

## A revision of neotropical *Diospyros* (Ebenaceae): part 2

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### Abstract

In the course of a revision of New World Ebenaceae for "Flora Neotropica" and other regional floras, specimens from 75 herbaria have been studied. The four Central American species *Diospyros johnstoniana* STANDL. & STEYERL. (synonym: *D. xolocotzii* MADRIGAL & RZED.), *D. oaxacana* STANDL. (synonym: *D. torresii* PROVANCE & A.C.SANDERS), *D. rekoii* STANDL. (synonym: *D. morenoi* A.POOL), and *D. yatesiana* STANDL. ex LUNDELL (synonym: *D. zacapana* STANDL. & STEYERL.), as well as the Cuban endemic *D. halesioides* GRISEB., are here described in detail. Figures, distribution maps and lists of specimens are also presented.

**Key words:** Ebenaceae, *Diospyros halesioides*, *D. johnstoniana*, *D. morenoi*, *D. oaxacana*, *D. rekoii*, *D. torresii*, *D. xolocotzii*, *D. yatesiana*, *D. zacapana*, revision, taxonomy, flora of Central America and Cuba.

### Zusammenfassung

Im Rahmen einer Revision der neuweltlichen Ebenaceae für "Flora Neotropica" und andere Regionalfloren, konnten Herbarbelege aus 75 Herbarien studiert werden. Die vier mittelamerikanischen Arten *Diospyros johnstoniana* STANDL. & STEYERL. (Synonym: *D. xolocotzii* MADRIGAL & RZED.), *D. oaxacana* STANDL. (Synonym: *D. torresii* PROVANCE & A.C.SANDERS), *D. rekoii* STANDL. (Synonym: *D. morenoi* A.POOL) und *D. yatesiana* STANDL. ex LUNDELL (Synonym: *D. zacapana* STANDL. & STEYERL.), sowie der Kubanische Endemit *D. halesioides* GRISEB. werden hier in Detail beschrieben. Abbildungen, Verbreitungskarten und Listen der gesehenen Herbarbelege werden ebenfalls präsentiert.

### Introduction

In the Americas, the Ebenaceae are represented by the genera *Diospyros*, with about 100–130 species, and *Lissocarpa* with 8 species. In the course of an ongoing revision of Ebenaceae (WALLNÖFER 2001a, 2001b, 2003b, 2004a, 2004b, 2004c, 2006, 2007, 2008a, 2008b, WALLNÖFER & MORI 2002, ESTRADA & WALLNÖFER 2007) for "Flora Neotropica", "Flora of Ecuador", "Flora of the Guianas", "Flora de Paraguay" and "Flora ilustrada de la Península de Yucatán" several new species have already been described (WALLNÖFER 1999, 2000, 2003a, 2005).

Note: Additions are given in brackets; coordinates given in brackets have been determined during this revision; acronyms of herbaria according to HOLMGREN & HOLMGREN (1998–2009); herbarium specimens are arranged according to ZANELLA et al. (2000); data from herbarium labels are cited here in a standardized way; – abbreviations: defl = deflorate; fl = flowering; flbuds = with flower buds; fr = fruiting; st = sterile; yfr = with young fruits; carp = fruit in the carpological collection; n.s. = not seen; 2× = 2 sheets.

***Diospyros halesioides* GRISEB.**, Cat. pl. Cub. 168–169 (1866); [fig. 1–3].

**Typus:** Cuba or., Quemado [locality not traced; according to HOWARD (1988): Camagüey, possibly P. Principes], (fr), 2 Jul. 1860–1864, **C. Wright 2937** [lectotype: GOET (selected by HOWARD 1988: appendix 1: 157), isoelectotypes (?): BM, G 2×, GH, K, LE, MA n.s. (dig. photo), MO n.s., P], "a slender tree 20° h"; – Guantánamo, Cuchillas de Baracoa, [ca. 20°20' N, 74°35' W], (fl male), 20 Jun. 1860–1864, **C. Wright 2936** [syn-types (?): BM, G 2×, GH, GOET, K, LE, MA n.s. (dig. photo), MO, NY 2×, P 2×, S, US], "fruticose 10° h; flowers white"; [the data for both collections were taken from the original labels at GH].

Note: As had been noted previously when studying Wright's specimens pertaining to *D. caribaea* and *D. crassinervis* (WALLNÖFER 2007), and as is apparently also the case here, some of his different gatherings had been mixed at some later point and distributed under the same number. Therefore, it is not clear at all if all of the above mentioned duplicates of 2936 and 2937 may really belong to only two gatherings. A specimen deposited at NY, with male flowers on the twigs and a capsule containing some deteriorated seeds, bears two labels: a typical one (as can generally be seen on Wright's specimens) with the number 2937 but without locality and date and a second one, hand-written and unnumbered, with the following data: "Potrero Manati, Trinidad, Mar. 16" (here separately listed among the "specimens examined"). Another sheet at NY, numbered 2936, bears two twigs: one with male flowers and the other with female flowers (not fruits)! Unfortunately, the publication of HOWARD (1988) is very rare and, except for some parts of the appendices, not available to me. Therefore, it was not possible to check if HOWARD had noted anything about any subsequent, and possibly intentional, mix-up of Wright's original collections.

Shrubs or low trees up to ca. 5.5 m tall, apparently semi-deciduous, but flowers always developed on sprouting twigs; buds, twig apices and very young leaves densely covered with up to 1.5 mm long, straight, spreading, light brown hairs; young twigs terete, gray, brown or blackish brown, sometimes warty, ± densely covered with light brown (but core often dark brown), spreading or slightly appressed, straight or slightly flexuose hairs of different lengths when young, glabrescent and longitudinally fissured when older; **leaves** alternate, with brochidodrome venation; petioles (1–) 2–4 mm long, ca. 1 mm thick, covered with the same kind of indumentum as on the twigs, ± flat adaxially; leaf lamina broadly lanceolate or slightly obovate, sometimes elliptic, (1–) 3–8 (–9) cm long, (0.7–) 1.5–4 (–4.6) cm wide, (1.2–) 2–2.7 (–3.1) times longer than wide, firmly chartaceous, dull adaxially when dry, medium densely covered with spreading or patent, straight or slightly flexuose, 0.25–1.5 mm long hairs on both sides (indumentum adaxially, as well as the longer hairs abaxially weathered when old), sometimes warty due to the thickened bases of broken hairs adaxially; leaf apex acute and usually minutely mucronate (mucro often hidden between the long hairs), rarely obtuse or less commonly broadly rounded; base of the lamina attenuate; leaf margin entire, usually densely hairy, especially on the proximal part revolute when dry, with a irregularly sinuate marginal vein; flachnectaria on abaxial leaf surfaces 0–11 (often infected and transformed into protruding warts), usually missing near apex and base of the lamina; midvein flat or slightly impressed adaxially, markedly prominent abaxially, covered with a very dense indumentum on both sides (except on the distal half on the adaxial side); secondary

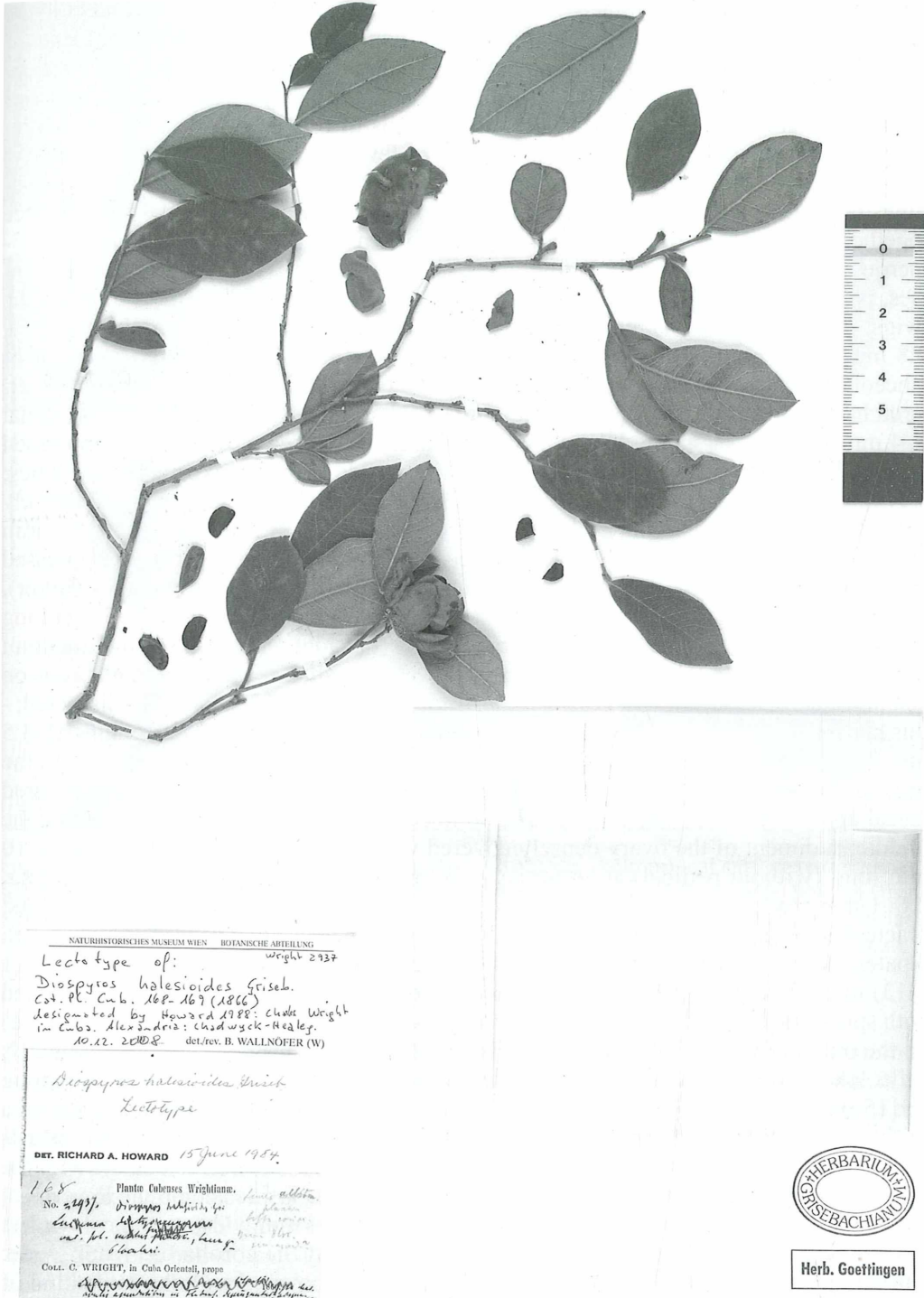


Fig. 1: Lectotype of *Diospyros halesioides* GRISEB.

veins 5–7 on each side, prominent (but area along them often sunken with respect to the rest of the lamina) adaxially, markedly prominent abaxially, the proximal ones  $\pm$  straight; intersecondary veins  $\pm$  conspicuous; tertiary and quaternary veins often reticulate and  $\pm$  prominent on both sides; **inflorescences**: cymes in the axils of soon caducous bracts, the female ones sometimes also in the axils of regular, but somewhat smaller leaves; the male ones (1–) 3-flowered, arranged a few together (less frequently solitary) near the base of sprouting, a few cm long, leafy shoots (the lower of these shoots sometimes lacking well developed leaves); female cymes 1-flowered, solitary or up to three together near the base of sprouting, up to several cm long, leafy shoots; **flowers** 4–5-merous; the male ones shortly before anthesis 7–9 mm long (without pedicel); peduncles, pedicels and bracts densely covered with the same kind of indumentum as on the twigs; peduncles 1–3 (–4) mm long and ca. 1 mm thick; pedicels 1–2 mm long and ca. 0.8 mm thick; bracts 3–5 (–7) mm long and 1–1.5 mm wide, narrowly triangular or lanceolate, acute or acuminate, adaxially glabrous or especially distally with some scattered hairs, caducous; calyx 5–6.5 mm long, ca. 3 mm wide, undivided in the proximal 3–4 mm, outside (including lobes) medium densely to densely covered with appressed or spreading, straight or slightly flexuose hairs, inside glabrous except for the lobes; calyx lobes triangular, acute distally, 2–3 (–3.5) mm long and 1.5–2 mm wide, densely hairy adaxially; corolla white when alive; corolla tube ca. 3.5 mm long, ca. 2.5 mm wide, widest near the middle, outside densely covered with long,  $\pm$  straight, appressed (near the base of the lobes  $\pm$  spreading), light brown hairs (their core sometimes darker), outside near the base and inside glabrous; throat narrowed; corolla lobes ca. 5 mm long and 1.5–2 mm wide, acute distally, on abaxial side (outside) with a similar indumentum as that on the calyx but hairs especially near the margins shorter and thinner, glabrous on adaxial side (inside); stamina 12 (only one, 4-merous flower of Ekman 7349 dissected; - this number has also been reported by HIERN 1873), of different sizes and lengths, 2–3.5 mm long, glabrous; filaments 0.5–1.5 mm long, their proximal 0.2–0.5 mm adnate to the base of the corolla tube; anthers ca. 1–2 mm long (except the ca. 0.5 mm long, pointed apical appendage of the connective) and up to ca. 0.5 mm wide, widest in or below the middle; rudiment of the ovary densely covered with erect hairs; **female flowers** ca. 10 mm long (without pedicel) at anthesis; stalk (peduncle and pedicel) 3–17 mm long, 0.6–1 mm thick, covered with the same kind of indumentum as on the male plants; bracteoles 5–6 mm long and 0.8–1.8 mm wide, medium densely to densely covered with  $\pm$  patent hairs of different lengths abaxially, less densely hairy adaxially; calyx (7–) 8–11 (–13) mm long, 10–15 mm wide, undivided in the proximal 3–4 mm, densely covered with spreading or  $\pm$  appressed, straight or slightly flexuose hairs (often with darker core) on the outside (abaxial side) and on both sides of the lobes, inside glabrous proximally; calyx lobes broadly ovate-triangular, acute or  $\pm$  acuminate distally, (4.5–) 6–11 mm long and (5–) 6.5–9 mm wide, on proximal parts with margins strongly flexed outwards; area of the sinuses between the calyx lobes only little expanded and not protruding towards the base of the calyx; corolla ca. 10 mm long, white when alive, covered outside with the same kind of indumentum as on the male flowers, glabrous inside and on the lowermost ca. 2 mm on the outside; corolla tube 8 mm long and ca. 4 mm wide, obconical, widest below the middle, near apex ca. 2 mm wide; aperture of the corolla ca. 1 mm wide; corolla lobes ca. 5–6 mm long and 1–2 mm wide, acute, covered with the same kind of indumentum as on the calyx, but hairs especially near the margins shorter and thinner,

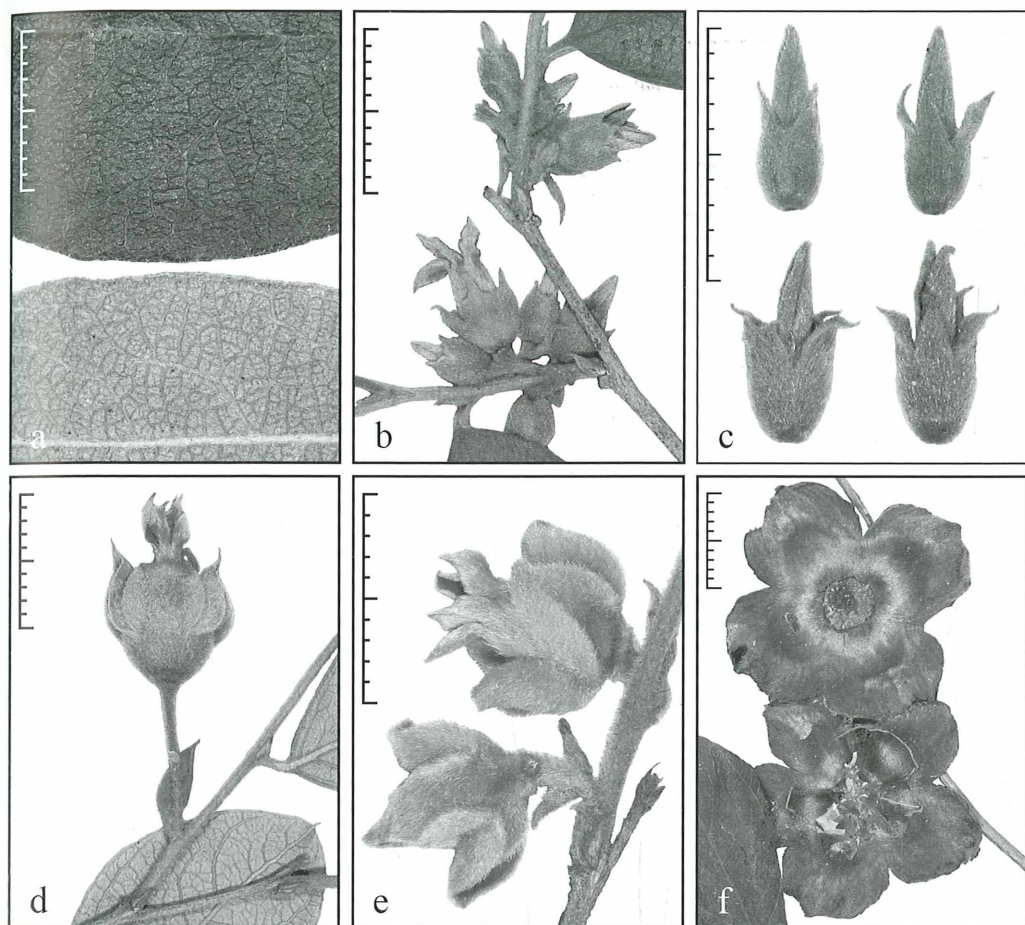


Fig. 2: *Diospyros halesioides*: **a**: adaxial (on top) and abaxial (bottom) leaf surface (from Ekman ser. III 5945 [MICH]); **b**: male inflorescence (from Wright 2936 [S]); **c**: male flowers (from Ekman 7349 [G]); **d**: female flower (from Ekman ser. III 8605 [S]); **e**: female flowers (from Jack 6009 [A]); **f**: calices of fruits, seen from adaxial side (from Bro. Chrysogone 2998 [NY]); scale = 1 cm.

glabrous adaxially (inside); staminodia 5 (only one, probably postanthetic, 5-merous flower of Ekman 8605 dissected), equal in shape and size, 4 mm long, glabrous; filaments 2.5 mm long, ca. 0.2 mm thick, their proximal 0.5 mm adnate to the base of the corolla tube; aborted anthers flat, 1.5 mm long, 0.5 mm wide, lanceolate,  $\pm$  acute distally; ovary as a whole 7 mm long, the lower subglobose part ca. 3–4 mm wide and 5 mm high, densely covered with appressed, straight,  $\pm$  parallel hairs, 8 or 10-locular (in the dissected flower 9 locules with ovules could be seen; HIERN [1873] could not study female flowers, but indicated the fruit to be 8-locular); stylodia 5 (in 4-merous flowers most likely 4), ca. 2 mm long, fused together except for the distal ca. 0.5 mm, densely covered with short hairs; stalk of the **fruits** 4–8 mm long and ca. 1.5 mm thick,

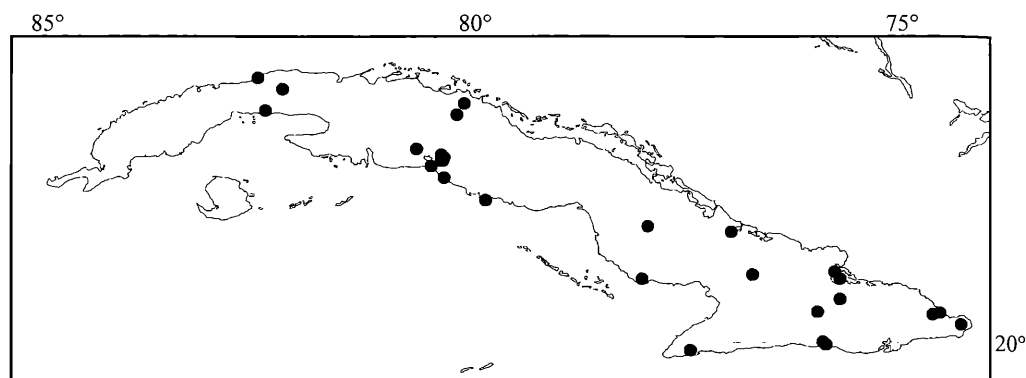


Fig. 3: Distribution of *Diospyros halesioides* GRISEB.

markedly enlarged distally; fruits  $\pm$  oblate-globose, ca. 3 cm in diameter (only crushed fruits were available), "red, like a tomatoe" when mature (?) and alive (León & Soustalot 9476), brownish and dull when dry, densely covered with light brown,  $\pm$  appressed, sub-parallel, straight or slightly flexuose hairs of different lengths and thickness when young, only scattered hairy or partially glabrescent with age; fruit wall ca. 0.5 mm thick, smooth, with tightly adhering epidermis; calyx ca. 3–4 cm in diameter and less than 1 cm high, undivided in the proximal ca. 4 mm, lacking longitudinal ridges running down from the sinuses abaxially, on both sides densely covered with a light brown indumentum; area around and below the sinuses between the calyx lobes only slightly expanded and protruding outwards; calyx lobes 10–14 mm long and 11–16 mm wide, broadly ovate, acute distally, with raised, longitudinal venation externally; margins and apices of the lobes  $\pm$  strongly flexed outwards on  $\pm$  mature fruits; mature seeds not available, the largest immature (and quite deteriorated) ones ca. 15 mm long, 8 mm wide and 6 mm thick, with a very finely structured surface.

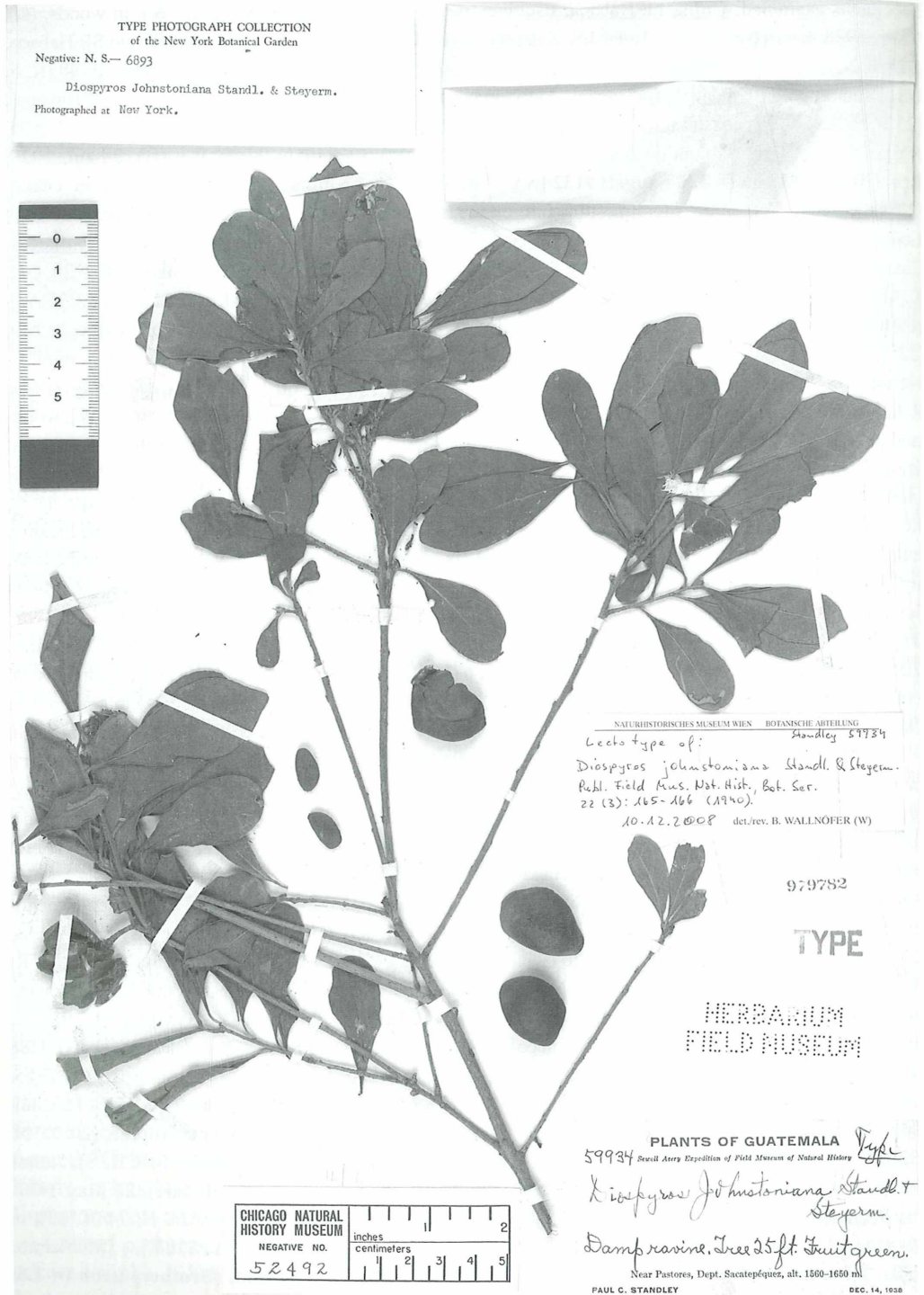
The anatomy of leaves and stems has been studied by PARMENTIER (1892).

Vernacular names and use: ébano blanco (according to several herbarium labels of Ekman; FONG et al. 2005); ébano blanco, ébano negro, manatí (SAUGET & LIOGIER 1957–1963). According to the latter authors, the whitish-yellow, hard and dense wood is used in carpentry.

Distribution, habitat, ecology, and phenology: This species is only known from Cuba (fig. 3) and has been reported by BORHIDI (1996) to occur in semi-deciduous, xerophytic forests (bosque semideciduo micrófilo), where it is a member of the plant association named "Grimmeodendro-Gochnatietum sagraeanae BORHIDI". According to herbarium labels, it has been collected in thickets, in low forests and in coastal thickets, both on limestone, on coastal limestone cliffs, on top of limestone hills (mogotes), in pastures, woodland pastures, in rocky woods, and in charrascales (thickets and low forests on serpentine rock). It has been collected in flower from March to June and in fruit from May to August.

Specimens examined: **Cuba, La Habana**, Esquivel, near Batabanó, [22°43' N, 82°23' W], in woods, (st), 9 Sep. 1928, **Bro. (Brother) León (= J.S. Sauget) 13642** [GH]; – Lomas de Camoa, ca. 25 km SE Habana, [22°58' N, 82°11' W], thickets in low forest, limestone, (defl male), 6 Nov. 1921, **E.L. Ekman 13448** [K, S, US], "small tree"; – **Ciudad de La Habana**, Mariano beach [= Marianao], (NY-label: thickets W of Havana), [23°6' N, 82°28' W], coastal thickets, (yfr), 17 Jun. 1916, **Bro. (Brother) León (= J.S. Sauget) 6257** [GH, NY]; – **Villa Clara**, Sabana de Amaro-Rodrigo (Sta. Clara), [22°40' N, 80°9' W], (st), 20 Jul. 1920, **Bro. (Brother) León (= J.S. Sauget) 9132** [NY], "shrub 2–3 m"; – hill near Sagua la Grande (Sta. Clara), [22°48' N, 80°4' W], on top of a limestone hill; on the highest Mogote, (fr), 12 Aug. 1920, **Bro. (Brother) León (= J.S. Sauget) & A. Soustaltot 9476** [GH, NY], "shrub 3 m; fruit red, like a tomatoe"; – **Cienfuegos**, Cienfuegos, Cieneguita, [22°16' N, 80°37' W], in rocky woods, (fr), 28 May 1895, **R. Combs 94** [F 2×, GH, K, MO, NY, P], "shrub 10 ft., rare"; – Cienfuegos Bay region, along bay coast, Milpa, [22°4' N, 80°27' W], coast, (st), Aug. 1941, **R.A. Howard 6368** [F, GH, UC], "small tree"; – Caunao River to Cienfuegos bay, [22°12' N, 80°20' W], (fr), 31 Jul. 1930, **J.G. Jack 8137** [F, LE, NY, S, US], "slender tree 18 ft. high"; – vicinity of Soledad, Finca de los Bermudes, [ca. 22°8' N, 80°20' W], in pastures, (fr), Aug. 1941, **R.A. Howard 6628** [GH, MICH, MO, NY], "10–12' tree"; – Soledad, Limones, [22°8' N, 80°19' W], woodland pastures, (st female), 31 Aug. 1927, **J.G. Jack 5384** [A, F, US], "small tree 10 ft. high"; – same locality and coordinates: pasture, (fl female), 28 Mar. 1928, **J.G. Jack 5886** [K, NY 2×, P, US 2×], "shrub or small tree; fls. creamy white, petals thick"; – same locality and coordinates: (fl male), 21 Apr. 1928, **J.G. Jack 6008** [A, K, NY, P, S, US, WIS (MAD) n.s.], "small tree 15 ft. high; fls. white"; – same locality, coordinates and date: (fl female), **J.G. Jack 6009** [A, NY], "small tree 15 ft.; flowers white"; – same locality, coordinates and date: (fl female), **J.G. Jack 6010** [A, G, K, NY, P, S, US n.s.], "small tree 12 ft high; flowers white"; – same locality and coordinates: (fr), 31 Jul. 1929, **J.G. Jack 7573** [A, FHO (fragm.), NY, US], "small tree 10 ft. high; fruit not yet ripe or fully grown, oblate, 1.25 in. diam."; – Soledad, Guabairo, [22°10' N, 80°18' W], (st), 24 Nov. 1928, **J.G. Jack 6717** [DS, F, US]; – same locality and coordinates: (fl female), 1 May 1929, **J.G. Jack 7316** [K, P, RSA, US], "10 ft. high; fls. white, waxy"; – Guajimico S of Cienfuegos, [21°56' N, 80°18' W], coastal limestone cliffs, (st female), 21 Mar. 1953, **Bro. (Brother) Alain (= E.E. Liogier) 2829** [GH, NY]; – **Sancti Spiritus**, Potrero Manati, Trinidad, [21°40' N, 79°49' W], (fl male), 16 Mar. 1860–1864, **C. Wright s.n.** (sub "2937"; see the note following the type) [NY]; – **Camagüey**, Camaguey, [ca. 21°22' N, 77°55' W], (st female), 10 May 1915, **J.T. Roig 913** [NY]; – Santa Cruz del Sur ad septentr. versus, [20°45' N, 77°59' W], in pascuis, (fl female), 11 May 1917, **E.L. Ekman ser. III 8605** [G, NY, S]; – **Las Tunas**, near Manatí, [21°18' N, 76°56' W], savanna, (st), 30 Dec. 1933, **Bro. (Brother) León (= J.S. Sauget) 16034** [GH]; – **Holguín**, Sabanaso, prope Mir ad occident. versus, [20°48' N, 76°41' W], in sylvia, (st), 26 Oct. 1915, **E.L. Ekman ser. III 6522** [S], "arbor parva"; – Antilla, [20°50' N, 75°44' W], in sylvia litoral (solo calcareo), (fl male), 22 May 1916, **E.L. Ekman 7349** [F, G, K, MICH, NY, S, US], "arbor"; – Preston ad Nipe Bay prope viam ferream, [20°45' N, 75°40' W], in fruticet., (defl male), 13 Nov. 1914, **E.L. Ekman ser. III 3421** [G, NY, S], "arbor parva"; – **Granma**, vic. Sevilla, Pinar del Papayo, [ca. 19°55' N, 77°25' W], in collibus, (defl male), 23 Jun. 1918, **E.L. Ekman ser. III 9288** [S], "arbor parva"; – **Santiago de Cuba**, Bayate, [20°22' N, 75°56' W], in sylvia, (st), 2 Jul. 1915, **E.L. Ekman ser. III 6201** [S], "arbor parva"; – Renté, Santiago Bay, [ca. 20°1' N, 75°52' W], (fr), Jul. 1943, **Bro. (Brother) Chrysogone 2998** [GH n.s., NY]; – Sierra de Nipe, Loma de la Estrella, [20°31' N, 75°40' W], in charrascales, (defl male), 8 Jun. 1915, **E.L. Ekman ser. III 5945** [F, MICH, S], "arbor parva"; – Santiago (ad austr. versus), [ca. 19°59' N, 75°50' W], in pascuis, (defl male), 21 May 1917, **E.L. Ekman ser. III 8634** [F, S]; – **Guantánamo**, Baracoa, Finca Playuela, [ca. 20°21' N, 74°30' W], in sylvia ("on the coral reef"), (st), 28 Jan. 1915, **E.L. Ekman ser. III 4503** [G, K, NY, S, US]; – [Municipio] Maisí, Mesa del Chivo, [ca. 20°13' N, 74°15' W], (defl male), Jul. 1938, **Bro. (Brother) León (= J.S. Sauget) 18306** [NY].



Fig. 4: Lectotype of *Diospyros johnstoniana* STANDL. & STEYERM.



*Diospyros johnstoniana* STANDL. & STEYERM., Publ. Field Mus. Nat. Hist., Bot. Ser. 22 (3): 165–166 (1940); [fig. 4–7].

**Typus:** Guatemala, Sacatepéquez, along Rio Guacalate, near Pastores, 1560–1650 m, [14°36' N, 90°45' W], damp ravine, (fr), 14 Dec. 1938, **P.C. Standley 59934** [Lectotype: F (here designated; photo F 52492; photo NY: N.S. 6893 at FHO), isotypes: A n.s., F n.s. (dig. photo), MICH, NY, US]; "tree 25 ft.; fruit green"

= *Diospyros xolocotzii* MADRIGAL & RZED., Acta Bot. Mex. 1: 3–6, fig. 1 (1988).

**Typus:** Mexico, Michoacán, Mun. Morelia, La Mintzita, 10 km al SW de la ciudad de Morelia, 1930 m, [19°39' N, 101°16' W], matorral subtropical, primario; asociacion: *Celtis*, *Cedrela*, *Ehretia*, *Phoebe*, *Casimiroa*, *Morus*, *Condalia*, *Forestiera*; montículo pequeño; suelo: rocoso, litoso; roca: basalto, (fl female), 15 Apr. 1987, **X. Madrigal-Sánchez 4245** [holotype: IEB n.s., isotypes: CIIDIR n.s., EBUM n.s., ENCB n.s., IBUG? n.s., MEXU n.s., MICH (fig. 5), TEX]; "5 m, 15 cm diam.; corteza rugosa, castaño-grisáceo; flor aromática; vern. name: zapote prieto"

Tree ("shrub") up to 8 m tall (already flowering when 4 m tall), deciduous; trunk up to 30 cm in diameter, only slightly grooved (Madrigal-Sánchez 3745); bark on trunks grayish or brownish-gray, with quadrangular scales on lower parts and a rugose surface on upper parts (Madrigal-Sánchez 4172, 4174); wood medium hard and heavy, yellow when alive, turning dark brownish-gray when dry (for further details see MADRIGAL-SANCHEZ & RZEDOWSKI 1988); buds densely covered with straight or slightly flexuose, appressed or slightly spreading, whitish-gray or brown, rarely blackish-brown hairs; young, sprouting twigs subterete (near apex somewhat compressed below the leaf insertions), sparsely or medium densely covered with minute, usually patent, whitish-translucent, stiff hairs and some scattered longer hairs similar to those on the buds (indumentum soon ± lost in the Mexican population, but somewhat more persistent in the populations from Guatemala and El Salvador); older twigs glabrous, gray, later on dirty brown or blackish-brown, bearing longitudinal lenticels; old leaf scars raised; **leaves** alternate, with brochidodrome venation; petioles 2–5 (–6) mm long, 0.8–1 mm thick, medium densely covered with minute, patent, whitish-translucent, stiff hairs adaxially and very scattered, often dark brown, longer, appressed hairs abaxially (petioles soon becoming glabrescent in the northern population, but not so early in the southern ones); leaf lamina obovate, very rarely ± lanceolate, (0.7–) 2–6 (–7) cm long, (0.6–) 1–3.3 cm wide, (1.3–) 1.7–3 (–4.3) times longer than wide, firmly chartaceous, slightly shiny when alive adaxially, dull when dry and glabrous on both sides, or sometimes especially in the proximal half with scattered, long, appressed, whitish, dark brown or rarely black hairs abaxially, sometimes minutely granulate on both sides; leaf apex broadly rounded, less frequently obtuse, rarely emarginate; base of the lamina narrowly cuneate or long attenuate, tapering wing-like into the petiole; leaf margin entire, revolute when dry; flachnectaria on abaxial leaf surfaces 0–3, missing at the base and near the apex of the lamina; midvein on the adaxial side flat or slightly impressed, sometimes slightly prominent but area along it somewhat sunken, glabrous or covered with patent, whitish-translucent, stiff hairs proximally, on the abaxial side markedly prominent; secondary veins ca. 5 per side, flat or slightly raised adaxially, prominent abaxially; intersecondary veins not conspicuous; tertiary and quaternary veins ± flat and inconspicuous on both sides; **inflorescences:** cymes of both sexes in the axils of soon caducous bracts; the male ones 1-flow-

DEC 02 1992



Isotype of: *Diospyros xolocotzii* Madrigal & Rzed.  
Acto Bot. Mex. 1: 3-6 (1988).

10.12.2008 det./rev. B. WALLNÖFER (W)

INSTITUTO DE ECOLOGIA - CENTRO REGIONAL DEL BAJIO  
*Diospyros xolocotzii* Madrigal & Rzedowski  
ISOTIPO

Determinó

UNIVERSIDAD MICHOACANA DE SAN NICOLAS DE HIDALGO  
ESCUELA DE BIOLOGIA-MORELIA, MICH. MEXICO  
HERBARIO

N.º. *Diospyros* N.º. "zapote prieto"  
Fam. Ebenaceae Loc. La Mintzita  
Estado MICHOACAN Mpio. Morelia  
Habitat: Asnm. 1930 s. Topografía montículo pequeño  
Suelo rocoso, litosol Roca basalto  
Vegetación: Tipo matorral subtropical Asociación Celtis,  
Cedrela, Ehretia, Phoebe, Casimiroa, Morus, Condalia, Forestiera  
Prim. (Xsec.) Planta: F. Biol. M. Alt. 5 m. Diam. 15 cm. Corteza  
rugosa, castaño-grisáceo Fenol. Fl. 3 Abund. (1)  
Usos.  
Colector (es) X. Madrigal Sánchez  
No. 4245 Observaciones: planta femenina; flor aromática  
Det. Fecha 15.IV.1987

Fig. 5: Isotype of *Diospyros xolocotzii* MADRIGAL & RZED.

ered, arranged, (1–) 3–7 together, near the base of sprouting, a few cm long, leafy shoots or on much shorter (only a few mm long), undeveloped, leafless shoots (their subtending leaf already fallen) which end in a vegetative bud; female cymes 1-flowered, 1–4 together near the base of sprouting, a few cm long, leafy shoots; **flowers** 5-merous when male and (5–) 6–7 (–8)-merous when female; male flowers ca. 8 mm long (without pedicel); stalk (peduncle and pedicel) 4–7 (–13) mm long and 0.5 mm thick, medium densely covered with  $\pm$  patent,  $\pm$  straight, stiff, translucent or rarely dark brown hairs and some scattered glands; bracts ca. 2 mm long and wide, usually soon caducous, abaxially covered with a similar indumentum as on the buds, adaxially only with scattered, sessile glands; bracteoles 1–3 mm long and 0.5 mm wide, ovate or  $\pm$  oblong, abaxially bearing the same kind of indumentum as on the pedicels, adaxially only with scattered sessile glands; calyx 4 mm long, undivided in the proximal 1 mm, on the outside (including the lobes) scattered to medium densely covered with appressed or spreading, straight or slightly flexuose hairs; calyx lobes triangular, 2.5–3 mm long, 2 mm wide, acute distally, at the apex with a dense tuft of dark brown hairs, on the adaxial side medium densely covered with appressed, small hairs, distally with patent hairs and in the central part only with some scattered sessile glands; corolla cream-colored when alive; tube 7 mm long, funnel shaped, widest just below the apex and there ca. 4 mm wide (aperture of the corolla ca. 2 mm wide), on the outside medium densely covered with  $\pm$  spreading, often flattened, straight or flexuose hairs, on the inside distally scattered and proximally densely covered with small, patent, straight, light hairs; corolla lobes  $\pm$  circular, ca. 2.5 mm long and 2–2.8 mm wide, on the outside and on the margins densely covered with  $\pm$  appressed or spreading hairs, on the inside towards the margins medium densely to scattered covered with much smaller, often flattened, flexuose hairs and towards the throat  $\pm$  glabrous; stamina 18 (only one flower of Madrigal-Sánchez 4247 dissected; MADRIGAL-SANCHEZ & RZEDOWSKI 1988 indicate 20), of different lengths, some paired, 3.5–6.5 mm long; filaments 2–4 mm long, adnate to the base of the corolla tube except for the distal ca. 0.5–1 mm, densely covered with small, patent, straight hairs; anthers 2–2.5 mm long and 1 mm wide, widest below the middle, strongly narrowed and pointed distally, glabrous, but at the apex papillose or with some, small hairs, opening by two lateral slits in the distal half; rudiment of the ovary glabrous, forming an elevated, ring-like bulge with a deep funnel-like depression in the center; **female flowers** (available only from the Mexican population) ca. 7–8 mm long (without pedicel and considering the calyx lobes to be spreading), scented (Madrigal-Sánchez 4245); stalk (peduncle and pedicel) 7–16 mm long and 0.8–1 mm thick at anthesis, bearing scattered,  $\pm$  patent, small hairs; bracts and bracteoles already shed at anthesis; calyx ca. 1 cm long, undivided in the proximal 2 mm, medium densely covered with appressed, straight or slightly flexuose hairs on its proximal parts on the outside; calyx lobes ovate-lanceolate, obtuse distally, 7–9 mm long and 3–4 (–5) mm wide, often  $\pm$  strongly revolute, on distal parts often with a slightly wavy margin when dry, with scattered, appressed, whitish or sometimes below the apex dark brown hairs abaxially, glabrous or with scattered, sessile glands adaxially, at the apex with a dense tuft of dark brown or blackish hairs (these usually weathered on fruits); corolla whitish to cream-colored when alive (Santos Martínez 2050, MADRIGAL-SANCHEZ & RZEDOWSKI 1988); tube urceolate, ca. 5 mm long and ca. 5–6 mm wide, widest below the middle, medium densely covered with appressed or  $\pm$  patent hairs (but glabrous near the base) on the out-

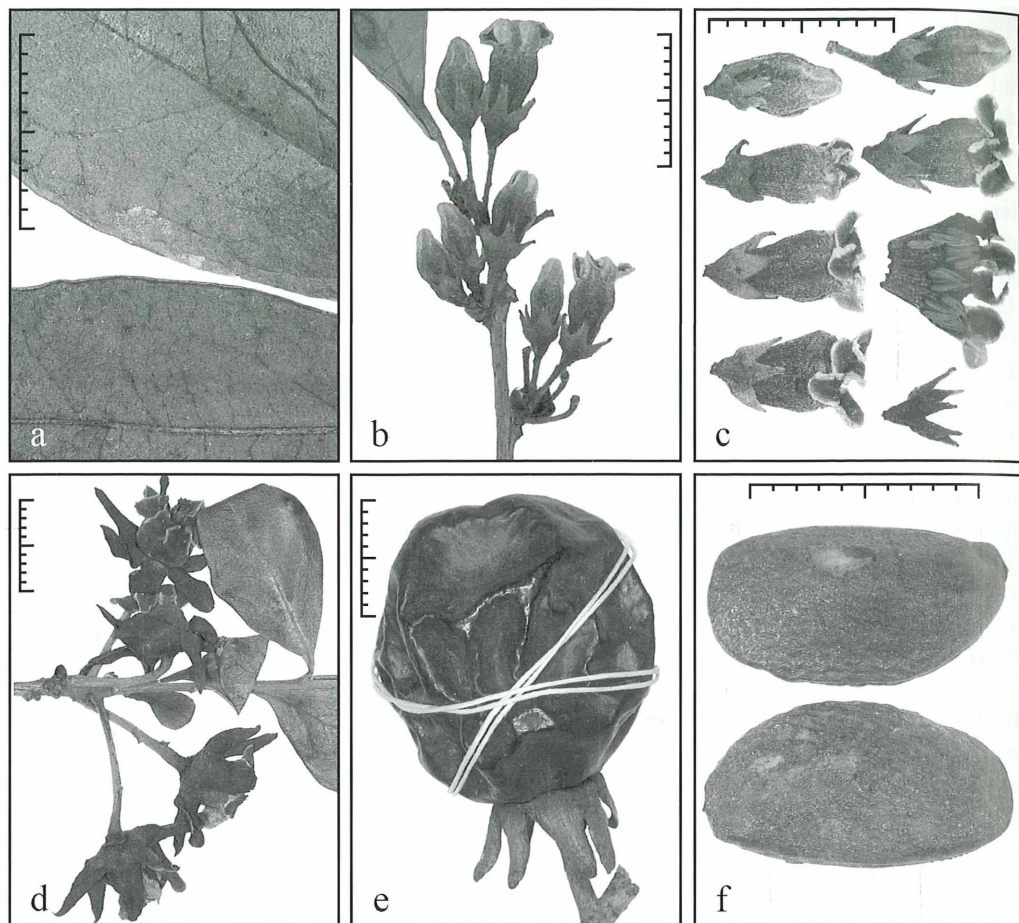


Fig. 6: *Diospyros johnstoniana*: **a**: adaxial (on top) and abaxial (bottom) leaf surface (from Gomez s.n. ISF00365 [MO]); **b**: male inflorescence (from Madrigal 4247 [MICH]); **c**: male flowers (from Madrigal 4247 [MICH]); **d**: female inflorescence (from Madrigal 4172 [MEXU]); **e**: fruit (from Madrigal 3745 [TEX]); **f**: seeds (from Standley 59934 [F]); scale = 1 cm.

side, on the inside (Madrigal-Sánchez 4172 at MICH) with scattered, smaller, patent hairs or partially glabrous; aperture of the corolla ca. 3–4 mm wide; corolla lobes broadly lanceolate to elliptic, ca. 4–5 mm long and ca. 4 mm wide, obtuse distally, outside (abaxial side) with the same kind of indumentum but denser as that on the tube, on the inside covered with shorter, strongly flexuose or collapsed hairs, on the margins densely matted, distally with a dense tuft of longer, light hairs; staminodia apparently missing (but this needs confirmation); ovary ca. 4 mm in diameter, glabrous, apparently 14-locular (as seen on fruits of Madrigal-Sánchez 3745, but confirmation required); stylopodia (5–) 6, ca. 4 mm long, fused together in the lowest ca. 1 mm, medium densely covered with appressed or spreading hairs, slightly clavate distally; stalk of the **fruits** (4–) 10–15 mm long and 2 mm thick; fruits ellipsoidal or oblate-globose, up to 3.3 cm in

diameter and up to 2.8 cm high when dry (according to MADRIGAL-SANCHEZ & RZEDOWSKI 1988: 2.5–3.5 cm in diameter and 3–4.5 cm high when alive), green or yellowish (Sandoval & Chinchilla 3) or dark brown (MADRIGAL-SANCHEZ & RZEDOWSKI 1988) when unripe and alive, black, shiny and pendulous (Santos Martínez 2050, MADRIGAL-SANCHEZ & RZEDOWSKI 1988) when ripe and alive, black or blackish-brown, smooth and with large folds when dry, glabrous (Mexican population) or with a scattered to medium dense indumentum basally and distally (southern populations), 2–5-seeded (MADRIGAL-SANCHEZ & RZEDOWSKI 1988); fruit wall thin, 0.25–0.5 mm thick, with the epidermis adhering when dry; fruit pulp black, soft and sweet (MADRIGAL-SANCHEZ & RZEDOWSKI 1988); calyx on fruits brownish-green when alive (MADRIGAL-SANCHEZ & RZEDOWSKI 1988), undivided in the proximal 1–3 mm; area below the sinuses between the lobes inconspicuous; lobes 8–12 mm long and 2.5–4 mm wide, strongly reflexed and orientated  $\pm$  parallel to the pedicel, flat or longitudinally revolute when dry, oblong or ovate-lanceolate, obtuse distally, firm, glabrous on both sides in the northern (Mexican) population, covered with scattered,  $\pm$  patent, small hairs on both sides in the southern populations (Guatemala, El Salvador), without conspicuous, longitudinal venation; seeds flattened, 13–14 mm long, 7–8 mm wide, 4–5 mm thick, (MADRIGAL-SANCHEZ & RZEDOWSKI 1988 reported the seeds to be 15–18 mm long and 10–11 mm wide), brownish, with a very finely structured surface.

Flowers from populations in Guatemala and El Salvador are urgently needed for study.

Figures: twig, male and female flower, fruit, seed (MADRIGAL-SANCHEZ & RZEDOWSKI 1988; same plate as in CARRANZA GONZÁLEZ 2000).

Vernacular names and use: in Mexico: zapote prieto (Madrigal-Sánchez 3745, 4172, 4174, 4245, 4247, CARRANZA GONZÁLEZ 2000, MADRIGAL-SANCHEZ & RZEDOWSKI 1988). The fruits are reported to be edible (MADRIGAL-SANCHEZ & RZEDOWSKI 1988); – in El Salvador: cacho de venado (Sermeño AS0043 (JBL 930), Sandoval & Chinchilla 3, LINARES 2005, WHITEFOORD & KNAPP 1999–2008), ébano (LINARES 2005), limoncillo silvestre (Gómez s.n., LINARES 2005, WHITEFOORD & KNAPP 1999–2008), palo negro (Sandoval & Sandoval 981, LINARES 2005, WHITEFOORD & KNAPP 1999–2008), pergamino negro (LINARES 2005).

Distribution, habitat, ecology, and phenology: This species is known from one small population in Michoacán (Mexico) and from the type locality in Sacatepéquez (Guatemala), as well as from a few places in Ahuachapán (El Salvador), where it grows at elevations of 350 m in El Salvador, 1560–1650 m in Guatemala, and 1900–1930 m in Mexico, (fig. 7). In Guatemala it was reported to have been found in a damp ravine, in El Salvador in a primary forest on a slope, and in Mexico (a distribution map was published by CARRANZA GONZÁLEZ 2000) in a subtropical matorral (shrubland) on small, basaltic hills. On these hills it grows on rocky ground, as well as on undulate terrain covered with clay soil or lithosol. The population occurring there is small (only 20 individuals have been counted in 1988) and was (and probably still is) heavily threatened by agricultural activities (for further details see MADRIGAL-SANCHEZ & RZEDOWSKI 1988). In Michoacán, this species was reported to be leafless in January and February, to flower in March and April, and to bear mature fruits in December and January (MADRIGAL-SANCHEZ & RZEDOWSKI 1988). In Guatemala and in El Salvador it has been collected in fruit in February, during July and August and from November to December.

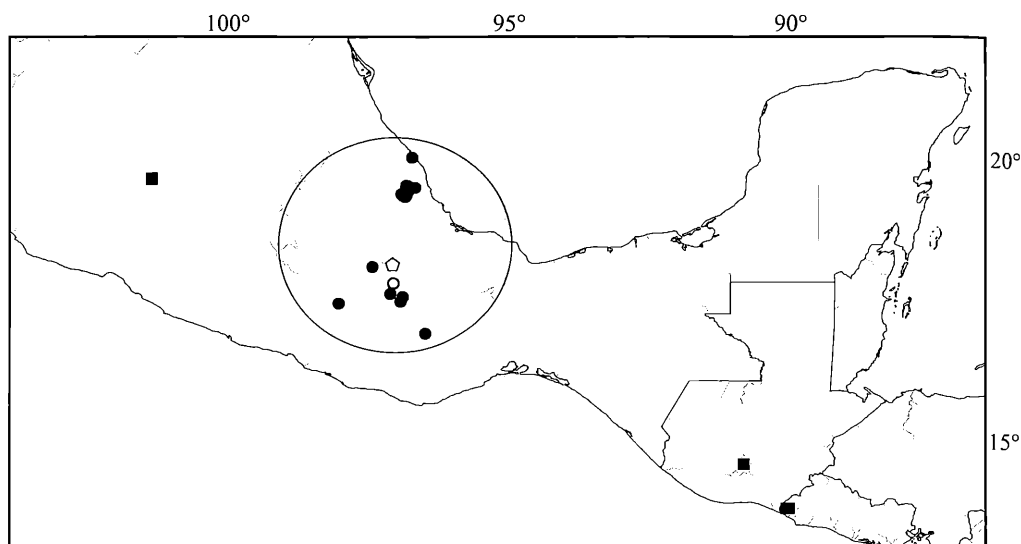


Fig. 7: Distribution of *Diospyros johnstoniana* STANDL. & STEYERM. (■) and, within the large circle, of *D. oaxacana* STANDL. (●; – type locality of *D. oaxacana*: ○; type locality of *D. torresii* PROVANCE & A.C.SANDERS: ○).

Specimens examined: **Mexico**, **Michoacán**, Municipio de Morelia, La Mintzita 10 km al SW de la ciudad de Morelia, 1930 m, [19°39' N, 101°16' W], matorral subtropical; terreno ondulado, rocoso; suelo arcilloso, (fr), 19 Sep. 1984, **X. Madrigal-Sánchez 3745** [EBUM n.s., ENCB n.s., IEB n.s., MEXU n.s., MICH, TEX, paratypes]; "corteza rugosa, grisacea; tallo poco acanalado"; – same locality: matorral subtropical; vegetación primaria; asociacion: *Celtis*, *Cedrela*, *Ehretia*, *Casimiroa*, *Phoebe*, *Morus*, *Opuntia*, *Ipomoea*; ladera de montículo, terreno ondulado; suelo: rocoso, litosol; roca: basalto, (fl female), 27 Mar. 1986, **X. Madrigal-Sánchez 4172** [EBUM n.s., ENCB n.s., IEB n.s., MEXU, MICH, TEX, paratypes]; "7 m alta, 15 cm diam.; corteza con placas cortas en la base, rugosa; planta femenina"; – same locality: matorral subtropical; vegetación primaria; asociacion: *Celtis*, *Erythrina*, *Cedrela*, *Ehretia*, *Casimiroa*, *Phoebe*, *Morus*; cima de montículo, terreno ondulado; suelo: rocoso, litosol; roca: basalto, (fl male), 27 Mar. 1986, **X. Madrigal-Sánchez 4174** [EBUM n.s., ENCB n.s., IEB n.s., MEXU, MICH, paratypes]; "7 m alta, 30 cm diam.; corteza con placas cortas en la base, rugosa; planta masculina"; – same locality: matorral subtropical; vegetación perturbada por cultivos agrícolas y tala; loma pequeña; suelo rocoso, litosol, (fl male), 15 Apr. 1987, **X. Madrigal-Sánchez 4247** [EBUM n.s., ENCB n.s., IEB n.s., MEXU, MICH, TEX, paratypes]; "planta masculina"; – alrededores de la Laguna La Mintzita, 1900 m, [19°38' N, 101°16' W], matorral, sobre peñas; potrero, malpais, (fl female), 19 Apr. 1987, **J. Santos Martínez 2050** [EBUM n.s., ENCB n.s., IEB n.s., MEXU]; "árbol de 4.5 m de alto; flores color crema; fruto negro; escaso"

**El Salvador**, **Ahuachapán**, Municipio San Francisco Menéndez, P.N. El Imposible, San Benito, 13°49' N, 89°56' W, bosque primario, en una pendiente de 36 grados; arboles alrededor: 1 mano de león, 1 pimienta negro, 1 salitre; arbustos alrededor: 2 chaparrones, 2 guayacán, 1 zorrillo, 1 cerezo, (fr), 18 Dec. 1989, **A. Sermeño AS0043 (JBL 930)** [B n.s., FHO, LAGU n.s., MEXU n.s., MO]; "árbol 8 m; frutos verdes"; – same area: San Benito, al N de entrada cafetal de Isidro, La Cumbre, 13°49' N, 89°56' W, (fr), 8 Feb. 1993, **E. Sandoval & M. Sandoval 981** [B n.s., LAGU n.s., MO]; "árbol; hojas hasta 6.5 cm de largo y 3 cm de ancho; frutos verdes; no comun"; – same area: Hda. San Benito, Cerro León, mirador del Cerro León,



13°49' N, 89°56' W, (fr), 15 Nov. 1991, **Sandoval & F. Chinchilla 3** [B n.s., LAGU n.s., MO]; "árbol 7 m; frutas amarillas"; – same area: Cerro El Caballo, sendero el potrillo, 13°49' N, 89°56' W, (fr), 25 Jul. 1994, **F. Gómez s.n. (LAGU: ISF00365)** [MO]; "arbusto ca. 4 m; hojas hasta 4.8 cm de largo y 2 cm de ancho; fruto verde"; – El Corozo, Mariposario, zona alta "Los Sánchez", 350 m, 13°49' N, 89°59' W, (fr), 14 Aug. 2000, **J.M. Rosales 1286** [B, LAGU n.s.]; "arbusto de ca. 5 m; corteza gris; fruto verde"

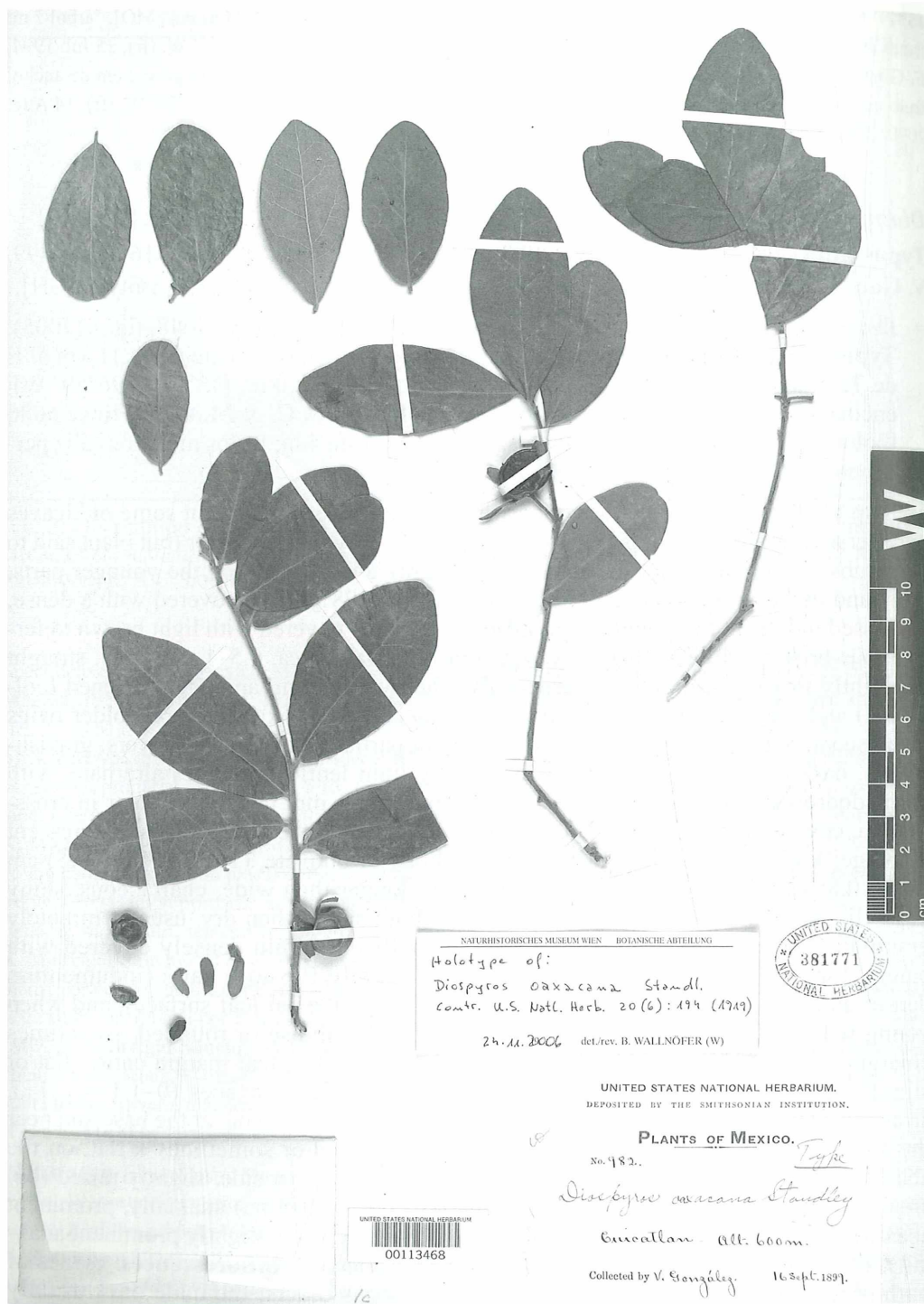
*Diospyros oaxacana* STANDL., Contr. U. S. Natl. Herb. 20 (6): 194 (1919); [fig. 7–9].

**Typus:** Mexico, Oaxaca, Cuicatlán, 600 m, [17°48' N, 96°58' W], (fr), 16 Sep. 1899, **V. González 982** [holotype: US (381771; photo NY: N.S. 6888 at FHO), isotype: GH].

= *Diospyros torresii* PROVANCE & A.C.SANDERS, Sida 21 (4): 2046–2048, fig. 1 (2005).

**Typus:** Mexico, Oaxaca, Distr. Teotitlán, [Mpio. Santiago Texcalcingo], 11 km al E de Teotitlán del Camino, carr. a Huautla de Jiménez, 1710 m, [18°8' N, 96°59' W], encinar, (young fl buds and fr), 17 Mar 1985, **R. Torres C. & M.A. Martínez 6636** [holotype: MO; isotypes: CHAPA n.s., TEX]; "arbusto 4 m; frutos maduros cáliz persistente"

Tree up to 10 m tall (already flowering when 1 m tall), deciduous (but some old leaves may persist); trunk according to PACHECO (1981) 15–30 cm in diameter (but plant said to be shrubs 1–4 m tall); bark on trunks reddish-gray and grooved on the younger parts, scaly and darker or grayish on older parts PACHECO (1981); buds covered with a dense, appressed indumentum; young twigs subterete, densely covered with light brown to ferruginous-brown (whitish when very young or old), patent, ca. 0.5–1 mm long, straight or slightly flexuose, sometimes (especially when very young and dry) flattened (collapsed) and slightly twisted hairs and with scattered gland-like structures; older twigs glabrescent, with epidermis and old indumentum partially detaching in layers, grayish-brown, dark brown or blackish-brown, bearing light lenticels; **leaves** alternate, with brochidodrome venation; petioles 1.5–3 mm long, ca. 1 mm thick, ± circular in cross-section, covered with the same kind of indumentum as on the young twigs, glabrescent with age; leaf lamina broadly lanceolate, ± elliptic or obovate, (1–) 2.5–6.5 (–7.5) cm long, (0.8–) 1.5–4 cm wide, (1–) 1.3–2.5 times longer than wide, chartaceous, shiny adaxially when alive (PACHECO 1981), dull on both sides when dry, usually minutely granulate adaxially (less commonly also abaxially), medium densely covered with patent, long (especially abaxially), straight or slightly flexuose hairs (indumentum denser along primary and secondary veins and on the abaxial leaf surface), and when young with scattered gland-like structures; leaf apex obtuse or rounded, sometimes emarginate; base of the lamina shortly attenuate or rounded; leaf margin entire, flat or slightly revolute when dry; flachnectaria on abaxial leaf surfaces (0–) 1–4 (–11), arranged particularly in the proximal half of the lamina, but missing at the base and near the apex; midvein on the adaxial side slightly impressed or sometimes ± flat, on the abaxial side markedly prominent; secondary veins ca. 5–7 per side, slightly raised (but area along them often sunken with respect to the rest of lamina) adaxially, prominent abaxially; intersecondary veins not conspicuous; tertiary veins slightly prominent adaxially, nearly flat abaxially; quaternary veins inconspicuous; **inflorescences:** cymes of both sexes 1-flowered, in the axils of soon caducous bracts; the male ones usually arranged 1–5 together, near the base of sprouting, a few cm long, leafy shoots or more

Fig. 8: Holotype of *Diospyros oaxacana* STANDL.

frequently on much shorter (only a few mm long), undeveloped, leafless shoots (their subtending leaf often still present) which end in a often hardly visible, vegetative bud; female cymes 1–3 together near the base of sprouting, a few cm long, leafy shoots (on Chiang et al. F-1795 on a few mm long shoots without large leaves); **flowers** 5-merous; the male ones (Ventura 3116 and Panero et al. 6650) 4–6 mm long at anthesis (without pedicel), emanating a sweet smell (PACHECO 1981); stalk (peduncle and pedicel) as well as the abaxial side of bracts and bracteoles covered with a similar kind of indumentum as on the young twigs; bracts and bracteoles glabrous adaxially, soon caducous; stalk 1–3 mm long; bracts ca. 2 mm long and wide, ovate; bracteoles narrowly triangular or slightly ovate, 1–1.8 mm long and 0.5–0.8 mm wide, acute distally; calyx 2.5–3.5 mm long, undivided in the proximal ca. 1 mm, on the outside (including the lobes) medium densely covered with  $\pm$  patent and straight, whitish hairs; calyx lobes narrowly triangular, 1.5–2.5 mm long, 0.6–1 mm wide, glabrous except for some sessile glands on the inside, acute distally, at the apex with a dense tuft of light brown hairs; corolla white, whitish or whitish-green when alive (Panero et al. 6650, Ventura 3116, PACHECO 1981); tube 3–5 mm long (3 mm in Ventura 3116 and 5 mm long in Panero et al. 6650), broadly funnel shaped, 3 mm wide near the apex (aperture of the corolla ca. 2 mm wide), on the outside  $\pm$  glabrous near the base, medium densely covered with short,  $\pm$  spreading, light hairs and some sessile glands in the central part, and more densely covered with longer, appressed or spreading, light hairs distally (indumentum on Panero et al. 6650 very dense, whitish, composed of flattened [collapsed], more flexuose hairs), on the inside densely covered with minute, patent, light hairs, glabrous distally; corolla lobes 1.5–2 mm long and wide,  $\pm$  truncate or slightly emarginate distally, covered on the outside with a dense, appressed indumentum as on the distal part of the tube, on the margins densely matted, on the inside glabrous; stamina 18 (only one flower of Ventura 3116 dissected; PACHECO 1981 indicates 20), of different lengths, often paired (the inner ones with shorter, the outer ones with longer filaments), 3–4 mm long; filaments 1–2 mm long, their proximal 0.7–1.2 mm adnate to the base of the corolla tube, medium densely covered with small, patent, light hairs; anthers ca. 2 mm long and 0.5 mm wide, widest below the middle, pointed distally, somewhat papillose especially near the apex, opening by two lateral slits in the distal half (for pollen see AYALA-NIETO & LUDLOW-WIECHERS 1983); rudiment of the ovary small, elevated, glabrous; **female flowers**: only very young, not fully developed, ca. 8 mm long (without pedicel) flower buds available (Torres & Martinez 6636); stalk (peduncle and pedicel) less than ca. 2 mm long, covered with a similar kind of indumentum as on the young twigs; bracts 4 mm long and 3 mm wide, ovate, distally obtuse, covered with a dense indumentum abaxially (hairs appressed and often collapsed and flattened), glabrous except for some scattered glands adaxially; bracteoles  $\pm$  oblong or lanceolate, 5–6 mm long and 1.5 mm wide, distally obtuse, abaxially covered with the same kind of indumentum as on the bracts, adaxially medium densely covered with short, patent hairs and glands; calyx ca. 8 mm long, undivided in the proximal ca. 1.5 mm and there covered with a dense indumentum; calyx lobes ovate-lanceolate, ca. 6 mm long, ca. 2.8 mm wide, loosely covered on both sides with  $\pm$  patent and straight, often flattened hairs,  $\pm$  acute distally, at the apex with a dense tuft of hairs; corolla ca. 3 mm long in bud, its tube ca. 1 mm long, glabrous on both sides; corolla lobes ca. 2 mm long and 1 mm wide, covered on the outside with a dense, appressed indumentum, on the inside glabrous; staminodia missing (but only one bud

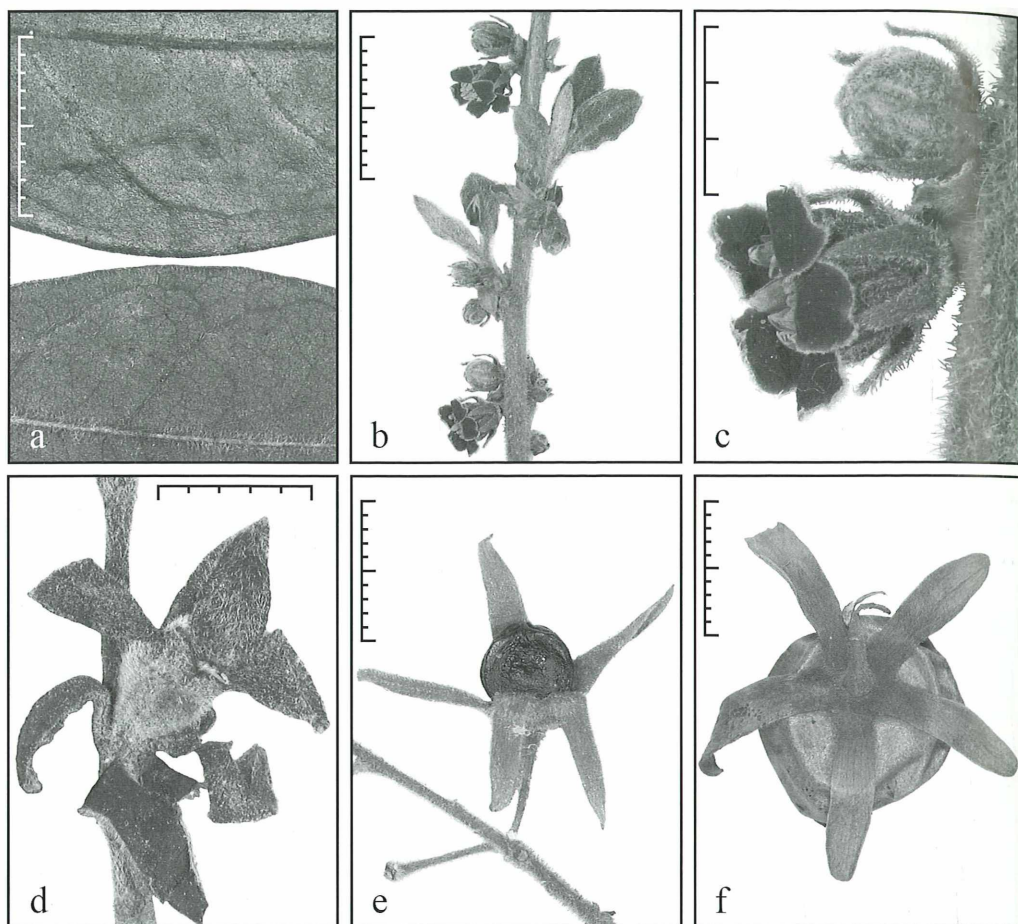


Fig. 9: *Diospyros oaxacana*: **a**: adaxial (on top) and abaxial (bottom) leaf surface (from Chazaro & Texon 3139 [WIS]); **b**: male inflorescence (from Ventura 3116 [MO]); **c**: male flowers (from Ventura 3116 [MO]); **d**: female flower bud (from Torres & Martínez 6636 [TEX]); **e**: young fruit (from Vovides & Calzada 654 [F]); **f**: fruit (from Gonzalez 982 [GH]); scale = 1 cm, except c = 3 mm, d = 5 mm.

dissected); very young ovary ca. 1.5 mm in diameter, 10-locular (as seen on fruits),  $\pm$  glabrous (except for minute, hair-like structures in some areas; but this needs to be confirmed with more specimens); stylodia ca. 0.5 mm long, glabrous, fused together in the proximal half; stalk of the **fruits** 5–15 mm long and 1–1.5 mm thick, slightly thickened distally; fruits oblate-globose, up to 2.5 cm in diameter and up to 2 cm high when dry (according to PACHECO 1981: 0.8–2.8 cm wide and 1.2–3 cm long), green, yellow or yellowish (Chazaro & Chazaro 4272, Chazaro & Texon 3139) when alive, black, slightly shiny, smooth and with large folds when dry, glabrous (but with scattered hairs on Calzada 20318 and Delgadillo 268), 8-locular (also indicated by PACHECO 1981) or 10-locular (Ortega 489); fruit wall thin, less than 0.5 mm thick, becoming soft when ripe, with epidermis adhering when dry; fruit pulp black, with a sweet smell and taste when

mature (PACHECO 1981); stylodia on young fruits 4 (–5), bilobed, scattered hairy, ca. 1 mm long, fused together in the proximal half; calyx on fruits ca. 3–3.5 cm in diameter, undivided in the proximal ca. 2 mm; area below the sinuses between the lobes inconspicuous; lobes spreading, 13–16 mm long and ca. 4.5 mm wide, usually oblong or slightly obovate, obtuse or acute distally, often revolute when dry, firm, covered with well spaced, patent hairs on both sides (on Chiang et al. F-1795 distally with a small tuft of dark brown hairs), with slightly raised, longitudinal venation; seeds flattened, 13–14 mm long, 8 mm wide, ca. 4 mm thick, brownish, finely structured on the surface.

Additional flowering specimens (especially those with female flowers) are urgently needed for study. The indumentum on young twigs of Torres & Martinez 6636 (type of *D. torresii*), Calzada 20318 and Delagdillo 268 is composed of much shorter hairs than is usually the case in that species. In addition, the fruits of the two latter, geographically somewhat isolated collections are covered with scattered hairs. These two collections could also represent hybrids between *D. oaxacana* and another, unknown species or may have originated from cultivation by ancient tribes inhabiting Central America (here the same could apply as discussed under *D. konzattii* in WALLNÖFER [2007]; compare also the discussion in PROVANCE & SANDERS [2005]). Unfortunately, the type of *D. torresii* is somewhat atypical, because it had been collected during the unfavorable time of the year, with most mature leaves already shed, with a quite weathered indumentum on the previous season's twigs and with an immature indumentum on the sprouting, very young twigs. It is furthermore interesting to note that the types of *D. oaxacana* and *D. torresii* have been gathered not far away from each other (fig. 7). PROVANCE & SANDERS (2005, 2006) and PROVANCE et al. (2008) have proven to be very extreme "splitters" creating, beside *D. torresii*, many other mere phantom-species and -subspecies (see also WALLNÖFER 2007: 240–241).

Figures: twig, male flower, young fruit, transverse section of the fruit showing 9 locules (KELLY 2001: fig. 1); leaf and fruit (PACHECO 1981: fig. 1e + 1f); photo of the holotype of *D. torresii* (PROVANCE & SANDERS 2005: fig. 1); pollen (AYALA-NIETO & LUDLOW-WIECHERS 1983: plate IV).

Vernacular names and use: zapatillo de tejón (Cházaro MCH-1079), zapote negro (MARTÍNEZ 1978), zapote tejon (Chazaro & Chazaro 4272, Chazaro & Texon 3139), zapotillo (MIRANDA 1948, MARTÍNEZ 1978, CASAS et al. 2001, KELLY 2001), zapotito (KELLY 2001, PACHECO 1981). According to CASAS et al. (2001), it is used as a colorant, and the wood for construction.

Distribution, habitat, ecology, and phenology: This species is known only from Mexico (Oaxaca and Veracruz), where it grows at elevations between 360 and 1740 meters, (fig. 7). A distribution map from Veracruz has been published by PACHECO (1981), as well as in ANGULO & SOTO (1990) who also indicated the climatic requirements of this species. According to herbarium labels, it has been frequently gathered in low, deciduous forests; in oak-forests; in shrub-lands (matorrales); often in gorges, ravines and on precipices (barrancas, cañadas, cantiles) as well as on steep slopes; on rocky and stony ground (limestone or volcanic rock); on black soil, on tropical rendzina or on clay soil. MIRANDA (1948) reported it to grow at the bottom of canyons, where it grows in quebrachales, a plant community dominated by *Acacia pringlei* (quebracho; synonym: *Acacia unijuga*). According to ACOSTA CASTELLANOS (2002), it is a member of the "selva

baja caducifolia (e-espinosa)" – It has been collected in flower in February and June, and in fruit from February to December. According to KELLY (2001), it flowers in the Valle de Tehuacán-Cuicatlán from June to August and develops fruits from August to October.

Specimens examined: **Mexico, Veracruz**, Municipio Vega de Alatorre, Cañada de Mesillas, entrada por Santa Ana, 360 m, [ca. 20°2' N, 96°38' W], selva baja caducifolia en encinar, primaria, suelo negro pedregoso, calido húmedo, asociada *Sapindus saponaria*, *Quercus oleoides*, (fr), 24 Jul. 1981, **J.I. Calzada 7711** [MEXU], "arbusto 4 m, [abundancia:] regular; flor verde; fruto verde"; – Mun. Coatepec, Cerro de Achichuca, Ejido Tuzamapan sobre carr. Tuzamapan-Huatusco, antes Rio Pescado, 600 m, 19°23' N, 96°49' W, selva baja caducifolia, primaria; suelo: rendzina tropical sobre roca caliza metamorfica; amb.: calido subhúmedo; asoc.: *Casearia*, *Hechtia*, *Dioon*, *Bursera*, *Pistacia*, *Comocladia*, (yfr), 9 May 1981, **A.P. Vovides & J.I. Calzada 654** [F], "arbusto 1 m; fruto verde; abund.: escasa"; – Municipio Jalcomulco, La Mesa de Olvera en los alrededores de Jalcomulco, 600 m, 19°21' N, 96°47' W, selva baja caducifolia, primaria, suelo arcilloso rocoso, en los Cantiles [precipices], (fr), 30 Oct. 1982, **G. Castillo C. 2728** [MEXU, MO, QCA n.s. (dig. photo)], "arbusto 4 m, [abundancia:] regular; fruto verde"; – alrededores de Jalcomulco, 500 m, 19°23' N, 96°45' W, selva baja caducifolia, secundaria, suelo calizo rocoso, (yfr), 25 Jul. 1973, **J.M. Gandara & J. Dorantes 98** [CHAPA n.s., ENCB n.s., F, MEXU, NY, XAL n.s.], "árbol, perenne, 4 m, escaso; fruto verde"; – cañadita en las afueras de Buenavista, en el camino a Jalcomulco, 400 m, [ca. 19°20' N, 96°45' W], selva baja caducifolia, (fr), 29 Aug. 1984, **M. Chazaro & F. Texon 3139** [MEXU, WIS], "árbol; fruto amarilloso; – Mun. de Actopan, Trapichi [= Trapiche del Rosario], 400 m, [19°32' N, 96°44' W], matorral en terreno plano, (fl male), 15 Feb. 1971, **F. Ventura A. 3116** [ENCB n.s., MO], "arbusto 3 m, escaso; flores blanquecinas"; – Mpio. Actopan, 3 km antes de la desviación al Coyolillo rumbo a Actopan, 500 m, [19°32' N, 96°43' W], selva baja caducifolia, primaria; suelo rocoso, volcanico, "Mal Pais", (fr), 19 Aug. 1976, **R.V. Ortega 489** [F, MEXU, XAL n.s.], "arbusto 1.5 m; fruto verde; abund.: regular"; – Mpio. Actopan, Los Frailes, 500 m, [ca. 19°30' N, 96°35' W], matorral en cañada, (fr), 1 Mar. 1975, **F. Ventura A. 11003** [ENCB n.s., MEXU], "arbusto de 1.6 m de alto; flores [?] verde-amarillas"; – Mpio. Apazapam, cerro cerca de la Estacion Apazapam [= Apazapan] rumbo a El Palmar, 450 m, [19°22' N, 96°44' W], selva baja caducifolia, primaria, (fr), 25 Dec. 1986, **M. Chazaro & P.H. de Chazaro 4272** [WIS], "árbol 8 m; fruto amarillo"; – Mun. E. Zapata, fondo de la Barranca de San Antonio, 900 m, [19°26' N, 96°42' W], selva baja caducifolia, primaria, (fr), Oct. 1979, **M. Cházaro MCH-1079** [F], "árbol 10 m; fruto verde; abund.: escaso". – Oaxaca, Concepción Buenavista, km 98 de la carretera Tehuacán-Oaxaca, ca. 1.2 km al N del puente Santa Lucia, 1500 m, 18°06'15.5" N, 97°20'07.0" W, selva baja caducifolia, (fl male), 27 Jun. 1996, **J.L. Panero, E.E. Schilling & E.B. Wofford 6650** [TEX], "arboles 6–10 m, ocasional; corolas blancas; frutos verdes"; – same data and collectors: (fr), **6650a** [TEX]; – Dto. Coixtlahuaca, Mpio. Tepelmeme de Morelos, loc. Agua Limón, km 96.2 de la carr. Tehuacán - Oaxaca, 1740 m, 18°6' N, 97°20' W, selva baja en la barranca, (yfr), 9 Apr. 2001, **P. Tenorio L. 20008** [M, MEXU n.s., MO n.s.], "árbol de 8 m; fruto inmaduro"; – Distr. Santiago Juxtlahuaca, Mpio. Santos Reyes Tepejillo, loc. 4 km al N de Santos Reyes Tepejillo, entrada por La Cruz, río Boquerón, 1525 m, 17°27' N, 97°56' W, bosque de encino, ecotonía con una selva baja caducifolia; suelo negro con rocas calizas, (fr), 31 Oct. 1995, **J.I. Calzada 20318** [MEXU n.s., MO], "árbol 3 m; abundancia regular; frutos verdes"; – Almoloyas, 800 m, [17°37' N, 97°1' W], (fr), 25 Dec. 1906, **C. Conzatti & C. Conzatti 1660** [F 2×, MEXU]; – "Puebla", 16 km SE [?] de Dominguillo, Oaxaca, por la carr. Tehuacán Oaxaca, [17°34' N, 96°48' W], selva baja caducifolia, en caña con *Quercus*, *Croton*, *Xylosma*, (yfr), 29 Aug. 1980, **F. Chiang, F.G. Medrano, V. Jaramillo, J.L. Villaseñor, P. Ruiz & S. Singer F-1795** [MO, NY], "arbusto 3 m"; – N of Jayacatlan along road towards Nacaltepec, 1600 m, [17°29' N, 96°50' W], steep slope with *Quercus*, *Juniperus*, *Bursera*, *Ipomoea*, *Heliocarpus*, (fr), 4 Nov. 1973, **D.E. Breedlove 35928** [CAS. MO], "shrub 15 ft"; – 4 km NW de Mitla, [16°55' N, 96°24' W], (fr), 11 Feb. 1966, **C. Delgadillo M. 268** [MEXU n.s., W]; "arbusto 2–3 m; fruto verde; abundancia: regular"



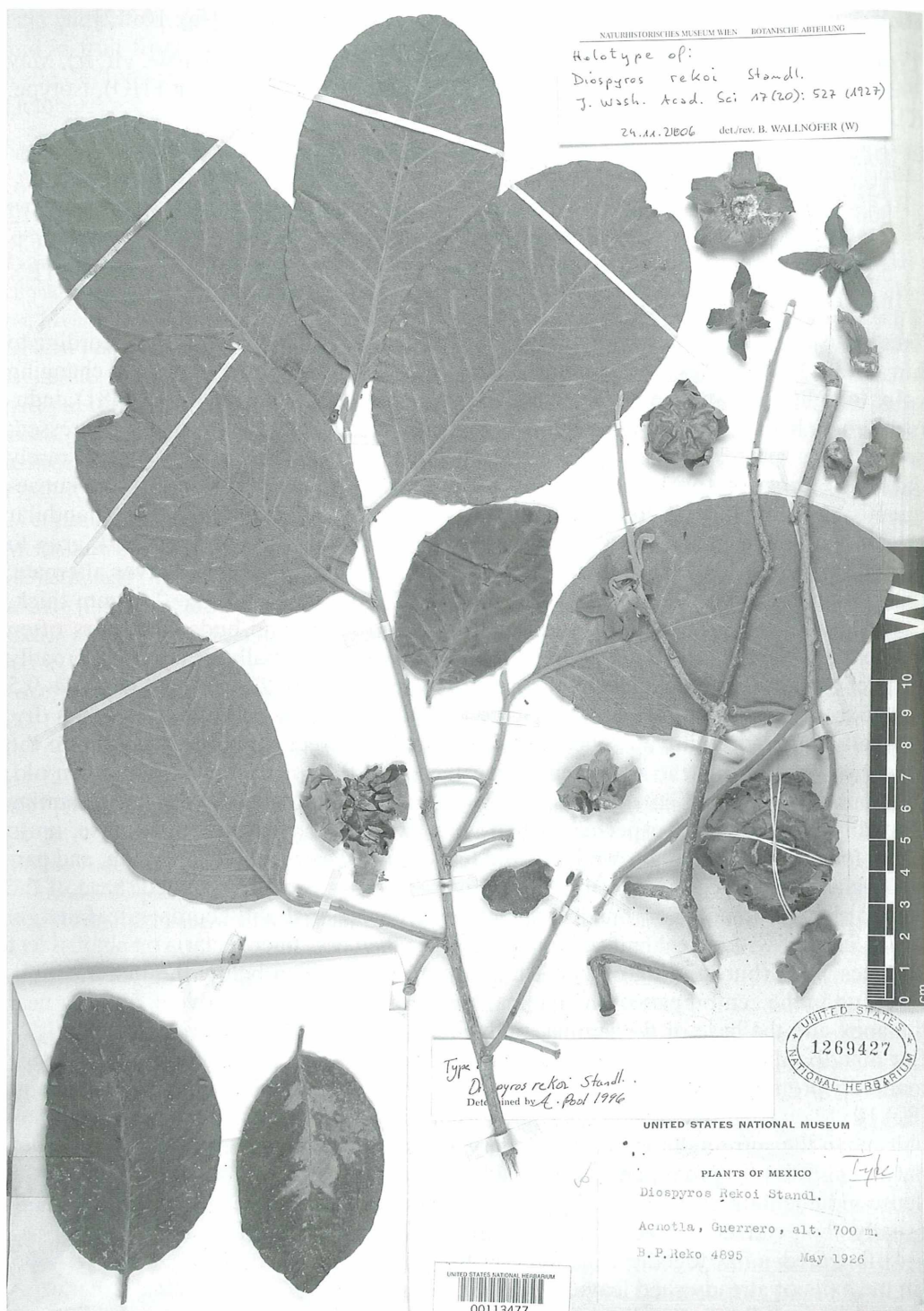
*Diospyros rekoï* STANDL., J. Wash. Acad. Sci. 17 (20): 527 (1927); [fig. 10–12].

**Typus:** Mexico, Guerrero, Achotla, 700 m, [18°9' N, 100°9' W], (fl female, yfr, fr), May 1926, **B.P. Reko 4895** [holotype: US 1269427 (photo NY: N.S. 6895 at FHO), isotype: K].

= *Diospyros morenoi* A.POOL, Novon 7 (2): 189–190, fig. 1 (1997).

**Typus:** Nicaragua, Madriz, S of Somoto, between Valle Santa Teresa and El Rodeo, 800–900 m, 13°27' N, 86°34' W, heavily grazed oak forest on rocky slopes, (fr), 12 Jul. 1983, **W.D. Stevens & P.P. Moreno 22224** [holotype: MO, isotypes: BM, CR n.s., EAP n.s., F n.s., FHO, HNMN n.s., MEXU n.s., MICH n.s., NY n.s., P n.s., TEX n.s., US n.s.], "large tree; bark falling in places [plaques?]; fruits green, hard"

Tree up to 20 m tall (already flowering when ca. 4 m tall), dbh up to 40 cm (according to Maya 4381), deciduous; bark smooth, black, the slash light brown to yellow, changing color to light green, with agreeable smell; sapwood white (data from Maya 4381); indumentum on buds and very young leaves very dense, concealing the surface, ± appressed; young twigs subterete, moderately to densely covered with blond to light brown (rarely darker), ± erect or spreading, flexuose, sometimes flattened (collapsed) and subsequently twisted, 0.1–1 mm long hairs and very scattered, minute, sessile, glandular structures (but these not always present); older twigs glabrescent, their bark gray to grayish-brown or blackish-brown, bearing scattered, small, lenticels; **leaves** alternate, with brochidodrome venation; petioles 5–10 (–12) mm long, 1.5–2 (–2.5) mm thick, covered with the same kind of indumentum as on twigs and buds (but hairs often shorter), glabrescent when old, with a longitudinal groove adaxially; leaf lamina broadly elliptic, broadly lanceolate, ovate or rarely obovate, (2.5–) 7–22 cm long, (1.3–) 4–9.5 cm wide, 1.2–2.8 times longer than wide, chartaceous, dull on both sides when dry, adaxially covered with well-spaced, ca. 0.5 mm long, erect (often inclined due to the pressure when drying the specimens), translucent, stiff hairs, ± glabrescent when old, with punctiform, small emergences and when young with glandular structures; lamina abaxially moderately or especially when young densely covered with flexuose, up to 1 mm long, blond to light brown hairs; old leaves with weathered indumentum, and partially glabrescent; leaf apex acute, obtuse or sometimes broadly rounded; base of the lamina shortly attenuate or rounded, sometimes truncate or slightly cordate; leaf margin entire, usually with patent hairs, slightly revolute when dry; flachnectaria on abaxial leaf surfaces 1–17 (but missing on some leaves), often ± hidden below the indumentum, scattered in the central part of the lamina, sometimes near to the midvein, missing near the apex and the base of the lamina; midvein on adaxial side impressed proximally, ± flat distally, densely covered with translucent, erect, stiff hairs, on the abaxial side markedly prominent and densely hairy (partially glabrescent when old); secondary veins (8–) 10–12 on each side, slightly prominent adaxially, raised abaxially and more densely hairy than the surroundings; intersecondary veins not conspicuous; tertiary and quaternary veins slightly prominent on both sides, reticulate, often hardly visible below the dense indumentum abaxially; **inflorescences:** cymes of both sexes in the axils of small, usually soon caducous bracts; the male ones (Hinton 3941, Matuda et al. 30696) 1–2 (–4)-flowered, a few together on a few, clustered, up to 5 (–10) mm long, leafless shoots (in the axils of already shed leaves of the previous season) which end always in a vegetative bud; usually on the distal parts of twigs (as seen on Hinton 3941), one of these

Fig. 10: Holotype of *Diospyros rekoii* STANDL.

shoots per node elongates up to ca. 12 cm, with flowers arranged within the lowermost ca. 1.5 cm and with regular leaves distally (this second mode of growth is the regular case on female plants); female cymes 1-flowered, arranged 1 (–3) together near the base of up to 10 cm long, sprouting shoots which develop regular leaves distally (rarely these shoots are, like on male plants, only a few mm long, leafless and end in a vegetative bud); **flowers** (4–) 5 (–7)-merous; the male flowers ca. 12 mm long (without pedicel), green when alive (Hinton 3941); peduncles 2–4 mm long and pedicels 3–5 mm long, both 0.5–1 mm thick, covered with the same kind of indumentum as on the young twigs; bracts ovate, slightly acute distally, up to ca. 4 mm long and 3 mm wide, covered with a  $\pm$  dense indumentum abaxially, glabrous adaxially; 1-flowered cymes with bracteoles similar to those on female plants; calyx parted nearly to its base; calyx lobes on anthetic flowers variable in size and shape on the same plant, 2.5–6 mm long, 1.5–2.5 mm wide, narrowly to broadly triangular or less frequently  $\pm$  ovate, acute to  $\pm$  obtuse distally, with raised, longitudinal veins when dry, abaxially (externally) covered with a similar indumentum as on the young twigs, but hairs appressed or slightly spreading, adaxially covered with  $\pm$  scattered, minute glands and rarely with some remote hairs; apex of the lobes usually with a dense tuft of sometimes slightly darker, often strongly flexuose hairs; corolla tube at anthesis ca. 10 mm long and 4–5 mm wide when dry, widest in the lower half, markedly constricted at the apex, outside moderately (on the proximal part) to densely (on the distal part) covered with appressed or slightly spreading, blond to light brown hairs and with some scattered, minute glands, inside covered with short hairs in the basal part, glabrous in the middle and towards the apex; corolla lobes on the abaxial side densely covered with the same kind of indumentum as on the distal part of the tube, adaxially glabrous, elliptic, ca. 3.5 mm long and up to 2.3 mm wide, broadly rounded distally, black when dry; stamens 20 (only one flower of Hinton 3941 dissected); filaments 3–4 mm long, adnate to the corolla tube except for the distal 0.5–1 mm, glabrous; anthers ca. 3 mm long and 1 mm wide, acute distally, rounded at the base; connective dark, glabrous on both sides; rudiment of the ovary slightly elevated, densely covered with erect, short hairs; **female flowers**: ca. 10 mm long (without pedicel and considering the calyx lobes to be spreading); stalk (peduncle and pedicel) ca. 10 mm long and 1–1.5 mm thick, covered with a dense indumentum like that on young twigs; bracts similar to those on male plants; bracteoles 4–8 mm long and 1–2.8 mm wide, linear to narrowly ovate, acute distally, densely hairy abaxially, with sessile glands and especially in its central part with  $\pm$  scattered hairs adaxially; calyx undivided in the proximal 2 mm, on both sides medium densely to densely covered with light brown, straight or  $\pm$  flexuose, erect or spreading, up to ca. 0.5 mm long hairs (those at the apex of the lobes being of the same type); calyx lobes broadly ovate or sometimes oblong or slightly obovate, acute to obtuse or rounded distally, 13–22 mm long and 6–10 mm wide, especially adaxially with scattered, sessile glands; corolla urceolate, on the outside densely covered with an indumentum like that on the calyx, inside glabrous; tube 6–8 mm long and ca. 7 mm wide, widest below the middle; aperture of the corolla narrow; corolla lobes ca. 4–5 mm long and 3–3.5 mm wide, obtuse, on the outside covered with the same dense, kind of indumentum as on the tube, on the margins densely matted and on the inside glabrous; staminodia apparently missing (but this needs to be confirmed); ovary ca. 7 mm in diameter, 10-locular, densely covered with  $\pm$  straight, appressed or spreading hairs; stylodia ca. 3 mm long, hairy on the abaxial side; stalk of the **fruits** up to 8–13

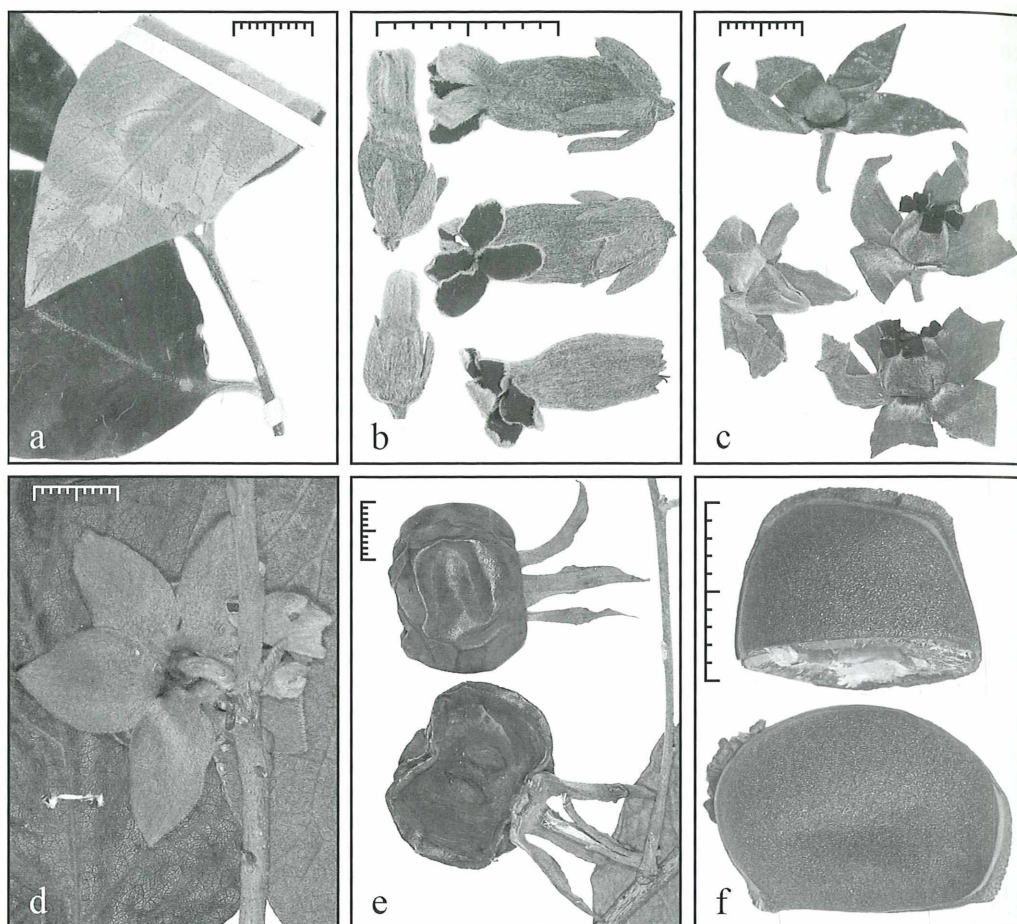


Fig. 11: *Diospyros rekoï*: **a**: abaxial (on top) and adaxial (bottom) leaf surface (from Hinton et al. 5787 [BM]); **b**: male flowers (from Hinton 3941 [MICH]); **c**: female flowers (from Hinton et al. 5787 [BM]); **d**: calyx of a female flower seen from abaxial side (from Chazaro & Machuca 7159 [MEXU]); **e**: fruits (from Villacorta & María 2199 [B]); **f**: seeds (from Carballo et al. 247 [B]); scale = 1 cm.

mm long and 2–3.5 mm thick, covered with a similar indumentum as on the twigs; immature fruits green when alive, dark brown or when apparently mature (Hinton 7413, Cházaro & Machuca 7159) black when dry,  $\pm$  oblate, up to 4–4.5 cm in diameter and ca. 3 cm high (ellipsoidal in Breedlove 40165: ca. 4 cm in diameter and 4.5 cm high), often deformed during the process of drying and with large folds when mature and dry, covered with a medium to dense, light brown indumentum when young, glabrescent (except near base and apex where remnants of the indumentum persist) when mature,  $\pm$  smooth or with small, lighter-colored, raised granula composed of stone-cells; fruit wall less than 1 mm thick, with a 0.25–0.5 mm thick stone-cell-layer, with the epidermis detaching when mature; calyx on fruits ca. 3–4 cm wide, brown to black when dry,  $\pm$  densely



hairy on both sides, somewhat glabrescent when old; entire (proximal) part of the calyx ca. 2–3 mm long, lacking longitudinal ridges running down from the sinuses abaxially; sinuses between the calyx lobes flat, not enlarged; calyx lobes (14–) 22 mm long, (5–) 8–13 mm wide, spreading or flexed downwards (the proximal half often adhering to the fruit), flat or longitudinally revolute when dry; lobes with  $\pm$  raised longitudinal veins especially on abaxial side; seeds (Carballo et al. 247) flat, 18 mm long, 12–15 mm wide and 6 mm thick, in cross section narrowly elliptic, at the end located near the base of the fruit with a flat, 1 mm wide, protruding margin; seed-surface brown, finely structured.

In some populations (especially those near México City) the hairs on the abaxial side of the leaves are longer than those found on specimens from other populations. As a consequence of this, the indumentum appears to be much denser in the former. Flowers from the eastern populations have not been studied and are therefore urgently needed.

Figures: twig, leaves, fruits (POOL 1997: fig. 1), photo of a herbarium specimen (CARBALLO 2002).

Vernacular names in Mexico: sapote (Hinton 7413), sapotillo (Aguirre Bravo 100–17), zapotillo (Hinton 3941).

Distribution, habitat, ecology, and phenology: This species is known from Mexico (Jalisco, México, Guerrero, Oaxaca, and Chiapas), El Salvador (Santa Ana and Cabañas), and Nicaragua (Madriz), where it grows at an elevation of 380 meters in El Salvador and between 700 and 1300 meters in Mexico and Nicaragua, (fig. 12). It was indicated by two collectors to be rare and has been collected in tropical deciduous and semideciduous forests; in pine- and oak-forests with *Ficus*, *Alnus*, and *Liquidambar*; in oak-forests on rocky slopes; in thorny, low, deciduous forests; in low shrub-land (matorrales); on dry hillsides and gorges (barranca); furthermore it has also been reported from a "ridge with *Pinus* and *Quercus* and streams with seasonal evergreen forest" and from a "steep slope with montane rain forest along rio" It has been collected in flower from March to July, and in fruit in July, September, January, and February.

Specimens examined: México, Jalisco, 7–8 km NW de El Grullo, cercanías del Rancho Puerta del Barro El Grullo, 900–1000 m, [19°51' N, 104°17' W], BTS [= bosque tropical subcaducifólio] perturbado con *Vitex mollis*, *Ceiba aesculifolia*, *Acacia*, *Bumelia*, *Bursera*, (yfr), 16 Aug. 1990, **L. Hernandez & A. Vazquez 56** [WIS 2×], "árbol escaso, 3–4 m; frutos verdes"; – Mpio. San Martín Hidalgo, en San Jerónimo [= San Jerónimo], brecha de San Martín Hidalgo a Quila, [20°24' N, 103°58' W], bosque tropical caducifólio, (yfr), 23 May 1993, **M. Cházaro B. & J.A. Machuca N. 7159** [MEXU, MICH, NY (as 7159a), TEX], "árbol" – México, Distr. Temascaltepec, Pungaranchó [= Pungaracho?], [ca. 19°1' N, 100°30' W], hill, (defl female, yfr), 17 Jun. 1934, **G.B. Hinton et al. 6180** [K, NY], "tree 4 m"; – Palmar Chico, 750 m, [18°41' N, 100°21' W], en ladera seca; matorral bajo, (fl male), 13/14 Apr. 1954, **E. Matuda et al. 30696** [MEXU]; – Distr. Temascaltepec, Pto. Salitre, 1300 m, [18°40' N, 100°16' W], wet barrancas, (fl female), 2 Jul. 1932, **G.B. Hinton 941** [BM, F, G, K], "large tree"; – same district, Salitre, Cañitas, 1300 m, [ca. 18°40' N, 100°15' W], barranca, (fl male), 18 May 1933, **G.B. Hinton 3941** [K, MICH], "tree 15 m; flowers green"; – same district, Cañitas, [ca. 18°40' N, 100°15' W], barranca, (fl female), 14 Mar. 1934, **G.B. Hinton et al. 5787** [A n.s., BM, G, K, MO], "shrub 4 m"; – same district, Villaneda [locality not traced], hill, (fr), 22 Feb. 1935, **G.B. Hinton et al. 7413** [A, BM, G 2×, K], "tree 6 m high" – Guerrero, 3 Cruces, Ejido Chapultepec, Tlalchapa, 700 m, [ca. 18°22' N, 100°32' W], selva baja espinosa caducifolia, (fr), 5 Jan. 1974, **C. Aguirre Bravo 100–17** [MEXU], "árbol" – Oaxaca, Distrito de Juchitán, Ruta 190, ca. 15 km al NE

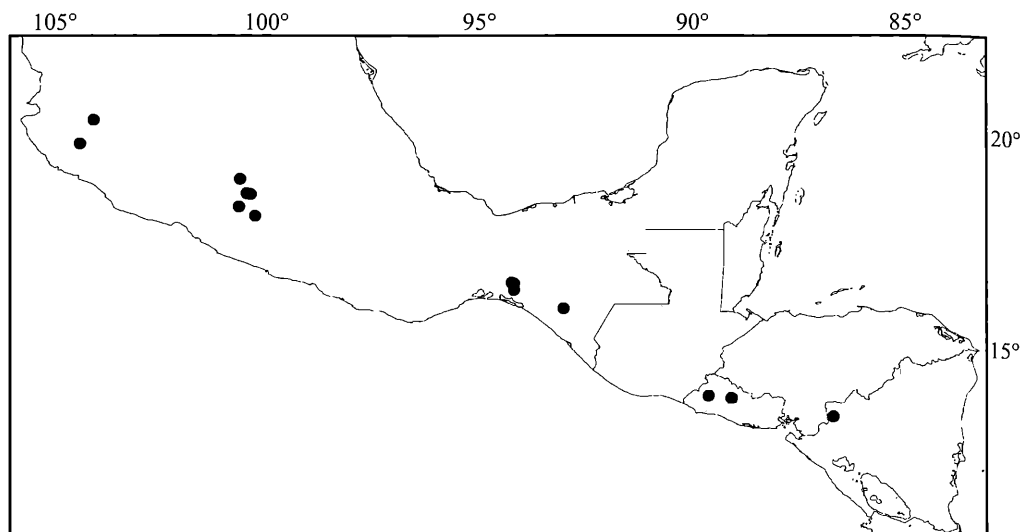


Fig. 12: Distribution of *Diospyros rekoi* STANDL.

[NW?] de Tapanatepec, [16°25' N, 94°5' W], (fr), 24 Feb. 1981, **R. Cedillo T. 559** [MEXU, MO], "árbol de 10 m"; – Mpio. San Miguel Chimalapa, La Hondonada, ca. 16 km al S de Benito Juárez, valle del Río Portamonedas, ca. 25 km en línea recta al NNE de San Pedro Tapanatepec, 16°35' N, 94°8' W, bosque de pino-encino, con *Ficus*, *Alnus*, *Liquidambar*, terrenos planos y laderas, suelos arenosos, (yfr), 15 Apr. 1987, **S. Maya J. 4381** [MEXU], "árbol 20 m, dap 40 cm, escaso; corteza lisa, negra; brecha café claro y amarillo, con cambio de color a verde tierno, olor agradable, albura [sapwood] blanca; fruto verde" – Chiapas, Mun. of Cintalapa, 23 km W of Las Cruces along road to La Mina Microwave Station, 870 m, [ca. 16°34' N, 94°5' W], ridge with *Pinus* and *Quercus* and streams with seasonal evergreen forest, (fr separate, n.s.), 19 Sep. 1981, **D.E. Breedlove 52917** [CAS], "tree 50 ft."; – Mun. of Angel Albino Corzo, along Río Cuxtepeques [= Custepeques or Cuztepeques] near Finca Gadow, 1270 m, [ca. 15°59' N, 92°55' W], steep slope with montane rain forest along rio, (fr), 12 Sep. 1976, **D.E. Breedlove 40165** [DS], "tree 30 ft"

El Salvador, Santa Ana, Coatepeque, Las Lajas, [ca. 13°56' N, 89°30' W], creciendo dentro del bosque, (fr), 4 Sep. 1994, **R. Villacorta & J. María 2199** [B, LAGU n.s., MO n.s.], "árbol de ca. 17 m; frutos de color verde claro lustroso" – Cabañas, Cinquera, zona protegida, entrada de bosque por cementerio, 380 m, 13°53' N, 88°57' W, (fr), 28 Feb. 2002, **R.A. Carballo, H. Castaneda & E. Erazo 247** [B, LAGU n.s., MO n.s.], "arbol de ca. 12 m; frutos verde claro y redondos"

***Diospyros yatesiana* STANDL. ex LUNDELL**, Publ. Carnegie Inst. Wash. 436 (12): 281, 317 (1934); [fig. 13–15].

**Typus:** Mexico, Campeche, Chan Laguna, [18°29' N, 90°12' W], (fr), 5 Dec. 1931, **C.L. Lundell 1020** [Lectotype: MICH (here designated; photo at LL), isotypes: DS, F, GH, MO, NY, UC, US, WIS n.s.], "large 15 m tree, 0.5 m in diam.; dense foliage", [paratype: Lundell 1309, see list of specimens].



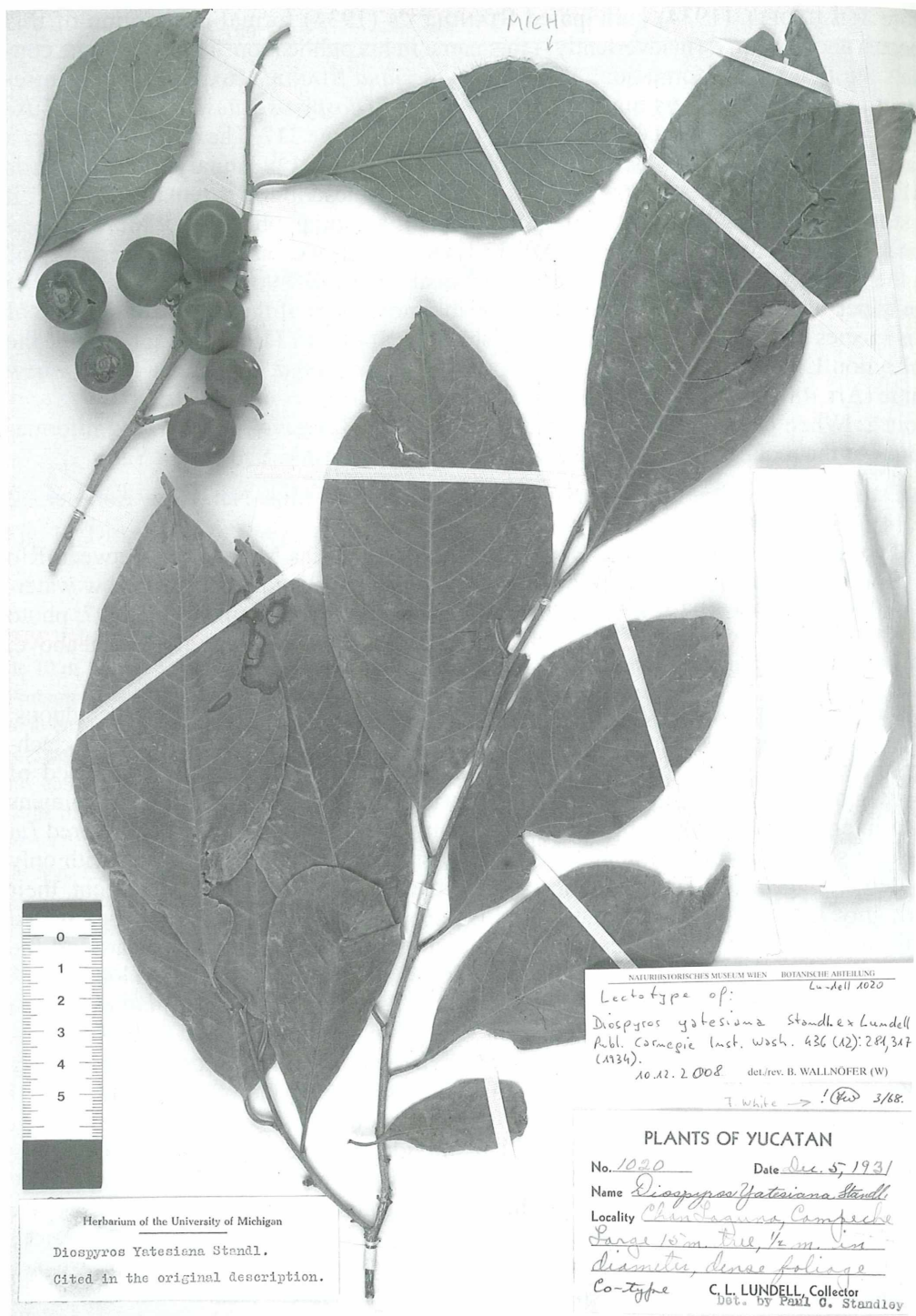
Note 1: LUNDELL (1934) anticipated STANDLEY's (1935) formal description of this species and validated (inadvertently?) this name in his publication. The protologue contains the following information: "*Diospyros yatesiana* STANDL. Tuxpeña (1309). Infrequent tree 10 to 20 meters high" on page 281, and "*Diospyros yatesiana* STANDL. Tuxpeña (1309), Chan Laguna (1020, type collection)" on page 317. The description lacks a Latin diagnosis, but this became mandatory only from 1<sup>st</sup> January 1935 onwards (MCNEILL et al. 2006, Art. 36.1). Although the given description is remarkably poor, it is sufficient to formally fulfill the requirements for a valid publication (J. McNeill, personal communication; compare the Art. 32.1 and 32.3, as well as the entry "description" in the glossary in appendix VII in MCNEILL et al. 2006). STANDLEY (1935) did not cite the paper of LUNDELL (1934) and was probably not aware of the fact that the name of this species had already been validly published. As STANDLEY (1935) did not exclude the collection Lundell 1020 from his description of *D. yatesiana*, he did not create a new name (Art. 48.1 and J. McNeill, personal communication).

Note 2: When describing *D. yatesiana*, STANDLEY (1935) gave the following information: "At the request of Mr. Lundell, this tree is named for Mr. Sheldon S. Yates, "

= *Diospyros zacapana* STANDL. & STEYERM., Publ. Field Mus. Nat. Hist., Bot. Ser. 22 (4): 263 (1940).

**Typus:** Guatemala, Zacapa, Dept. Zacapa, Sierra de las Minas, trail between Río Hondo and waterfall, 250–400 m, [15°2' N, 89°35' W], along stream below waterfall, (fr), 10 Oct. 1939, **J.A. Steyermark 29490** [holotype: F (photo F 52497; photo NY: N.S. 6889 at FHO)], "shrub 15 ft. tall; leaves membranaceous, dull green above, paler green beneath"

Treelet or tree up to 18 (–28?) m tall (already flowering when 2–3 m tall), deciduous; trunk diameter up to 50 cm, its bark gray-brown, finely longitudinally fissured, detaching in medium sized, irregular plates; indumentum on buds dense, composed of appressed to spreading, straight to flexuose, usually light hairs (but on some specimens with interspersed, blackish-brown hairs); young twigs subterete, densely covered (at least on some areas) with minute, patent, whitish-translucent, stiff hairs and with only scattered, longer hairs similar to those on the buds; older twigs soon glabrescent, their bark gray, light brown or sometimes blackish-brown, often with black spots or covered with the detaching grayish remnants of the epidermis, ± smooth except around the lenticels; **leaves** alternate, with brochidodrome venation; petioles 6–12 mm long, 1–1.5 mm thick, in cross section ± circular or adaxially flattened, densely covered with ± patent hairs (some of them minute as on young twigs) on the adaxial side, with scattered, appressed to slightly spreading hairs abaxially, on each side with an edge coming down from the lamina; scars of petioles markedly thickened and often protruding; leaf lamina broadly lanceolate to elliptic, less frequently obovate, (1.3–) 5–19 (–21) cm long, (2–) 4–9 cm wide, 1.4–3.2 times longer than wide, chartaceous, dull, usually finely warty (especially adaxially) and of the same color on both sides when dry, adaxially with scattered, thin, patent hairs and with scattered glands when very young, except on the veins soon glabrescent, abaxially covered especially on the veins with scattered, slightly thicker and longer, ± patent or appressed, light or rarely blackish-brown hairs; leaf apex acute or obtuse, rarely rounded and even more rarely emarginate; base of the lamina shortly attenuate or sometimes rounded; leaf margin entire and flat, revolute especially near the base when dry, its marginal vein inconspicuous; flachnectaria 1–6

Fig. 13: Lectotype of *Diospyros yatesiana* STANDL. ex LUNDELL.

(but missing on some leaves and up to 22 on the basal, small leaves of sprouting shoots), located on both (!) leaf surfaces, scattered in the central part of the lamina, rarely near the margin or on the midvein or below the apex, missing at the base of the lamina; midvein on the adaxial side sunken ( $\pm$  flat towards the apex),  $\pm$  densely covered with  $\pm$  patent hairs, on the abaxial side markedly prominent and with very scattered,  $\pm$  appressed hairs; secondary veins ca. 7 on each side, with scattered, patent hairs on both sides, adaxially usually slightly prominent, less frequently flat or together with its surroundings slightly sunken, abaxially prominent and a little decurrent along the midvein; intersecondary veins smaller than the former,  $\pm$  prominent on both sides; tertiary and quaternary veins flat or only slightly prominent on both sides; **inflorescences**: cymes of both sexes arranged in the proximal half of sprouting, several cm long, usually leafy shoots (cymes very rarely arranged on only a few cm long, leafless shoots); the lowermost cymes in the axils of small, usually soon caducous bracts, the following ones in the axils of small, and the upper ones in the axil of fully developed leaves; male cymes (3–) 15-flowered, exhibiting a dichasial branching pattern, including the flowers up to 1.5 cm long; female cymes 1 (–3)-flowered (very rarely with more flowers per cyme, but in this case only one, rarely two of them developing into a fruit), including the flowers up to 1 cm long; inflorescence axes and pedicels of both sexes usually very densely covered with  $\pm$  patent or spreading (rarely  $\pm$  appressed),  $\pm$  straight, light hairs (indumentum appearing light brown to yellowish; less frequently some black hairs are interspersed); **flowers** 4 (–5)-merous (only one 5-merous calyx seen on Förther 2742); the male ones 4–5.5 mm long at anthesis (without pedicel); peduncles 2–5 mm long and ca. 1 mm thick; pedicels ca. 0.5 mm long and 1 mm thick; bracts (1.5–) 2–3 mm long and (1–) 1.5 (–2) mm wide, triangular, acute distally, loosely covered with appressed hairs abaxially, glabrous adaxially; calyx undivided in the proximal 1.5 mm, and there covered with a dense, sometimes yellowish indumentum as on the inflorescence axes; calyx lobes 1.8–3 mm long and 1.2–2 mm wide, triangular, obtuse to acute distally, usually with flat margins, but on some specimens (e.g., Contreras 810) somewhat enlarged and longitudinally bent towards the abaxial side (forming a narrowly triangular, densely hairy step on the adaxial side) at anthesis, thus resembling slightly those of the female flowers; lobes abaxially (on the outside) medium densely covered (towards the margins scattered) with appressed or slightly spreading, straight or slightly flexuose, usually light (less frequently with interspersed, blackish-brown) hairs and with small warts, adaxially (on the inside) with a similar, but especially towards the central and basal part with a much more dense indumentum (but also scattered hairy towards the margins) and with slightly raised, longitudinal veins when dry; corolla white when alive; tube at anthesis 2 mm long and ca. 2 mm wide, narrowly cup-shaped, widest distally (aperture ca. 2 mm wide), outside medium densely covered (except at the base and on the areas covered by the calyx lobes) with slightly spreading or appressed, straight or slightly flexuose, light, longer hairs, inside glabrous; corolla lobes 1.5–2 mm long and 2 mm wide, triangular, acute distally, covered on the abaxial side with the same indumentum as the tube, but except some minute hairs, glabrous towards the margins (but hairy on the margins themselves), with small warts distally, glabrous adaxially; stamens 16–18 (Contreras 8513 and Walker 1329 with 16, Contreras 810 with 18), 1.5–2.5 mm long, glabrous; free part of the filaments 0.5–1 mm long and 0.3 mm thick, united in pairs (one standing in front of the other), adnate to the corolla tube ca. 0.5 mm above its base;

anthers 1.2–1.8 mm long and ca. 0.8 mm wide, widest at the base, light (contrasting to the dark connective), opening with two short apical slits, papillose at the conical apex; rudiment of the ovary ca. 1 mm high, longitudinally canaliculate, distally covered with scattered, short, patent hairs (Contreras 810 has additionally a 0.5 mm long, densely hairy rudiment of the style); **female flowers** ca. 8 mm long (without pedicel); stalk (peduncle and pedicel) 2–5 mm long and 0.5–1 mm thick; bracts similar to the bracteoles, ca. 3 mm long and 2.5 mm wide, triangular, soon caducous; bracteoles 2.5–4 mm long and 1.5–2 mm wide, narrowly triangular, acute distally, medium densely (scattered towards the margins) covered with short, appressed hairs abaxially, glabrous adaxially; usually with small, compressed buds in the axils; calyx undivided in the proximal 2 mm, and there covered with a very dense, sometimes yellowish indumentum as on the stalk; calyx lobes broadly ovate, acute or  $\pm$  obtuse distally, 4.5–5 mm long and 3.5–4 mm wide, on both sides medium densely (scattered towards the margins) covered with appressed, usually light (but sometimes with interspersed black) hairs of different lengths, with scattered glands proximally and with warts distally, and especially adaxially with slightly raised, longitudinal veins; corolla white when alive, tube 2–2.5 mm long and ca. 3–4 mm wide,  $\pm$  shortly cylindrical and with a wide aperture, on the outside densely covered (but at the base glabrous) with  $\pm$  appressed, straight or flexuose hairs of different lengths, inside glabrous; corolla lobes 2–3 mm long and 2 mm wide, acute,  $\pm$  triangular, on the outside densely covered with appressed, light hairs, but towards the margins as well as on the inside glabrous, distally on the outside (abaxial side) with warts; staminodia 8 (Contreras 7649, 7666), equal in shape and size, episepalous and epipetalous, glabrous, ca. 3 mm long, adnate to the corolla tube 1 mm above its base; free part of the filaments ca. 1 mm long and 0.2 mm thick; rudimentary anthers ca. 1.2 mm long and 0.5 mm wide, flat, with a dark connective and a slightly clavate, markedly papillose, light apex; ovary ca. 2 mm in diameter and 1.5 mm high, 4-locular, densely covered with  $\pm$  straight, appressed or spreading hairs and some isolated, sessile glands; stylodia two, 2–2.5 mm long, densely hairy, fused together only near their base; stigmata enlarged, glabrous; stalk of the **fruits** 1–2 mm long and 2 mm thick, covered with the remnants of the weathered indumentum; fruits usually solitary, less frequently two together in the same leaf axil (usually the terminal and one of the two lateral ones developed in a cyme), green or dark green when immature, according to Lundell 16240 orange colored when ripe, brown to dark brown when dry,  $\pm$  globose, up to ca. 2 cm in diameter and (without calyx) 1.5–2 cm high, smooth, medium densely covered with  $\pm$  spreading or appressed, straight, light hairs of different lengths and thickness when young, glabrescent except near the apex when mature, 1 (–2)-seeded (Frisch s.n., 12 Jan. 2004); fruit wall less than 0.5 mm thick, with a thin hypodermal stone-cell layer, with the epidermis tightly adhering but detaching at maturity; unripe fruit on the inside light brown to slight orange tinged, later on yellow-orange (seeds surrounded by a yellowish pulp); calyx on fruits green, the apices of its teeth blackish (always?) when alive, up to ca. 2 cm wide, its basal (undivided) part  $\pm$  cup-shaped (as seen from the outside), 4–6 mm wide, 2–5 mm high, medium densely to densely hairy (somewhat glabrescent with age) and wrinkled on the outside, lacking longitudinal ridges running down from the sinuses abaxially; sinuses between the calyx lobes flat, not enlarged; undivided (basal) part of the calyx on its inside (adaxial side) densely covered with appressed, centrifugally (parallel) orientated, long hairs, adhering tightly to the fruit and forming a nearly

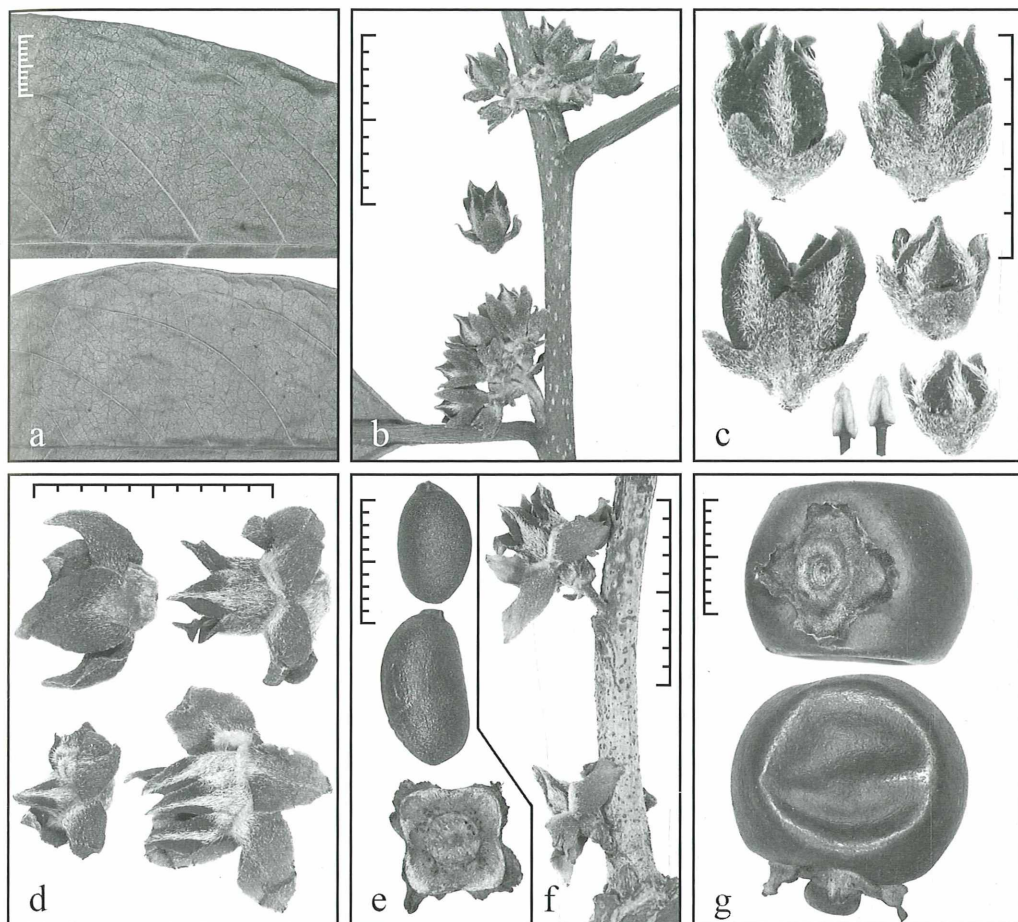


Fig. 14: *Diospyros yatesiana*: **a**: adaxial (on top) and abaxial (bottom) leaf surface with flachnectaria (from Contreras 8437 [C]); **b**: male inflorescences (from Contreras 8436 [LL, single flower from DUKE]); **c**: male flowers (from Contreras 8513 [S]); **d**: female flowers (from Contreras 8437 [C + CTES]); **e**: seeds (on top) and calyx of a fruit (bottom) seen from adaxial side (both from Lundell 1309 [US]); **f**: female inflorescences (from Zamora & Hernández 4323 [CICY]); **g**: fruits (from Lundell 1020 [GH]); scale = 1 cm, except c = 5 mm.

quadratic plate (fig. 14e), the corners of which protrude as triangles into the proximal part of the four calyx lobes and end there in a densely hairy, markedly developed step (the adjacent parts of the calyx lobes are strongly bent downwards after this step); calyx lobes 5–6 mm long, 4.5–5 mm wide,  $\pm$  triangular when flattened, longitudinally bent downwards (towards the abaxial side), as a whole either horizontally spreading or flexed downwards,  $\pm$  glabrescent with age, especially abaxially with slightly raised longitudinal veins; apices of the calyx lobes obtuse or acute; seeds shaped like segments of an orange-fruit, ellipsoidal or  $\pm$  flattened, with a small, flat protrusion on the distal end (attachment to the placenta), 11–13 mm long, 6–8 mm wide and 4.5–5.5 mm thick, white inside; seed-surface dark brown, very finely structured.



The male inflorescences of the collection Contreras 837 are somewhat anomalous: the terminal flowers of the cymes as well as those of the lateral partial-inflorescences are structurally hermaphroditic and apparently sterile (being shed before anthesis). The calyces resemble in shape and size those of the female flowers. The androecium consists of 17 stamens (only one flower bud dissected) which are quite similar to the regular stamens in the male flowers. The anthers are, however, flatter and devoid of pollen and the apical slits, although present, do not open downwards into the  $\pm$  flattened pollen sacks. The ovary is somewhat smaller than usual and seems to lack ovules; the stylodia are not fully developed. This phenomenon requires further investigation.

Vernacular names and use: box e'elemuy (ZAMORA CRESCENCIO et al. 2008), box silil (Darwin 2489, WALLNÖFER 2003b), boxsiliil (SOSA et al. 1985, SANABRIA 1986, ZAMORA CRESCENCIO 2003), boxtzilil (WHITEFOORD & KNAPP 1999–2008), guayabillo (Contreras 5656), guayalullo (Contreras 5469), hicarillo (Spanish) and maax'luch' (Itzá Maya) (both: Wallnöfer 9550), palo prieto (Hernández et al. ES-173, WHITEFOORD & KNAPP 1999–2008, WALLNÖFER 2003b), silil (Chan 1694, Chan et al. 246, WALLNÖFER 2003b). – The timber is used for construction (Gongora 461, Chan 4181, WALLNÖFER 2003b). According to SANABRIA (1986), the plant is used as a medicine and as firewood. The fruits are reported to be edible (Chan et al. 246, WALLNÖFER 2003b). The poles are used by the Itzá Maya in Petén to fix palm leaves on roofs (Wallnöfer 9550).

Distribution, habitat, ecology, and phenology: This species is known to grow in southern Mexico (Tabasco, Campeche, Yucatán, Quintana Roo, and Chiapas), as well as in Belize (Orange Walk), Guatemala (Petén, Zacapa), and Honduras (Cortés, Comayagua) where it grows at elevations of 5–250 (–400) meters (fig. 15). In Mexico it has been reported to grow in primary, but frequently also in secondary, low to medium tall, deciduous to subdeciduous forests (selvas bajas y medianas caducifolias y subcaducifolias) on red, black or loamy soils, and was indicated also from wet grounds. Martínez (10925) collected it in a tall, evergreen forest (selva alta perennifolia), and Roe et al. (1335) in a "grazed thorn-scrub forest with *Acacia* dominant" In Guatemala it is known to be a member of the following vegetation types: **zapotal** (climax forest dominated by *Manilkara zapota*), **ramonal** (climax forest dominated by *Brosimum alicastrum*), **tintal** (wooded swamps dominated by *Haematoxylum campechianum*), and **escobal** (slightly less swampy areas with the dominant palm *Cryosophila stauracantha*) (for further details see LUNDELL 1937). *Diospyros yatesiana* flowers from March to May (till the beginning of June) and has been found with fruits throughout the year excluding April.

Specimens examined: **Mexico**, Tabasco, Reforma, Balancan, [17°45' N, 91°17' W], (fl male), 22–26 May 1939, **E. Matuda 3188** [A, F, GH n.s., LL, MEXU n.s., MICH 3×, NA n.s.], "arbor 10 m, 25 cm diam." – Campeche, Mpio. Campeche, Unidad de Eval. y Monitoreo de la Biodiversidad de Hampolol, 5 m, 19°56'30" N, 90°22'40" W, selva mediana subperennifolia, primaria, ruderal; suelo negro, (fl male), 1 Jun. 2000, **C. Gutiérrez B. 6858** [CICY], "árbol 9 m; flor blanca; abundancia regular"; – 1 km de la población de Hampolol, 19°55' N, 90°23' W [added by CICY: ca. 19°55'53" N, 90°23'24" W], veg. secundaria; suelo negro pedregoso, (fl male), 25 May 1982, **P. Yam 201** [CICY], "árbol 4 m; flor blanca; abund. escaso"; – Aguada de Hampolol, 4 m (10 m), 19°55' N, 90°23' W [added by CICY: 19°55'33" N, 90°23'24" W], selva mediana subperennifolia, secundaria; suelo negro húmedo; (fr), 25 Aug. 1982, **C. Chan 1694** [CICY], "árbol 5 m; fruto verde; abund. regular"; – salida del poblado Cayal rumbo a Edzna, [19°44' N, 90°9' W], selva mediana subperennifolia, secundaria, (fr), 25 Feb. 1992, **M. Méndez, R. Durán & G. Campos 537**



[MEXU], "árbol 7 m; fruto verde; abundancia regular"; – entre Ceibaplaya [= Seyba Playa] y Champotón, [19°30' N, 90°41' W], (fl male), 17 May 1954, **F. Miranda 8006** [US]; – Mun. Cd. del Carmen [corrected by CICY: Escárcega], ejido Nueva Chontalapa, entronque carretera Villahermosa-Escárcega, 18°25' N, 90°51' W [added by CICY: 18°28'43" N, 91°05'30" W], selva baja subcaducifolia, alterada, secundaria; suelo rendzina, (fr), 11 May 1983, **E. Gongora 461** [CICY], "árbol 6 m; fruto globoso; abund. regular"; – a 1 km S de la carretera Escárcega-Palenque sobre el camino a Felipe Angeles, [18°27' N, 91°5' W], veg. secundaria, (fl female, yfr), 19 Apr. 1982, **E. Cabrera & H. de Cabrera 2425** [CAS, COL n.s. (dig. photo), F, MO, TEX], "árbol 7 m; flor verdosa; fruto y resina amarga"; – Municipio Candelaria, Zona Arqueológica El Tigre, 18°13'00" N, 90°50'05" W, vegetación a orillas de la carretera en área general de selva mediana subperennifolia hasta selva alta perennifolia muy alterada y convertida en potreros con solo pequeños parches dispersos de vegetación boscosa primaria o en diversos grados de alteración, (fr), 22 Sep. 1999, **G. Carnevali, F. May-Pat & J.L. Tapia 5861** [CICY n.s., W], "árbol de 4 m de alto; frutos verdes"; – Campo Experimental Forestal Tropical "El Tormento", km. 5, carr. Escárcega a Candelaria, [18°34' N, 90°46' W], selva med. subperenn. de *Manilkara zapotilla*; suelo arcilloso gris, roca caliza (sah-kab) a 62 cms, (st), 22 Dec. 1965, **J. Chavelas P. et al. ES-1048** [DS], "altura 3 m"; – same locality: (fr), 29 Dec. 1965, **E. Hernández X., J. Chavelas P. & X. Madrigal ES-173** [MICH], "arbusto 3,5 m"; – Rancho San Augustin [locality not traced], near Escárcega, [ca. 18°35' N, 90°40' W], with *Alseis*, *Manilkara*, *Bucida*, *Sabal*, *Roystonea*, *Lonchocarpus castilloi*, *Brosimum alicastrum*, (fr), 14 Mar. 1968, **F. White 9074** [FHO 2× (+ carp.)], "treelet 6 m"; – Mpio. Champotón, camino de Silvítuk [= Silvítuc] a Chan Laguna, 20 m, [added by CICY: 18°33'00" N, 90°15'05" W], selva mediana caducifolia; suelo moreno húmedo, (fr), 10 Oct. 1984, **C. Chan 4181** [CICY, XAL n.s.], "árbol 6 m; fruto verde; abundancia regular"; – Tuxpeña [= La Tuxpeña], [according to CAMPOS-RÍOS & CHIANG CABRERA 2006: 18°25'60" N, 90°5'60" W], (fr), 10 Feb. 1932, **C.L. Lundell 1309** [F (photo F 52496; photo NY: N.S. 6890 at FHO), G, GH, MICH, NY, US, WIS n.s.], "large tree"; – Mpio. Champotón, camino a Calakmul entre el km 9 y 11, 150 m, 18°27'25" N, 89°53'25" W, selva mediana subperennifolia, primaria; suelo negro arcilloso, (fl female), 12 May 1995, **P. Zamora C. & J.A. Hernández T. 4323** [CICY], "árbol 3 m; abundancia escasa"; – Mpio. Calakmul, Loc. a 17 km al S de la caseta de entrada a Calakmul, 140 m, 18°23'14" N, 89°53'52" W, selva mediana subcaducifolia, alterada, (fr), 16 Oct. 1997, **E. Martínez S., D. Alvarez, S. Ramírez, E. Lira & E. Madrid 28912** [M, MEXU n.s.], "árbol de 12 m"; – Mpio. Calakmul, loc. Zoh-Laguna, 290 m, 18°35'39" N, 89°24'48" W, selva baja subcaducifolia, inundable, (fr), 16 Jan. 1997, **P. Alvaro M. & F. Trejo 698** [CICY, MEXU n.s.], "arbusto 3 m; fruto verde" – *Yucatán*, Sayil, 2 km W [S!] Santa Elena, 100 m, 20°10'37" N, 89°39'07" W, (fl female, yfr), without date, **R.I. Trejo, R. Dirzo, P. Tenorio & G. Avila 22129** [CICY], "arbol"; – same locality: (fl male), without date, **R.I. Trejo, R. Dirzo, P. Tenorio & G. Avila 22131** [CICY], "árbol 4 m"; – Santa Elena, 3 km al E de Sayil, 20°10'27" N, 89°37'44" W, selva baja caducifolia; suelo rojiso; asoc.: *Heliocarpus* y *Pithecellobium*, (fr), 22 Feb. 1996, **P. Simá & R. Durán 1884** [CICY, W], "árbol 5 m; fruto verde oscuro"; – Mun. Oxkutzcab, Xlapak, frente a las 7 Columnas, [added by CICY: 20°10'27" N, 89°36'22" W], selva baja caducifolia, secundaria, ruderal; suelo rojo-Kankab, poco pedregoso, (yfr), 1 Sep. 1981, **A. Puch & M. Narvaez 657** [CICY], "árbol 5 m; fruto verde; abund. escaso"; – Mun. Tekax [corrected by CICY: Oxkutzcab], ruinas de Labná, al S del Mirador, 80 m, 20°14' N, 89°34' W [added by CICY: 20°10'15" N, 89°34'42" W], selva mediana, primaria; suelo negro, pedregoso, calido, (fr), 21 Mar. 1981, **C. Chan, M. Narvaez & A. Puch 246** [CICY], "árbol 5 m; fruto verde; abund. escaso"; – 2 km S of Tekax on highway 164 [184?], ca. 31 m, 20°05' N, 89°20' W, [correct is: 20°11' N, 89°16' W], grazed thorn-scrub forest with *Acacia* dominant, (yfr), 21 Aug. 1965, **K. Roe, E. Roe & S.A. Mori 1335** [NY, WIS n.s.], "shrub 3 m; fruits green"; – between Thul and Becanchen, [ca. 20°1' N, 89°11' W], (fr), 10 Jan. 1982, **S.P. Darwin & D. White 2232** [BM, F, MO], "tree ca. 25 ft. tall; fruits green"; – Thul, Tekax-Peto, [20°4' N, 89°7' W], (fr), 15 Jan. 1956, **O.G. Enríquez 332** [MEXU n.s., US]; – [added by CICY: Mun. Tzucacab], hills near Tzucacab, along road to Becanchen, [added by CICY:

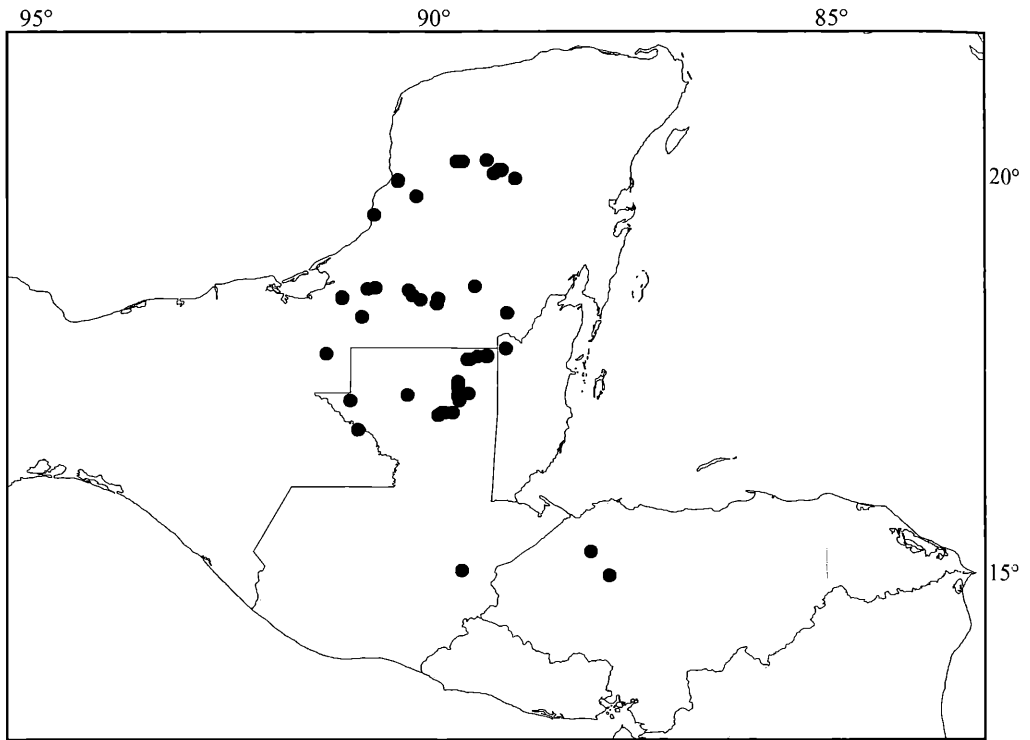


Fig. 15: Distribution of *Diospyros yatesiana* STANDL. ex LUNDELL

20°03'35" N, 89°06'25" W], near trail, (fr), 10 Jan. 1983, **S.P. Darwin 2496** [BM, CICY], "slender tree; fruits green"; – hills near Tzucacab, along road to Becanchen, [20°4' N, 89°5' W], (fr), 10 Jan. 1983, **S.P. Darwin 2489** [BM, MO, NY], "slender tree ca. 20 ft. tall; fruits green"; – Municipio Peto, 20 km al SE de Tzucacab, carretera a Carrillo Puerto, 19°57'10" N, 88°55'15" W, selva mediana perturbada; suelo negro, (fr), 14 Mar. 1998, **R. Durán, C. Espadas & P. Simá 3005** [CICY, GH n.s.], "árbol de 4 m; fruto verde oscuro" – Quintana Roo, a 12 km al S de San José de la Montaña, sobre el camino a Tomás Garrido, [18°16' N, 89°1' W], selva mediana con *Manilkara*, *Bursera* y *Alseis*, (yfr), 13 Jul. 1983, **E. Cabrera 5136** [MO], "arbusto 7 m; fruto verde" – Chiapas, Mun. Ococingo [= Ocosingo], a 3 km S de Frontera Corozal [= Frontera Echeverría] sobre el Río Usumacinta, 80 m, [16°48' N, 90°53' W], selva alta perennifolia, (fr), 21 Feb. 1985, **E. Martínez S. 10925** [MEXU n.s., W], "árbol 6 m"

Belize, Orange Walk, Río Bravo Conservation and Management Area, [17°49' N, 89°2' W], upland forest; sub-tropical moist forest life zone, (fr), 15 Oct. 1991, **N. Brokaw & M. Schulze 85** [MO], "tree 16 m; fruits green"

Guatemala, Petén, Guayacan, La Pita, bordering airport, [17°10' N, 90°59' W], in ramonal, (fr), 20 Jan. 1968, **E. Contreras 7500** [LL 2×], "shrub 12 ft., 3 in. diam."; – Paso Caballos, in low forest about 2 km S. W. W. [WSW?] of the village, [17°14' N, 90°16' W], in low forest, (fl male), 7 Apr. 1966, **E. Contreras 5656** [F n.s. (dig. photo)], "shrub ca. 40 ft. high, 8 in. diameter; flower white greenish"; – Paso Caballos, in forest about 1.5 km S, [17°14' N, 90°16' W], in forest, (fl male), 4 Apr. 1965, **E. Contreras 5390** [DAV,

DS, LL], "tree ca. 40 ft. high, 8 in. diam.; flowers greenish"; – Dos Lagunas, 1 km on Ixcanrio Road, [17°41' N, 89°31' W], in zapotal, (fl female), 1 May 1969, **E. Contreras 8437** [C, CTES, LL, RSA, S], "shrub 12 ft. high, 2 in. diam.; flowers white"; – same area: Ixcanrio, km 2.8, [17°41' N, 89°30' W], in tintal, (fr), 25 May 1969, **E. Contreras 8653** [C, CTES, DS, DUKE, LL, S], "shrub 8 ft. high, 1 in. diam."; – same area: km 5 of Ixcanrio Road, [17°41' N, 89°29' W], in zapotal, (fl male), 1 May 1969, **E. Contreras 8436** [CONN n.s., DUKE, LL, MICH, NY], "tree 30 ft., 3 in. diam.; flowers white"; – same area: km 15 of Ixcanrio Road, [17°43' N, 89°23' W], in zapotal, (fl female + defl), 26 Apr. 1969, **E. Contreras 8412** [C, CAS, DS, LL], "tree 18 ft. high, 3 in. diam.; flowers white"; – same area: Ixcanrio, bordering Aguada La Lagunita [locality not traced], 3 km east, [ca. 17°43' N, 89°23' W], (defl female, yfr), 15 May 1969, **E. Contreras 8557** [LL, NY, U], "shrub 15 ft. high, 2 in. diam."; – same area: Ixcanrio, [17°44' N, 89°16' W], in clearing, (fl female), 10 May 1969, **E. Contreras 8509** [C, DS, LL, PH, RSA, WIS n.s.], "shrub 12 ft. high, 2 in. diam.; flowers white"; – same area: Ixcanrio, bordering Ixcanrio River, [17°44' N, 89°16' W], (flbuds female, yfr), 22 May 1969, **E. Contreras 8619** [DUKE, LL, MICH, RSA], "tree 20 ft., 4 in. diam."; – same locality and coordinates: (fl male), 27 May 1969, **E. Contreras 8679** [DS, DUKE, GH, LL], "tree 20 ft., 3 in. diam.; flowers white"; – same area: Ixcanrio, 1.5 km south, [17°43' N, 89°16' W], in ramonal, (fl male), 10 May 1969, **E. Contreras 8513** [LL, S, U], "tree 35 ft. high, 10 in. diam.; flowers white"; – Uaxactun, about 500 m W, on road to the ruins, [17°24' N, 89°38' W], zapotal, (fr), 17 Dec. 1963, **E. Contreras 3611** [BM, DUKE, LL, RSA], "tree 20 ft. high, 6 in. diam."; – E de la aldea Uaxactún, citio arqueológico en el camino que conduce a la cienága "La Juventud", [17°24' N, 89°38' W], foresta alta, (fr), 18 May 1973, **R. Tún Ortiz 2603** [BM, MICH, US], "arbusto 9 m de alto; fruto verde"; – Uaxactun, bordering Aguada Paxcaman, 2 km from village, [17°24' N, 89°38' W], in zapotal/ramonal, (fr), 18 Jan. 1977, **C.L. Lundell & E. Contreras 20509** [LL, MO], "tree 40 ft., 5 in. diam.; fruit green"; – Tikal National Park, on Uaxactun trail, [ca. 17°20' N, 89°38' W], in escobal, (fr), 15 Aug. 1960, **E. Contreras 1414** [MO, NY, S], "tree 25 ft. high, 5 in. diam.; fruit green"; – Tikal, Aguada Seca, [ca. 17°14' N, 89°38' W], in high forest bordering Aguada, (fl female), 8 Apr. 1968, **E. Contreras 7666** [DS, LL, NY], "tree 30 ft., 4 in. diam.; flowers white"; – Tikal, 1.5 km W of Temple IV, [17°13' N, 89°38' W], in zapotal, (flbuds female), 5 Apr. 1968, **E. Contreras 7649** [DUKE, F n.s., LL, NY], "tree 50 ft., 18 in. diam.; flowers greenish"; – Ruinenstadt Tikal, ca. 60 km NE Flores/Santa Elena, entlang des Weges vom Tempel IV ENE zum Komplex H, ca. 100 m, [17°13' N, 89°38' W], halbbimmergrüner Tieflandregenwald, (yfr), 30 May 1989, **H. Förther 2742** [BM, MSB n.s., W], "Baum 28 m [?]"; – Tikal National Park, Tikal, [17°13' N, 89°38' W], in ramonal covering the ruins, (fr), 8 Jul. 1959, **C.L. Lundell 16240** [DS, DUKE, LL, NY, RSA, S, US], "tree 40 ft. high, 8 in. diam.; ripe fruits orange colored"; – same locality: (fr), 11 Jan. 1962, **C.L. Lundell 17030** [C, DS, DUKE, G 2×, LL, MICH, S], "tree 30 ft. high, 6 in. diam."; – Parque Nacional de Tikal, Complejo Q, [17°13' N, 89°38' W], bosque natural, (fr), 16 Jun. 1973, **R. Tún Ortiz 2710** [BM, F n.s. (dig. photo), MICH, US], "arbusto 10 m de alto, 18 cm de diam.; fruto verde"; – NNE-Umgebung des Lago Petén Itzá: im Bereich zwischen dem Parkplatz und dem Ruinengelände von Tikal, das ist 45 km NNE Flores, 200–220 m, 17°13' N, 89°37' W, am Straßenrand, (fr), 23 Aug. 1993, **B. Wallnöfer 7185** [G, MO, NY, U, W], "Baum 8 m; dbh 20 cm; mit grau-brauner, fein längsrissiger, in breiten Stücken sich ablösender Rinde; Blätter oberseits dunkelgrün; Kelch grün, an den Spitzen der Zipfel schwärzlich; unreife Früchte grün"; – same area: Aguada Terminos, [ca. 17°15' N, 89°30' W], in zapotal, (fr), 17 Feb. 1959, **C.L. Lundell 15617** [CAS, LL], "tree 30 ft., 6 in. diam."; – same area: on pinal trail, [ca. 17°15' N, 89°30' W], (fl male), 8 Mar. 1960, **C.L. Lundell 16767** [DS, G 2×, LL, MICH, US], "tree 40 ft. high"; – same area: on Remate road, [ca. 17°10' N, 89°37' W], in zapotal, (fr), 15 Jan. 1962, **C.L. Lundell 17094** [MICH, S, TEX], "tree 25 ft. high, 3 in. diam."; – Westufer des Lago Petén Itzá, nahe dem Seeufer ca. 1,3 km NNE-NE Zentrum von San José (NNE Chakmamantokfelsen bzw. SE Nuevo San José), 120 m, 16°59'26–32" N, 89°53–54' W, Sekundärvegetation und Reste der ursprünglichen Vegetation, (fr), 27 Aug. 1993, **B. Wallnöfer & F.M. Tut-Tesucun 6063** [K, M (MSB), MO, NY, U, USCG, W], "Baum 8 m; dbh 10 cm; Kelche und unreife

Früchte grün"; – same area: Sekundär-Vegetation W der Straße von San José nach Nuevo San José gegen den ehemaligen Aserradero Covaco (SW bei Nuevo San José), das ist 0,5–0,7 km N-NNW Zentrum von San José, 180–200 m, 16°59'11–14" N, 89°53–54' W, (fr), 27 Nov. 1994, **B. Wallnöfer 9550** [M (MSB), MO, NY, U, USCG, W], "Baum 4,5 m hoch, 4 cm dbh, zur Zeit nahezu blattlos; Früchte grün; unreifes Fruchtfleisch hellbraun mit Orange-Stich; Samen weiß"; – same area: im Anwesen von R.O. Frisch am Chakmamantok-Felsen, das ist 0,5 km NNE Zentrum von San José, ca. 180 m, 16°59'11" N, 89°53–54' W, (fr), 29 Aug. 2003, **R.O. Frisch s.n.** [W]; – same locality: (fr), 12 Jan. 2004, **R.O. Frisch s.n.** [W], "kleiner Baum; Früchte mit dünner, dunkelgrüner Schale, 4-teilig; 4 feste, gelborange Segmente mit gerader oder konkaver Längsfläche, dazwischen befindet sich je ein leicht ablösbarer, gelblicher, weicherer Fruchtfleisch-Block der einen Samen enthält; mehrere Früchte mit 1 Samen, eine Frucht mit 2 Samen"; – between Remate and San José, along north shore of Lake Peten Itza, [17°1' N, 89°50' W], on gypsum escarpment, (flbuds male), 16 Apr. 1960, **E. Contreras 837** [DUKE, LL, S, US], "shrub 6 ft. high, 2 in. diam."; – Remate, 4 km "nw.w." of the village, [17°1' N, 89°48' W], (fl male), 31 Mar. 1960, **E. Contreras 758** [DUKE, LL, MICH, MO, S], "tree 20 ft. high, 4 in. diam.; flowers white"; – NW El Remate, [17°1' N, 89°48' W], fence-row, (fl male), 2 May 1986, **R.L. Walker 1329** [BM, FHO 2×, MO], "tree 6 m tall; corolla whitish"; – Remate, on Tikal road, [17°1' N, 89°42' W], (flbuds female), 8 Apr. 1960, **E. Contreras 801** [LL, S], "tree 40 ft. high, 5 in. diam.; flowers green"; – same area: ca. 1 km NE of the village, [17°1' N, 89°42' W], high forest, (fl male), 9 Apr. 1960, **E. Contreras 809** [LL, MO], "tree 12 ft., 2 in. diam.; flowers white"; – Remate, on Tikal road, E of Piedras Blancas [locality not traced], ca. 400 m, [ca. 17°1' N, 89°42' W], in low forest, (fl male), 11 Apr. 1960, **E. Contreras 810** [CAS, LL, MO, NY, S], "tree 60 ft. high, 10 in. diam.; flowers white"; – same area: bordering Piedras Blancas, [ca. 17°1' N, 89°42' W], (flbuds female), 11 Apr. 1960, **E. Contreras 811** [LL], "shrub 5 ft.; flowers white"; – bordering the 7 temples, [locality not traced], ramonal, (fr), 18 Feb. 1966, **E. Contreras 5469** [MO, NY, PMA n.s. (dig. photo)], "tree 50 ft., 12 in. diam.; fruit green-brown" – Zacapa: see above (type of *D. zacapana*, **J.A. Steyermark 29490**).

**Honduras, Cortés**, orilla del Río Humuya, 40 km N Santa Cruz de Yojoa, 100 m, [WHITEFOORD & KNAPP 1999–2008 indicate: 15°15'38" N, 87°58'27" W], bosque de vega tropical, (fr), 1–30 Nov. 1980, **C. Nelson, E. Romero, H. Martínez, R. Andino, R. Rodríguez & A. Díaz 5755** [FHO, MO]; – Comayagua, Unión del Río Yure con Río Humuya, 100 km NE ciudad Comayagua, 200 m, [14°58' N, 87°44' W], bosque tropical de vega húmedo (Pinares y robledales), (fr), 22 Nov. 31 Dec. 1980, **C. Nelson, A. Díaz, R. Rodríguez, R. Andino, H. Martínez & E. Romero 6142** [BM, MO], "arbusto 2 m"

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### Literature

ACOSTA CASTELLANOS S., 2002: Plantas vasculares raras, amenazadas, o en peligro de extinción del estado de Oaxaca, un panorama preliminar. – *Polibotánica* 13: 47–82.

- ANGULO M. DE J. & SOTO E.M., 1990: Ebenaceae. – In: Bioclimatología de Flora de Veracruz 1 (2): 1–43. – Xalapa: Instituto de Ecología.
- AYALA-NIETO M.L. & LUDLOW-WIECHERS B., 1983: Catálogo Palinológico para la Flora de Veracruz. No. 13. Familia Ebenaceae. – Biotica 8 (2): 215–226.
- BORHIDI A., 1996: Phytogeography and vegetation ecology of Cuba. 2<sup>nd</sup> ed. – Budapest: Akadémiai Kiadó.
- CAMPOS-RÍOS M.G. & CHIANG CABRERA F., 2006: Una revisión nomenclatural de los tipos de plantas de la península de Yucatán (México). – Polibotánica 22: 89–149.
- CARBALLO R.A., 2002: Especies reportadas para El Salvador. – Pankia 21 (1–2): 10–11
- CARRANZA GONZÁLEZ E., 2000: Ebenaceae. – In: Flora del Bajío y de regiones adyacentes, 83: 1–9. – Pátzcuaro, Michoacán: Instituto de Ecología, A. C.
- CASAS A., VALIENTE-BANUET A., VIVEROS J.L., CABALLERO J., CORTÉS L., DÁVILA P., LIRA R. & RODRÍGUEZ I., 2001: Plant resources of the Tehuacán-Cuicatlán valley, Mexico. – Econ. Bot. 55 (1): 129–166.
- ESTRADA J. & WALLNÖFER B., 2007: Ebenaceae. – In: DUNO DE STEFANO R., AYMARD G. & HUBER O. (eds.): Catálogo anotado e ilustrado de la flora vascular de los Llanos de Venezuela, p. 460. – Caracas: FUDENA - Fundación Empresas Polar - FIBV
- FONG-G. A., MACEIRA-F. D., ALVERSON W.S. & SHOPLAND J.M., (eds.), 2005: Cuba: Siboney-Jutici. – Rapid biological inventories 10. – Chicago: The Field Museum.
- HIERN W.P., 1873: A monograph of Ebenaceae. – Trans. Cambridge Philos. Soc. 12 (1): 27–300 (+ XI plates).
- HOLMGREN P.K. & HOLMGREN N.H., 1998–2009: Index Herbariorum. – New York Botanical Garden. – <http://sciweb.nybg.org/science2/IndexHerbariorum.asp>
- HOWARD R.A., 1988: Charles Wright in Cuba: 1856–1867. – Alexandria, Va.: Chadwyck-Healey.
- KELLY L.M., 2001: Ebenaceae GÜRKE. – Flora del Valle de Tehuacán-Cuicatlán, 34: 1–5. – México D.F.: Universidad Nacional Autónoma de México, Instituto de Biología.
- LINARES J.L., 2005: Listado comentado de los árboles nativos y cultivados en la República de El Salvador. – Ceiba 44: 105–268.
- LUNDELL C.L., 1934: Preliminary sketch of the phytogeography of the Yucatan Peninsula. – Publ. Carnegie Inst. Wash. 436 (12): 255–355; (title of the volume: Contributions to American Archaeology).
- LUNDELL C.L., 1937: The vegetation of Petén. – Publ. Carnegie Inst. Wash. 478.
- MADRIGAL-SANCHEZ X. & RZEDOWSKI J., 1988: Una especie nueva de *Diospyros* (Ebenaceae) del Municipio de Morelia, Estado de Michoacán (México). – Acta Bot. Mex. 1: 3–6.
- MARTÍNEZ M., 1978: Catálogo de nombres vulgares y científicos de plantas mexicanas. – México: Fondo de Cultura Económica.
- MCNEILL J. et al. (eds.), 2006: International Code of Botanical Nomenclature. – Regnum Veg. 146 – Ruggell: Gantner Verlag.
- MIRANDA F., 1948: Datos sobre la vegetación en la cuenca alta del Papaloapan. – Anales Inst. Biol. Univ. Nac. México 19: 333–364.
- PACHECO L., 1981: Ebenaceae. – In: GÓMEZ-POMPA A. et al. (eds.): Flora de Veracruz, 16: 1–21. – Xalapa: Instituto Nacional de Investigaciones sobre Recursos Bióticos.
- PARMENTIER P., 1892: Histologie comparée des Ébenacées dans ses rapports avec la morphologie et l'histoire généalogique de ces plantes. – Ann. Univ. Lyon 6 (2): 1–155.

- POOL A., 1997: *Diospyros morenoi* (Ebenaceae), a new species from Nicaragua. – Novon 7: 189–190.
- PROVANCE M.C. & SANDERS A.C., 2005: *Diospyros torresii* (Ebenaceae): a new black zapote from tropical Mexico. – Sida 21: 2045–2050.
- PROVANCE M.C. & SANDERS A.C., 2006: More American black sapotes: new *Diospyros* (Ebenaceae) for Mexico and Central America. – Sida 22 (1): 277–304.
- PROVANCE M.C., GARCÍA RUIZ I. & SANDERS A.C., 2008: The *Diospyros salicifolia* complex (Ebenaceae) in Mesoamerica. – J. Bot. Res. Inst. Texas 2 (2): 1009–1100.
- SANABRIA O.L., 1986: El uso y manejo forestal en la comunidad Xul, en el sur de Yucatán. Etnoflora Yucatanense, Fascículo 2. – Xalapa: Instituto Nacional de Investigaciones sobre Recursos Bióticos.
- SAUGET J.S. & LIOGIER E.E., 1957–1963: Flora de Cuba, 2 (3–4): 138–141. – Contr. Ocas. Mus. Hist. Nat. Colegio "De La Salle" 13 + 16 (reprint 1974: Koenigstein: Otto Koeltz Science Publishers).
- SOSA V., FLORES J.S., RICO-GRAY V., LIRA R. & ORTIZ J.J., 1985: Lista florística y sinonimia Maya. Etnoflora Yucatanense, Fascículo 1. – Xalapa: Instituto Nacional de Investigaciones sobre Recursos Bióticos.
- STANDLEY P.C., 1935: New plants from the Yucatan Peninsula. – Publ. Carnegie Inst. Wash. 461: 49–91.
- WALLNÖFER B., 1999: Neue *Diospyros*-Arten (Ebenaceae) aus Südamerika. – Ann. Naturhist. Mus. Wien, B, 101: 565–592.
- WALLNÖFER B., 2000: Neue *Diospyros*-Arten (Ebenaceae) aus Südamerika - II. – Ann. Naturhist. Mus. Wien, B, 102: 417–433.
- WALLNÖFER B., 2001a: The Biology and Systematics of Ebenaceae: a Review. – Ann. Naturhist. Mus. Wien, B, 103: 485–512.
- WALLNÖFER B., 2001b: Lectotypification of *Diospyros cayennensis* A. DC. (Ebenaceae). – Taxon 50: 887–889 [see Erratum in Taxon 50 (4): 1319].
- WALLNÖFER B., 2003a: A new species of *Diospyros* from southwestern Amazonia. – Ann. Naturhist. Mus. Wien, B, 104: 563–566.
- WALLNÖFER B., (2003b [submitted for publication]): Ebenaceae. – In: CARNEVALI FERNÁNDEZ-CONCHA G. et al. (eds.): Flora ilustrada de la Península de Yucatán. – Mérida (Yucatán).
- WALLNÖFER B., 2004a: A revision of *Lissocarpa* BENTH. (Ebenaceae subfam. Lissocarpoideae (GILG in ENGLER) B.WALLN.). – Ann. Naturhist. Mus. Wien, B, 105: 515–564.
- WALLNÖFER B., 2004b: Ebenaceae. – In: KUBITZKI K. (ed.): The families and genera of vascular plants, 6: 125–130. – Berlin, Heidelberg: Springer Verlag.
- WALLNÖFER B., 2004c: Lissocarpaceae. – In: KUBITZKI K. (ed.): The families and genera of vascular plants, 6: 236–238. – Berlin, Heidelberg: Springer Verlag.
- WALLNÖFER B., 2005: New species of *Diospyros* (Ebenaceae) from the Neotropics and additional information on *D. apeibacarpus*. – Ann. Naturhist. Mus. Wien, B, 106: 237–253.
- WALLNÖFER B., (2006 [submitted for publication]): Ebenaceae. – In: JÖRGENSEN P.M. et al. (eds.): Catalogue of vascular plants of Bolivia.
- WALLNÖFER B., 2007: A revision of neotropical *Diospyros* (Ebenaceae): part 1. – Ann. Naturhist. Mus. Wien, B, 108: 207–247.
- WALLNÖFER B., 2008a: Ebenaceae. – In: HOKCHE O., BERRY P.E. & HUBER O. (eds.): Nuevo Catálogo de la Flora Vascular de Venezuela, pp. 356–357. – Caracas: Fundación Instituto Botánico de Venezuela Dr. Tobias Lasser.



- WALLNÖFER B., 2008b: Ebenaceae. – In: ZULOAGA F.O., MORRONE O. & BELGRANO M.J. (eds.): Catálogo de las Plantas Vasculares del Cono Sur. – Monogr. Syst. Bot. Missouri Bot. Gard. 107: 1987.
- WALLNÖFER B. & MORI S.A., 2002: Ebenaceae. In: MORI S.A., CREMERS G., GRACIE C.A., DE GRANVILLE J.-J., HEALD S.V., HOFF M. & MITCHELL J.D. (eds.): Guide to the vascular plants of central French Guiana. Part 2. Dicotyledons. – Mem. New York Bot. Gard. 76 (2): 254–257, pl. 50–51.
- WHITEFOORD C. & KNAPP S., 1999–2008: Ebenaceae. In: Flora Mesoamericana. – <http://www.mobot.org/mobot/fm/welcome.html>.
- ZAMORA CRESCENCIO P., 2003: Contribución al estudio florístico y descripción de la vegetación del municipio de Tenabo, Campeche, México. – Polibotánica 15: 1–40.
- ZAMORA CRESCENCIO P., GARCÍA GIL G., FLORES GUIDO J.S. & JAVIER ORTIZ J., 2008: Estructura y composición florística de la selva mediana subcaducifolia en el sur del estado de Yucatán, México. – Polibotánica 26: 39–66.
- ZANELLA F.C.V., DE OLIVEIRA M.L. & GAGLIANONE M.C., 2000: Standardizing lists of locality data for examined specimens in systematics and biogeography studies of new world taxa. – Biogeographica 76 (4): 145–160.

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