognized vegetatively by its small leaflets with numerous glands between the margin and midvein in the acrosopic side and its blade indumentum [18].

Additional specimens examined: Colombia. Chocó. Mun. Acandí: Vereda Coquitall, 150-200 m, [8°22'53.39"N, 77° 9'7.13"W], 23 May 1989 (fr), *R. Fonnegra et al. 2851* (HUA accession 61028 [!], MO accession 4593241; [n.v.]). Corregimiento de Capurganá, Bahía El Aguacate-Reserva Natural El Aguacate, Parcela Permanente, 200-250 m, 8°36'58"N, 77°19'41.6"W, 23 July 2008 (st), *S.E. Hoyos-Gómez et al. 808* (HUA accession 167747 [!]); *ibid.*, 6 September 2008 (st), *S.E. Hoyos-Gómez et al. 877* (HUA accession 167756 [!]).

***Tachigali panamensis* van der Werff & N. Zamora, Harv Pap Bot 15(1): 150, f. 1. 2010. Fig. 5.**

Type:—PANAMA, Canal Zone, Barro Colorado Island, 22 August 1978 (fl), *R. Foster & C. Philips 2905* (holotype: PMA accession 14378 [n.v.]; isotype: F accession 1845721 [digital image!], MO accession 2667143 [n.v.]).

Distinctive morphology: Trees up to 30 m tall, stipules pinnately divided, leaves alternate, 8-11 pairs of opposite leaflets, paripinnate, leaflet blade 6-13 × 2-4 cm, glabrous adaxially, sparsely appressed abaxially. *Inflorescences* as panicles terminals up to 20 cm long. *Flowers* with hypanthium cupular, asymmetrical, stamens 10, actinomorphic, monomorphic. *Fruits*

samara 14-16 × 4.5-5.5 cm, laterally compressed [19].

Distribution and habitat: Panamá, only known from Canal Zone and Barro Colorado Island [19]. In Colombia it is recorded from the Darién region, in the municipality of Acandí (Fig. 3), inhabiting lowland rainforest nearly to the sea level, under equatorial rainforest climate type (Af).

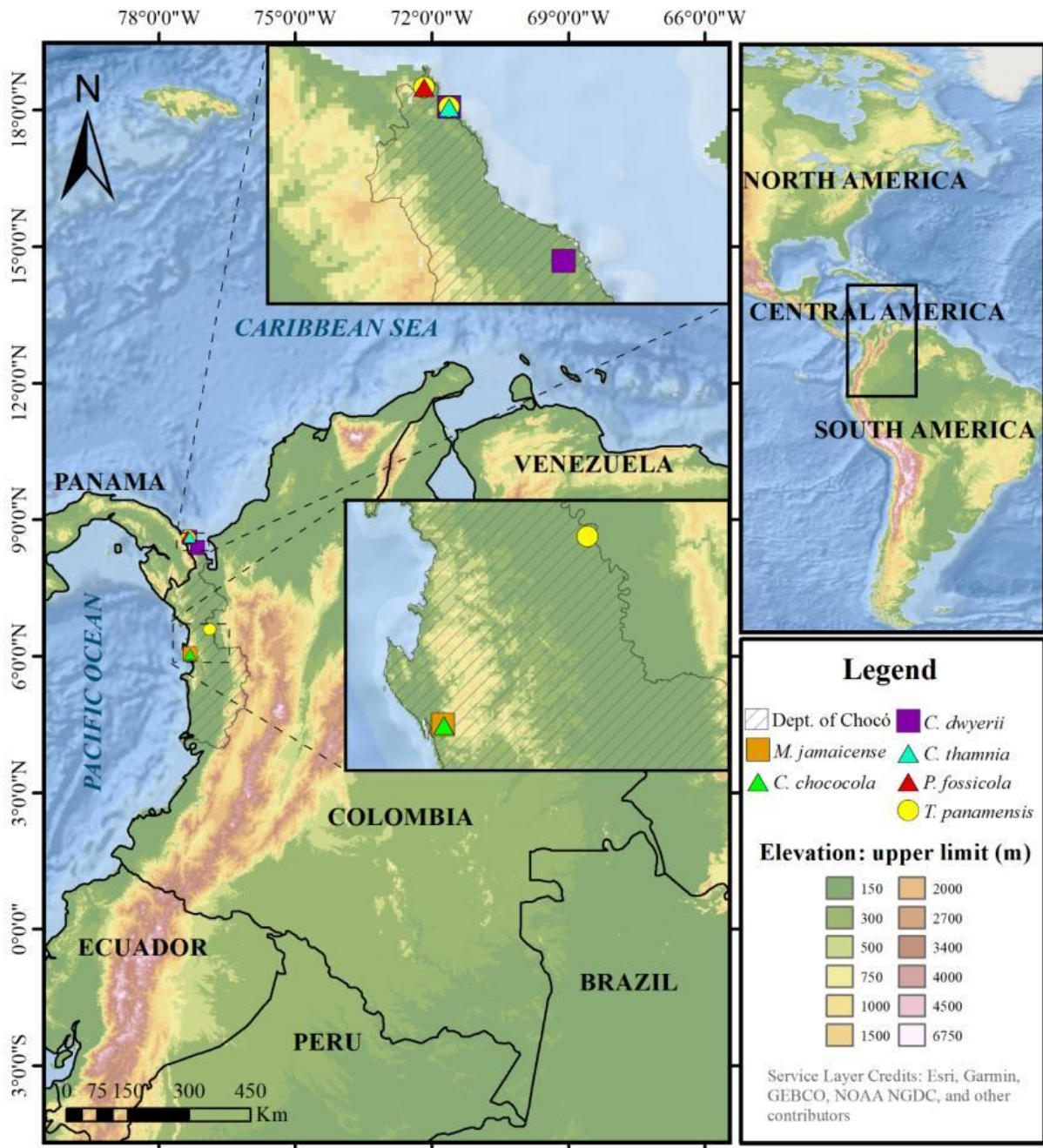


Fig. 3. Geographical distribution map inside Colombia of *Mosquitoxylum jamaicense*, *Cynometra dwyerii*, *Tachigali panamensis*, *Pouteria fossicola*; and georeferenced records of *Crematosperma chococola* and *Casearia thamnina*

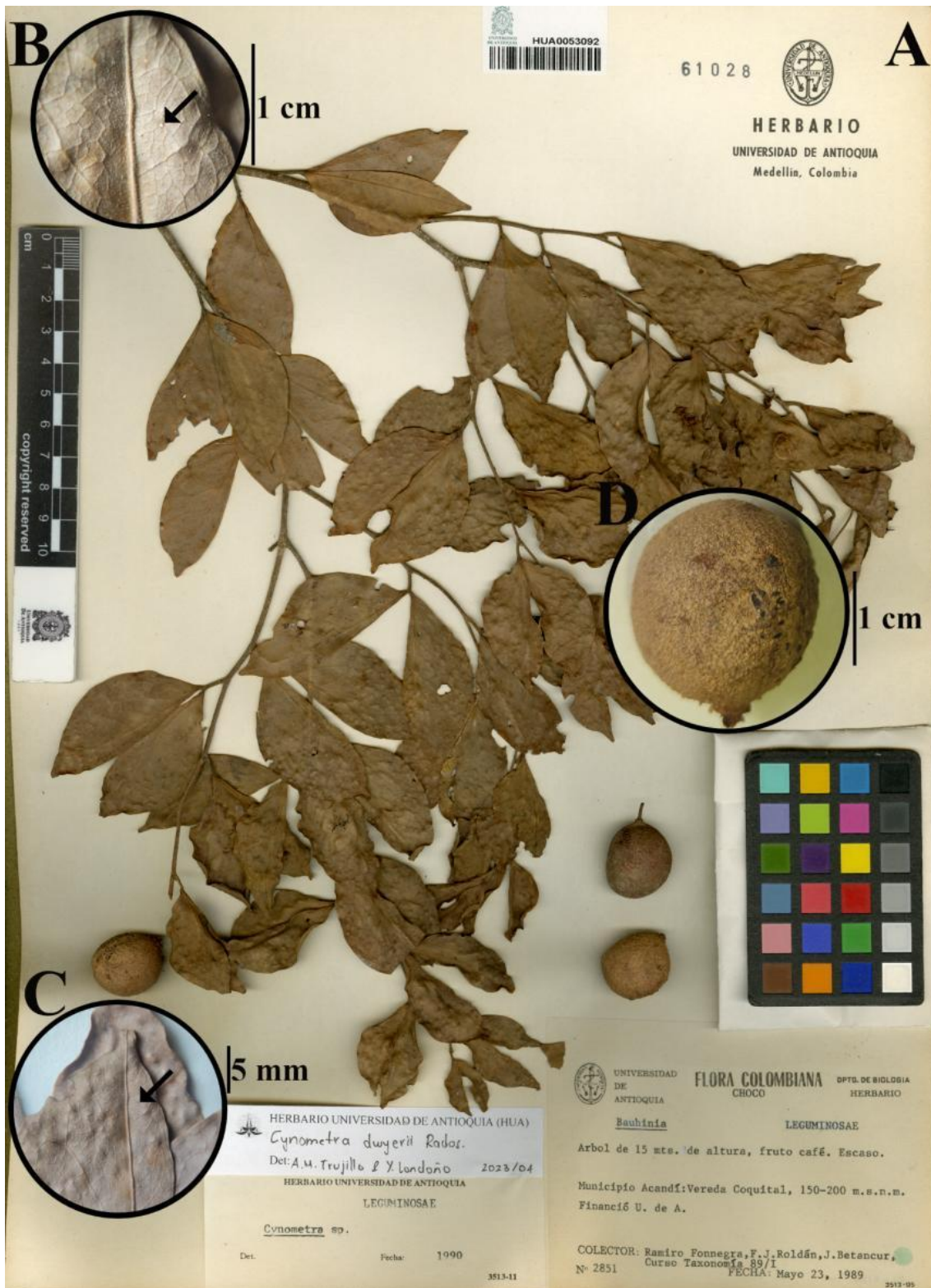


Fig. 4. Digital plate of *Cynometra dwyerii*. A) specimen at HUA. B) detail of leaflet at abaxial surface, showing laminar glands and indumentum, arrow indicating a gland. C) detail of leaflet at abaxial surface, showing distribution of laminar glands on the leaflet upper half, arrow indicating a gland. D) fruit, outer surface. A-D from *R. Fonnegra et al. 2851* (HUA accession 61028 [!]). Digital plate by Y. Londoño

Common names and uses: “Mierda de cachaco” from *E. Correa et al. 40* (Colombia); Alazano, Reseco (Panamá) [27]. It is used in construction and in manufacture of furniture and fence post [27].

Notes: *Tachigali panamensis* was known only from Panamá, being this the first record from Colombia. *T. panamensis* has been included under *Tachigali versicolor* Standl. & L.O. Williams distributed in Costa Rica, from which it differs mainly by its pinnate stipules (vs. entire in *T. versicolor*) [19]. *Tachigali panamensis* has been reported as monocarpic, dying after its first flowering [32].

Additional specimens examined: Colombia. Antioquia. Mun. Vigía del Fuerte: Comunidad indig. de Jarapeto, Río Jarapeto, 18 m, 6°35'33"N 76°53'12"W, 22 May 1993 (st), José A. Gómez 637 (HUA accession 100595 [!]). Chocó. Mun. Acandí: Reserva Agua Viva, 100m, 8 March 2000 (st), *E. Correa et al. 40* (HUA accession 151958 [!], JAUM [n.v.]); Corregimiento Capurganá, bahía El Aguacate, reserva Natural El Aguacate, parcela permanente, 200-250 m, 8°36'58.60"N, 77°19'41.60"W, 6 September 2008 (st), *S. E. Hoyos-Gómez et al. 868* (HUA accession 167754 [!]).

3.1.3 Sapotaceae

***Pouteria fossicola* Cronquist, Lloydia 9 (4): 289-290. 1946. Fig. 6.**

Type: Panama. Canal Zone: Barro Colorado Island, north shore near Pearson terminal, 7 September 1929 (fl & fr), *F. M. Salvoza 999* (holotype: A barcode 00075804 [digital image!]; isotype: A barcode 00075805 [digital image!]).

Distinctive morphology: Trees up to 30 m tall, young shoots finely white puberulous, stipules absent. Leaves spirally arranged, chartaceous, base acute to narrowly attenuate, mainly glabrous abaxially, secondary veins 13-20 in each side, tertiary veins oblique, quaternary veins finely areolate. Flowers with 7-8 sepals, spirally arranged, each appressed puberulous outside but glabrous toward margin, corolla tubular, 5-merous, sericeous outside, lobes entire, stamens included, staminodes present, ovary 5-locular. Fruits broadly ellipsoid to broadly ovoid, 10-25 cm long, surface densely lenticellate, seed with cotyledons plano-convex, without endosperm [20].

Distribution and habitat: Nicaragua to Panama [20,33]. Herein first documented from Colombia,

through a record from the Darién region, in the municipality of Acandí (Fig. 3). *Pouteria fossicola* in Colombia, inhabits lowland rainforest nearly to the sea level, under equatorial rainforest climate type (Af).

Common names and uses: Mamey, Mamey de injerto, Mamey verde (Panama); Zapote (Costa Rica) [20]; Zapote de montaña (Nicaragua) [33]; Sapote indio, Sapote de carne (Colombia) from *S. E. Hoyos-Gómez et al. 479*. Used as alimentary by its edible fruits, fide *S. E. Hoyos-Gómez et al. 479* and T.D. Pennington [20].

Notes: *Pouteria fossicola* has an edible fruit like to the fruit of *P. sapota* (Jacq.) H.E. Moore & Stearn, a species apparently closely related to it and widely used in Central and South America. This is the first record for Colombia, although the geographical range stills nearly equal because the record locality is very near to the frontier between Colombia and Panama. Previous record of *Pouteria fossicola* from Colombia are based in misidentified specimens from the Amazon biogeographic region (*D. Cárdenas et al. 42282* [NY!]), due fact, a duplicate of this specimen at the herbarium COAH was identified as *Pouteria baehniiana* Monach. by T.D. Pennington in the year 2017. *Pouteria fossicola* is clearly recognizable from the specimen *Cárdenas et al. 42282* by its leaves chartaceous (vs. coriaceous in *Cárdenas et al. 42282*), its leave quaternary veins finely areolate (vs. perpendicular to the tertiaries, not finely areolate), its sepals indumented but glabrous toward margins (vs. indumented throughout) and its corolla sericeous outside (vs. glabrous).

Additional specimens examined: Colombia. Chocó: Mun. Acandí, Bahía Sapzurro, La Diana Flanco Sur, selva húmeda tropical, 8°38'47"N, 77°21'58.9"W, 11 October 2005 (fl & fr), *S. E. Hoyos-Gómez et al. 479* (COL [n.v.], HUA accession 176081 [!], HUA accession 176106 [!]).

3.2 Noteworthy Records for Flora of Chocó Department

3.2.1 Annonaceae

***Crematosperma chococola* Pirie, Blumea 50: 47, f. 3. 2005. Fig. 7.**

Type:—COLOMBIA, Chocó: Alto de Buey, tropical wet forest, 500-1200 m, 8 January 1973 (fr), *A. H. Gentry & E. Forero 7286* (holotype: MO accession 2130033 [digital image!]; isotype: COL accession 192558 [digital image!]).



Fig. 5. Digital plate of *Tachigali panamensis*. A) specimen at HUA. B) detail of stipule. A-B from E. Correa et al. 40 (HUA accession 151958 [!]). Digital plate by Y. Londoño

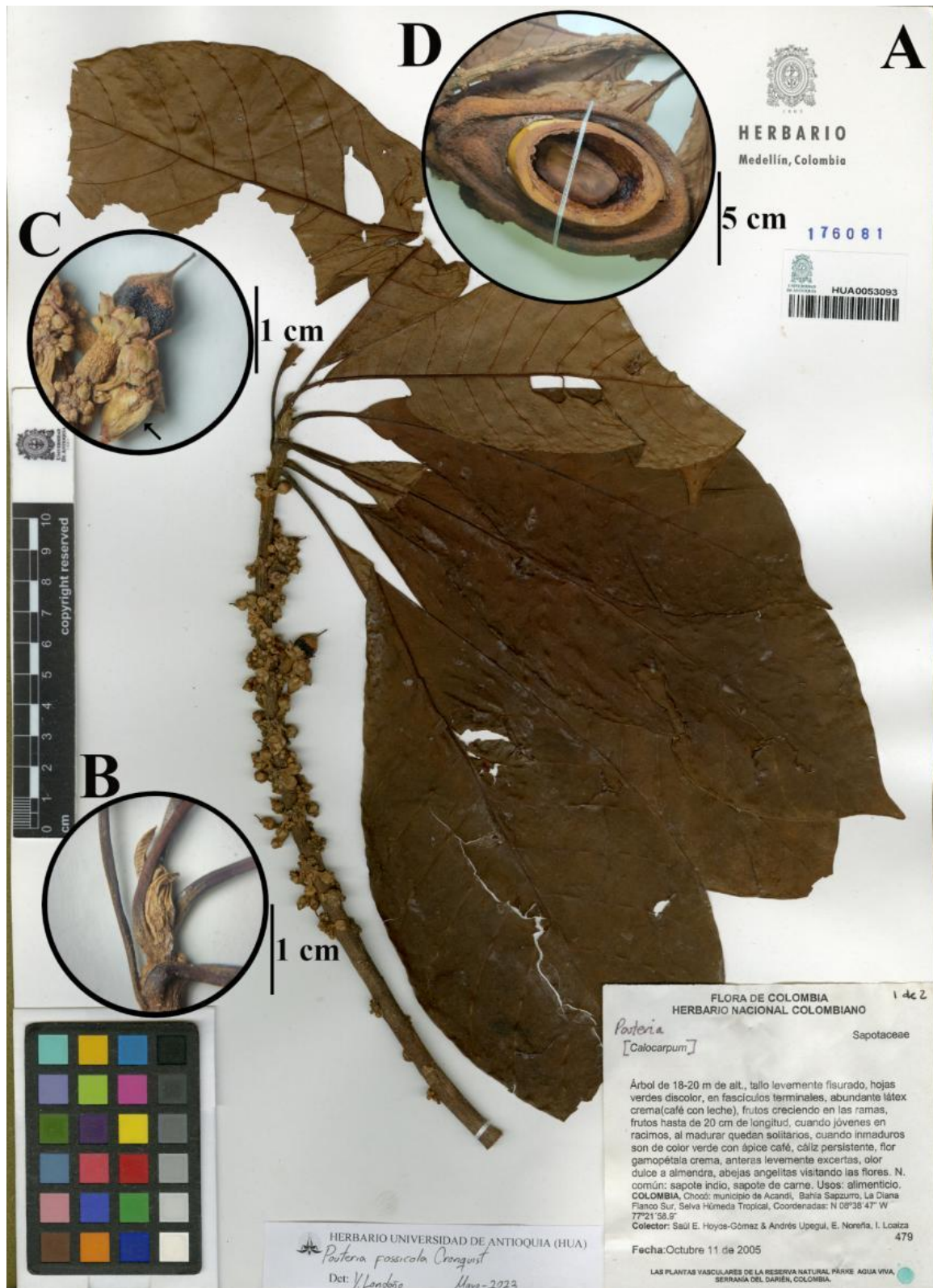


Fig. 6. Digital plate of *Pouteria fossicola*. A) specimen at HUA. B) young shoot. C) flowers and very immature fruit, arrow indicating the outer surface of corolla. D) mature fruit, longitudinally and manually open. A-C from S. E. Hoyos-Gómez et al. 479 (HUA accession 176081 [!]); D from S. E. Hoyos-Gómez et al. 479 (HUA accession 176106 [!]). Digital plate by Y. Londoño

Distinctive morphology: Trees ca. 5 m tall. Leaves blades narrowly elliptic, symmetrical, base acute to cuneate, apex acuminate, glabrous, concolorous, primary vein raised and grooved adaxially, secondary veins 8-10 in each side, marginal vein absent (e.g., present in the genus *Pseudoxandra* R.E. Fr.). Inflorescences cauliflorous, 1-flowered, pedicels 3.8-4.2 cm, glabrous. Fruits apocarpous, glabrous throughout, monocarps 10-13 per fruit, each 1.3-1.4 × 1-1.1 cm, indehiscent, ellipsoid and strongly asymmetrical, shorter than the stipes, each stipe 1.5-1.8 cm [21].

Distribution and habitat: Endemic to Colombia, where is recorded only for the Chocó department, at surroundings of the Baudó Mountain Range in the municipality of Bahía Solano [21] (Fig. 3). *Crematosperma chococola* inhabits the understory of lowland rainforest, at elevations between 0 to 1200 m, under equatorial rainforest climate type (Af).

Common names and uses: No common names and uses were reported.

Notes: *Crematosperma chococola* was only known by three specimens in the last review of the genus, of which the most recent one comes from the year 1990 [21]. The specimen Y. Londoño 264 is the first record after 28 years, representing the southernmost and more precisely georeferenced known population for this species.

Additional specimens examined: Colombia. Chocó: Mun. Bahía Solano, el Valle del Chocó, cuenca de la quebrada Mutatá, cerca a la comunidad indígena Boroboro, 307 m, 6°2'26.16"N, 77°18'26.34"W, 2 November 2018 (fr), Y. Londoño 264 (HUA accession 221719 [!], HUA accession 221720 [!]).

3.2.2 Salicaceae

***Casearia thamnina* (L.) T. Samar. & M.H. Alford, Novon 27 (1): 69. 2019. ≡ *Laetia thamnina* L., Plantarum Jamaicaensium Pugillus 31. 1759. Fig. 8.**

Type:—Jamaica. Red hills above the Angels, *P. Browne s.n.* (LINN Cat. 680.1 [digital image!]).

Distinctive morphology: Shrubs or trees up to 12 m tall. Leaves alternate, oblong to oblanceolate-oblong, apex acuminate, margin slightly crenulate, not revolute, persistent. Inflorescences as corymbiform cymes,

pedunculate. Flowers with receptacle unappendaged or unlobed, sepals 4, free, imbricate, petals absent, stamens perigynous, 60-80 per flower, filaments densely pubescent, ovary superior. Fruits as capsules.

Distribution and habitat: Mexico and West Indies to Panama and Colombia [22,34]. In Colombia only reported for Bolívar department through the specimen *M.H. Curran s.n.* (F accession 576264 [digital image!]; US accession 537578 [digital image!]) identified by H.O. Sleumer in the year 1978. Here, it is recorded first time from the Chocó department, basing in a record from the Darién region, in the municipality of Acandí (Fig. 3). *Casearia thamnina* in Colombia inhabits lowlands dry or rainforest habitat nearly to sea level, under equatorial climate types at several scales of precipitation (Aw and Af climate types).

Common names and uses: Wattlewood (Jamaica) [22]; Cafecillo, Quitacalzón (Costa Rica) [35]; Conejo, Conejo colorado, Palo blanco, Sarguia (Panama) [36,23]; Chauché, Ixiim Che, Zapote amarillo (México); Bakelac, Hueso de tortuga, Ixbakelac (Guatemala); Bullyhob, Night perfume, Perfume de la noche (Belice) [23]. Its wood is reported as creamish and hard, but any use is specifically reported by Sleumer [22]. More recently was reported as medicinal for the indigenous people of Panama and also as resource of wood for building [23].

Notes: *Casearia thamnina* stand as a widely distributed species, mainly at the Caribbean basin, including both continental and insular areas. The previous record from Colombia comes from the year 1916, in which M.H. Curran collected the specimens. The specimen *S. E. Hoyos-Gómez et al. 344* represents the second record for Colombia, 89 years after the Curran fieldwork; besides, it is the first record for the Chocó department. In the synopses of the genus *Laetia* Loefl. ex L. for Mesoamerica, *Casearia thamnina* (under *L. thamnina*) was recognized as a polymorphic species that perhaps include more than one taxonomic entities, even after the segregation of *Casearia povedae* (N. Zamora, Aguilar & D. Santam.) T. Samar. & M.H. Alford, a species previously confused and remarkably similar to *C. thamnina* [23]. The specimens here analyzed can be recognized from *C. povedae* by its leaves with margin slightly crenulate, the main useful feature for recognize these species indicated by the authors of *C. povedae*, which has leaves with margin entire in both juvenile and mature individuals.



Fig. 7. Digital plate of *Crematosperma chococola*. A) specimen at HUA. B) monocarps and seed surfaces. A from Y. Londoño 264 (HUA accession 221719 [!]); B from Y. Londoño 264 (HUA accession 221720 [!]). Digital plate by Y. Londoño



Fig. 8. Digital plate of *Casearia thamnina*. A) specimen at HUA. B) fruit, outer surface. C) fruit, longitudinally and manually open. A-C from S. E. Hoyos-Gómez et al. 344 (HUA accession 159705 [!]). Digital plate by Y. Londoño

Additional specimens examined: Colombia. Chocó. Mun. Acandí: corregimiento Capurganá, El Aguacate, Serranía del Darién, colecciones realizadas en el sendero de la toma de agua del Aguacate, cercanías quebrada la Esperanza y el filo de la montaña respectiva, 250-350 m, 8°37'N, 77°18'W, 24-25 July 2006 (fr), *Julio Betancur et al. 12295* (COL accession 563430 [digital image!], HUA accession 187760 [!]); Bahía El Aguacate, camino hacia la quebrada La Mora, [200-250 m], [8°36'58"N, 77°19'41.6"W], 30 June 2005 (fr), *S. E. Hoyos-Gómez et al. 344* (COL accession 544791 [digital image!], HUA accession 159705 [!]).

4. CONCLUSION

These records make up a small part of the plant diversity in the biogeographic Chocó, however they allow confirm that knowledge about the Chocó flora still requires extensive work. Being the biogeographical Chocó one of the global biodiversity hotspots, these records could be useful for future ecological studies or conservation plans for these species; in addition, they draw attention to the importance of continue carrying out scientific expeditions that improve the knowledge of Chocó flora through biological collections. This study also makes possible to highlight the importance of herbaria and biological collections as essential documentation and study centers in biodiversity research.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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