Ann. Naturhist. Mus. Wien	108 B	207 - 247	Wien, Mai 2007

A revision of neotropical *Diospyros* (Ebenaceae): part 1

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Abstract

In the course of a revision of New World Ebenaceae for "Flora Neotropica" and of several regional floras, specimens from ca. 75 herbaria have been studied. *Diospyros caribaea*, *D. crassinervis* s.str., *D. crassinervis* ssp. *kubal* (here reported as new to science), *D. crassinervis* ssp. *urbaniana* and *D. conzattii* are described in detail. *D. riojae*, *D. costaricensis*, *D. gomeziorum* and *D. tuxtlensis* (the last three were recently published as novelties), are transferred into synonymy of *D. conzattii*, whereas *D. acunae* is regarded to be a synonym of *D. crassinervis* ssp. *crassinervis*. Images, distribution maps and lists of herbarium specimens studied are also presented.

Key words: Ebenaceae, *Diospyros acunae*, *D. caribaea*, *D. costaricensis*, *D. crassinervis* ssp. *crassinervis*, *D. crassinervis* ssp. *kubal*, *D. crassinervis* ssp. *urbaniana*, *D. gomeziorum*, *D. pergamentacea*, *D. riojae*, *D. tuxtlensis*, revision, taxonomy, flora of South America.

Zusammenfassung

Im Rahmen einer Revision der neuweltlichen Ebenaceae für "Flora Neotropica" und für verschiedene Regionalfloren, konnten Herbarbelege aus ca. 75 Herbarien studiert werden. *Diospyros caribaea*, *D. crassinervis* s.str., *D. crassinervis* ssp. *kubal* (hier als neu vorgestellt), *D. crassinervis* ssp. *urbaniana* und *D. conzattii* werden detailliert beschrieben. *D. riojae*, sowie die erst kürzlich als neu publizierten *D. costaricensis*, *D. gomeziorum* und *D. tuxtlensis* werden als Synonyme zu *D. conzattii* gestellt. *D. acunae* wird dagegen als Synonym von *D. crassinervis* ssp. *crassinervis* angesehen. Abbildungen, Verbreitungskarten und Listen der untersuchten Herbarbelege werden ebenfalls präsentiert.

Introduction

In the Americas, the Ebenaceae are represented by the genera *Diospyros* with about 100 - 130 species and by *Lissocarpa* with 8 species. In the course of an ongoing revision of Ebenaceae (WALLNÖFER 2001a, 2001b, 2004a, 2004b, 2004c; WALLNÖFER & MORI 2002, DUANGJAI et al. 2006) for "Flora Neotropica", "Flora of Ecuador", "Flora of the Guianas", "Flora de Paraguay", and "Flora ilustrada de la Peninsula de Yucatán" several new species have already been described (WALLNÖFER 1999, 2000, 2003, 2005). Beginning with the present paper all the currently known neotropical species of *Diospyros* will be dealt with in a series of separate publications.

Note: Additions are given in [ ], coordinates given in brackets have been determined during this revision; – 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; – acronyms of herbaria according to HOLMGREN & HOLMGREN (1998 - 2007).

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***Diospyros caribaea* (A.DC.) STANDL.**, Publ. Carnegie Inst. Wash. 461 (4): 80 (1935); [fig. 1 - 2].

≡ *Macreightia caribaea* A.DC., Prodr. 8: 221 (1844).

≡ *Maba caribaea* (A.DC.) HIERN, Trans. Cambridge Philos. Soc. 12 (1): 125 - 126 (1873).

≡ *Maba caribaea* (A.DC.) BRANDEGEE, Proc. Calif. Acad. Sci., ser. 2, 3: 151 (1891), comb. illeg.

Typus: Hispaniola [probably Haiti], data on the label of the lectotype: "*Maba*? - St. Domingue (Nectoux) - h. Desfont. nunc Webb - 1842", **H. Nectoux s.n.** [lectotype (here designated): G-DC, isolectotypes: FI-W n.s. (digital images seen), G-DC].

Notes: The specimen here designated as lectotype lacks flowers. There is, however a second sheet in the De Candolle herbarium which bears the following data: "*Diospyros*? - ~~*Bumelia*?~~ - St. Domingue". Unfortunately, the collector of this specimen is not stated, but it also seems to be Nectoux. An additional label, probably (?) in De Candolle's hand, bears the following information: "*Maba*? - Cette plante ressemble à un *Maba*, par le nombre ternaire des organes, mais je ne la décris pas vu le petit nombre de fleurs et l'incertitude qui règne sur d'autres Ebenacées à type ternaire d'Amerique. (voy. *Maba acapulcensis*, *Diospyros inconstans* Jacq.)" [This plant resembles a *Maba* due to the trimerous organs, but I did not describe it due to the small number of flowers and the incertitude among the other trimerous Ebenaceae of America. (see ...)]. – Numbered 33868 (and with the wrong attribution: "Types of the Delessert Herbarium") the Field Museum Chicago has distributed a photo of this sheet to several herbaria (e.g., F, MICH, US ex NA; photo from the photo at US: NY neg. N.S. 6908 at FHO and NY). On this photo the narrow label ("*Macreightia caribaea* Alph. DC.", etc.), pinned to the outside of the folder containing the specimens, is overlaying and hiding a part of the label (detailed above) of the specimen! The twig on this sheet shows one flower, and another, dissected one, is in the capsule. – In the herbarium Webb (FI-W) there is another sheet (Herb. Webbianum no. 121925, filed till now among the undetermined *Diospyros*) with a flowering branch and the following information on two separate labels: "*Diospyros* [in pencil] - an *Bumelia* Swarts - St. Domingue - Nectoux" and "*Diospyros*? - St. Domingue". – The three specimens obviously seem to be part of the same gathering, and can, therefore, not be regarded as syntypes.

Shrub or small tree, up to 4 (- 9) m tall (according to León 11065 a tree 20 - 30 m tall); twigs terete, slightly flattened near the nodes when young, brown to dark brown or blackish-brown, soon glabrescent; lenticels on twigs usually well visible, scattered, elongated, salient, light brown, finally cracking up and becoming gray or black; older twigs with smooth or longitudinally fissured, gray or blackish-brown bark; buds and very young leaves densely covered with appressed, straight or slightly flexuose, blond to light brown hairs of different lengths, concealing the surface; **leaves** alternate, with brochidodrome venation; petioles 3 - 6 mm long, 1 - 1.5 mm thick, light or dark brown, slightly flattened, on adaxial side flat or with a faint longitudinal grove, soon glabrescent; leaf lamina obovate, less frequently lanceolate, rarely ± elliptic, (1.5 -) 5 - 8 (- 10) cm long, (0.5 -) 2 - 4 (- 6) cm wide, 1.3 - 2.5 (- 3) times longer than wide, coriaceous, gray brown to dark brown and ± shiny adaxially and usually lighter brown and dull abaxially when dry, glabrous (except for some remote, appressed hairs on the veins abaxially), sometimes partially covered with dense efflorescences of white crystals; leaf apex

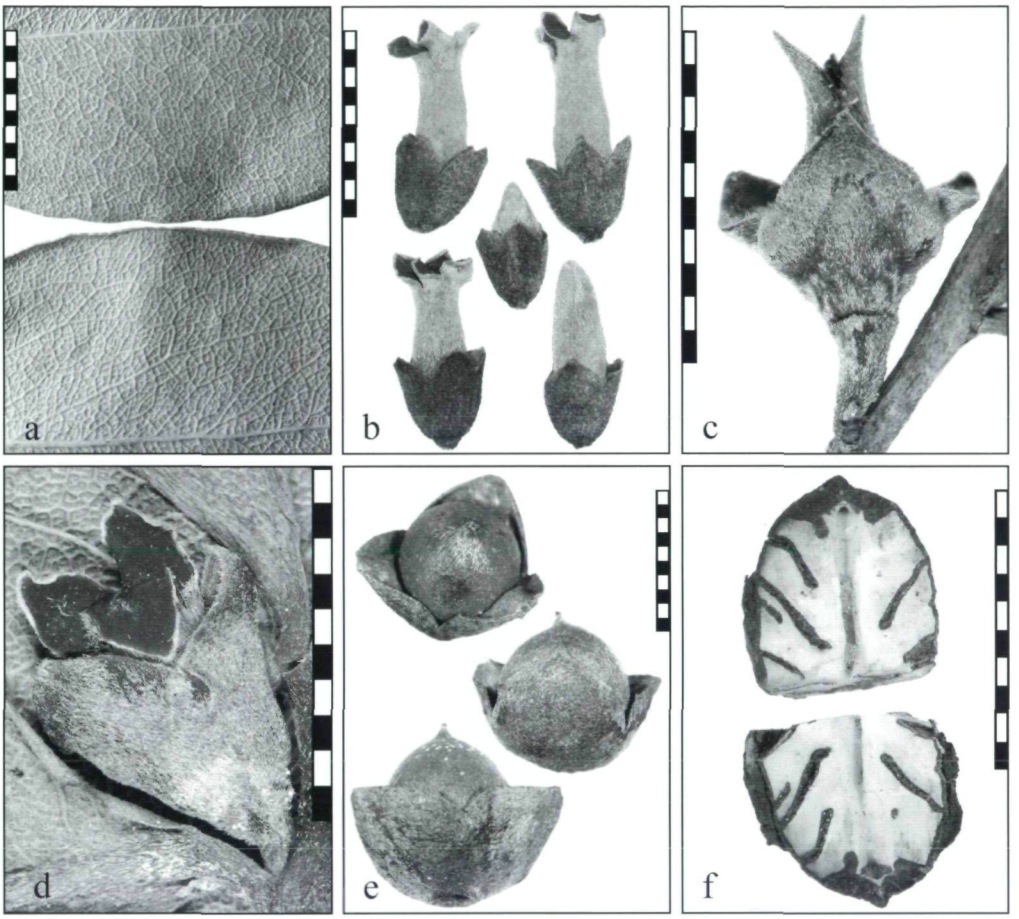


Fig. 1: *Diospyros caribaea*: **a**: adaxial (on top) and abaxial (bottom) leaf surface (from Bisse & Rojas 3687 [JE]); **b**: male flowers (from Ekman 14657 [G]); **c**: female flower (from Ehrenberg s.n. [HAL]); **d**: female flower (from Sauvalle s.n. [GH]); **e**: fruits (from Ekman H 372 [S]); *D. caribaea* or *D. crassinervis* ssp. *kubal*: **f**: interior of a seed showing ruminate endosperm (from Wright 1331 [GOET]); bar = 1 cm.

broadly rounded, obtuse or slightly acute, or emarginate; base of the lamina attenuate, tapering for a few millimeters into the petiole; leaf margin entire, slightly revolute when dry, and with a slightly thickened marginal vein; flachnectaria on abaxial leaf surfaces (0 -) 1 - 8 (sometimes completely missing), arranged in the proximal third of the lamina (sometimes directly on the midvein), light brown, flat or slightly sunken, surrounded by a thick vein which is connected to several other veinlets; midvein on adaxial side impressed, on abaxial side markedly prominent; secondary veins 5 - 8 on each side, adaxially flat or slightly prominent, abaxially slightly raised, straight (especially the basal ones) or slightly curved; intersecondary veins not conspicuous; tertiary and quaternary veins markedly reticulate and usually slightly prominent on both sides, on adaxial side lighter than the surroundings and well visible; areas between the veinlets slightly

sunken and glabrous on both sides; **inflorescences** in the axils of usually regular leaves on young shoots, (2 -) 3 (- 6)-flowered on male, 1-flowered on female plants; peduncles, pedicels, bracts and bracteoles densely covered with the same kind of indumentum as the twig apices (but hairs either light brown or blackish-brown); peduncles of male inflorescences 2 - 5 mm long and 0.5 - 1 mm thick, enlarged and somewhat flattened distally; pedicels ca. 1 mm long and 0.5 mm thick; bracts ca. 2 mm long and 0.8 mm wide, acute, glabrous adaxially, soon caducous; stalks (peduncle and pedicel) of female plants 1.5 - 3 mm long and 1 - 1.5 mm thick; bracteoles 1.2 - 2 mm long and 1 - 1.5 mm wide, acute; **flowers** 3 (- 4)-merous; the male ones 10 - 13 mm long at anthesis, white when alive; calyx 5 - 7 mm long, ca. 3 - 4 mm wide, undivided in the proximal 3 - 4 (- 5) mm, outside medium densely covered with blond to light brown or blackish-brown, appressed, relatively short and thick hairs, inside glabrous; calyx lobes broadly triangular, (1 -) 2 - 3 (- 4) mm long and 2 - 3.5 (- 4) mm wide; corolla 8 - 12.5 mm long, outside densely covered with long, appressed, blond to light brown hairs (their core usually not ferruginous), glabrous proximally and on the inside; corolla tube (5 -) 10 mm long and ca. 3 mm wide, widest near the middle; corolla lobes 2 - 3 (- 4) mm long and 2.5 mm wide, obtuse or rounded distally, near the margins on the outside with shorter hairs, inside glabrous; stamina 11, of different sizes and lengths, 3 - 6.5 mm long, glabrous; filaments 1.5 - 3 mm long, their proximal ca. 0.5 mm adnate to the base of the corolla tube; anthers 1.8 - 3 mm long and up to ca. 0.5 mm wide, narrow, widest below the middle, some of them asymmetric at the base, tapering and ± acute distally; rudiment of the ovary densely covered with spreading, short hairs; **female flowers** 11 - 12 mm long at anthesis; calyx 7 - 9 mm long, ca. 9 mm wide, undivided in the proximal ca. 4 mm, outside moderately to densely covered with short, appressed or slightly spreading, straight or slightly flexuose, light brown hairs of different lengths, inside densely covered with longer, ± spreading, ± straight, light brown to brown hairs; calyx lobes broadly triangular, 5 mm long and 5.5 - 6.5 mm wide, distally ± acute; area below the sinuses in-between the calyx lobes on some plants only slightly, on others strongly expanded and protruding outwards; corolla 10.5 - 12 mm long; corolla tube 6 - 7 mm long and ca. 3 - 4 mm wide, outside densely covered with long, ± appressed or only slightly spreading, ± straight, light brown, translucent hairs (their core dark brown), glabrous near the base and on the inside; corolla lobes 5 mm long and 3 - 5 mm wide, narrowly acute or ± rounded distally, outside with the same indumentum as the tube but the hairs towards the margin shorter, inside glabrous; staminodia 4, similar in size, 3 - 5 (- 6) mm long, glabrous; filaments 1.5 - 3.5 mm long, their proximal 0.8 - 1.5 mm adnate to the base of the corolla tube; aborted anthers flat, 1.5 - 3 mm long, 0.3 - 0.6 mm wide, narrow, widest in the lower portion, acute distally, sometimes slightly cordate proximally; ovary subglobose, ca. 3 mm in diameter, 6-locular, densely covered with appressed or slightly spreading, ± straight, ± parallel hairs; stylodia three, 3 mm long widened into the ovary, distally parted over ca. 1 mm; stalk of the **fruits** up to ca. 4 mm long and ca. 3 mm thick; fruits ± globose, up to 2.5 - 3 cm in diameter, smooth, densely covered with light brown, appressed, long hairs when young, glabrescent with age but especially near base and apex with persistent, weathered remnants of the indumentum; fruit wall ca. 0.4 mm thick, with tightly adhering epidermis; calyx covered outside with a scattered and appressed, inside with a dense, partially patent indumentum, undivided in the proximal 3 - 4 mm, lacking longitudinal ridges running down from the sinuses

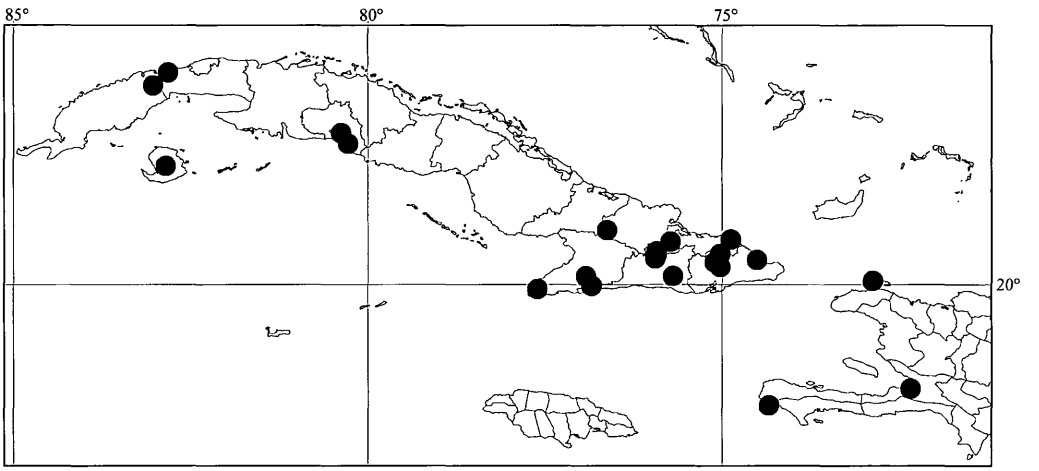


Fig. 2: Distribution of *Diospyros caribaea* (A.DC.) STANDL.

abaxially; area below the sinuses in-between the calyx lobes usually inconspicuous or only little expanded (moderately expanded and protruding outwards in Ekman 6231); calyx lobes up to 1.3 cm wide and ca. 0.8 cm long, obtuse or acute; marginal parts of the lobes slightly flexed outwards; seeds not available for study.

According to Ekman (see Ekman H 7135 under *D. crassinervis* as well as URBAN 1930), plants of this species are "branched from the base up" and, concerning the habit, quite distinct from *D. crassinervis*. Whether this is always the case remains to be seen.

Vernacular names: **Cuba**: "ebano carbonero" (Blain 180, SAUGET & LIOGIER 1957-1963), "ebano real" (Sagra 223), "ebano blanco otro clase (= tagua-tagua)" (Ekman ser. III 4502), "tagua-tagua" (Ekman ser. III: 4580, 4644, 4756, 4883, 6052, 6231; Ekman 7369, 14657; Gill 115, León 11065, SAUGET & LIOGIER 1957-1963, BISSE 1968). **Haiti**: "bois raide" (Ekman H 372, MOSCOSO 1943). In the Dominican Republic this species is apparently called "maboa" (PEGUERO 2002), and in Cuba (Isla de Pinos) "vigueta hembra" (SAUVALLE 1873), but this has, so far, not been confirmed by vouchers.

Distribution, habitat, ecology, and phenology: This species is known from Cuba and Haiti, and may also occur in the Dominican Republic (fig. 2), where it grows in woods, in "charrascales", on dry hills along the coast and on limestone hills at elevations between 200 and 900 meters. BISSE (1968) reports it from Cuba, although, with only one exception, from mesophytic woods in mountainous areas, where it grows on acidic soils. It has been collected in flower from May to the end of July, and with young fruits in July and August.

Specimens examined: **Cuba**, Pinar del Río, hill near Soroa, Candelaria, [ca. 22°48' N, 83°1' W], on top of hill, (st), 2/5 Jan. 1952, **E.E. Liogier (= Alain) & J. Acuña 2343** [GH n.s., NY]. – La Habana, Mariel Tinaja, in hills towards the sea, [22°59' N, 82°48' W], (st), 6 Jun. 1921, **E.L. Ekman 12872** [S]. – Isla de la Juventud, Isla de Pinos [= Isla de la Juventud], [ca. 21°40' N, 82°50' W], (fl female), s.d., **J. Blain 180** [F]. – Cienfuegos, Belmonte, Soledad, Cienfuegos, [22°8' N, 80°22' W], (st), 2 Feb. 1928, **J.G. Jack 5604** [A, NY, P, US], "small erect tree 12 ft. high"; – San Blas, La Sierra, 600 - 800 ft., [21°59' N, 80°16' W], in woods, (st), 4 Mar. 1929, **J.G. Jack 6976** [A, NY], "small tree 30 ft.". – Holguín, Mir at fluminem Rioja,

[20°46' N, 76°37' W], (st), 4 Mar. 1915, **E.L. Ekman ser. III 4883** [G, S], "arbor"; – Municipio Mayarí, camino de La Mensura a Mayarí, Loma de La Bandera, 20°35'52.2" N, 75°43'9.0" W [WGS 84 map datum], charrascal, (st), 21 Mai 2004, **J.R. Abbott, E. Bécquer Granados & A. Matos Viñals 19004** [FLAS n.s., HAJB n.s., W 2×], "shrubby tree ca. 4 m tall"; – Moa, orillas del rio Yagrumaje cerca del puente en el camino Moa-Baracoa, [20°38' N, 74°52' W], (st), Mar 1968, **J. Bisse & E. Köhler 6045** [JE]. – Granma, Finca Belice, Ojo de Agua, Cabo Cruz Oriente, [19°56' N, 77°36' W], (defl male), 6 Jun. 1952, **E.E. Smith 680** [LS n.s., US]; – in Sierra Maestra non procula Rio Yara, ca. 600 m, [ca. 20°7' N, 76°55' W], (fl male), 28 Jul. 1922, **E.L. Ekman 14657** [G, K, NY, S, US], "fl. white". – Santiago de Cuba, Bayate, [20°22' N, 75°56' W], in sylva, (yfr), 12 Jul. 1915, **E.L. Ekman ser. III 6231** [F, MICH, NY, S, US], "arbor mediocris"; – same area: prope fluminem Bayate, [ca. 20°22' N, 75°56' W], in sylva, (st), 8 Feb. 1915, **E.L. Ekman ser. III 4580** [S], "arbor"; – same area: in jug. mont. inter Arr. [Arroyo] Bibano et Rio Bayate, [same coord.], (st), 16 Feb. 1915, **E.L. Ekman ser. III 4644** [S], "arbor"; – same area: ad Arr. [Arroyo] Bibano, [same coord.], in sylva, (defl male), 16 Jun. 1915, **E.L. Ekman ser. III 6052** [K, NY, S], "arbor mediocris"; – same locality, (defl female), 13 Jun. 1916, **E.L. Ekman 7369** [G, K, NY, S], "arbor"; – Sierra de Nipe, ad rio Jimbambay, [20°28' N, 75°55' W], in coll. calcar., (st), 23 Feb. 1915, **E.L. Ekman ser. III 4756** [F, S, US], "arbor"; – Bayate, ad Sierra de Nipe ad "Bayate seco", [20°25' N, 75°55' W], in coll. calcar., (defl male), 30 Jul. 1915, **E.L. Ekman ser. III 6280** [S]; – Cobre Range of Sierra Maestra, Loma del Gato and vicinity, 900 m, [ca. 20°7' N, 75°41' W], rocky crest (yfr), 11 Jul. - 14 Aug. 1921, [GH label: top of Loma de Barbi, Sierra Maestra, Jul. 1922], **J.S.S. Frère León, Frère Clement & M. Roca 10205** [GH, NY], "shrub 3 - 4 m". – Guantánamo, southern Oriente and Pico Turquino, Loma del Naranjo, 600 - 700 m, [ca. 19°59' N, 76°50' W], (fl male), Jul. 1922, **J.S.S. Frère León 11065** [NY], "tree 20 - 30 m; corolla with 3 or 4 lobes"; – Guantánamo, Cupeyal del Norte, cerca de la casa de la reservación, 700 m, [ca. 20°26' N, 75°1' W], monte quemado, (fl male), Jun. 1967, **J. Bisse & L. Rojas 3687** [JE]; – Guantánamo, Monte Cristi, altiplano, 700 m, [20°19' N, 75°6' W], (fl female), Mai 1968, **J. Bisse & E. Köhler 8912** [JE]; – prope villam Monte Verde, at the Farallones, [ca. 20°15' N, 75°1' W], (fl, fr), 1860/1864, **C. Wright 1331** [BR, F, G 3×, GH 2×, GOET 2×, NY 4×, S, UC, US, W], [According to additional small labels present in the capsules of the duplicates at GH, this number is a mixture of at least 5 different gatherings partly belonging to this species and partly to *D. crassinervis* ssp. *kubal*]; – Baracoa, Finca Playuela, [ca. 20°21' N, 74°30' W], in sylva ("on the coral reef"), (st), 28 Jan. 1915, **E.L. Ekman ser. III 4502** [S], "arbor". – without data or not located, (st), s.d., **R. de la Sagra s.n.** [P]; – (st), s.d., **R. de la Sagra 223** [P]; – (fl female), s.d., **F.A. Sauvalle s.n.** [GH]; – illegibile, (st), 10 Dec. 1925, **T.H. Gill 115** [NY]; – in Cuba Orientali, (fr), 1861, **C. Wright 104** [S].

Haiti, Nord-Ouest, Ile La Tortue, La Vallée, high ridge of Morne Barranca, c. 300 m, [20°3' N, 72°52' W], (st), 23 Mai 1925, **E.L. Ekman H 4106** [G, S], "arbor parva". – Ouest, prope Port au Prince, [18°32' N, 72°20' W], (st, but female), Jun. 1894, **L. Picarda 1251** [L, NY, S, Z]. – Sud, inter Tiburon et Cahouane [= La Cahouane], [18°18' N, 74°20' W], in collibus siccis litoralibus, (yfr), 25 Jul. 1917, **E.L. Ekman H 372** [K, NY, S], "arbor parva". – **Hispaniola** (unclear origin: either from Haiti or from the Dominican Republic): St. Domingo, (fl female), s.d., **C.A. Ehrenberg s.n.** [HAL, NY]; – Santo-Domingo, sur les coteaux vers les plaines, exposées á la chaleux [on south-side of hills towards the plains], (fl female), s.d., **L.C. Richard s.n.** [C, P 2×], "frutex majusculus; fl. viriduli, coriacei".

Diospyros crassinervis* (KRUG & URB.) STANDL. ssp. *crassinervis, Publ. Carnegie Inst. Wash. 461 (4): 80 (1935); [fig. 3 - 6].

≡ *Maba caribaea* (A.DC.) HIERN var. *crassinervis* KRUG & URB., Bot. Jahrb. Syst. 15: 327 (1892).

≡ *Maba crassinervis* (KRUG & URB.) URB., Symb. antill. 7 (3): 329 - 330 (1912).

Typus: Bahamas, Crooked Island, Fortune Island [= Long Cay], [22°37' N, 74°20' W], (fr), 4 Feb. 1888, **H.F.A. Eggers 3811** [lectotype (here designated): HBG (ex B; fig. 3), isolectotypes: B (destroyed), BM, C 2× (photo NY: N.S. 6906 at FHO, NY), K, M],

Fig. 3: Lectotype of *Diospyros crassinervis* (KRUG & URB.) STANDL. ssp. *crassinervis*.

"arbor 12' alt. [C: "low tree, 12' - 16' high"], drupa lutea"; - Acklins Island, [ca. 22°25' N, 73°59' W], (st), 9 Feb. 1888, **H.F.A. Eggers 3940** [syntypes: B (destroyed), C (photo NY: N.S. 6905 at FHO, NY)], "frutex 10' alt."; - Hog Island, [there are three islands with that name in the Bahamas], (fr), Feb. [1888?], **H.F.A. Eggers 4160** [syntype: B (destroyed), duplicates not seen].

= *Diospyros acunae* ["*acuñai*"] BISSE, Mem. Fac. Ci. Univ. Habana, Ser. Ci. Biol., 1 (6, Fasc. 2): 2 - 3, 49 (tab. 1), mapa 2 (1968).
Typus: Cuba, Prov. Oriente [Guantánamo], Guantánamo, monte seco sobre diente de perro en la subida a Monte Cristi, 300 m, [20°18' N, 75°05' W], (flbuds male), Jun. 1967, **J. Bisse & L. Rojas 3533** [holotype: JE (fig. 4; photo W: 2097), isotype: HAJB n.s. (photo: table 1 in BISSE 1968)].
Note: In the protologue the data about the type are somewhat differing ("Cuba, Prov. Oriente, Guantánamo, prope Felicidad de Yateras in camino ad Bacunago in fruticetis siccis solo calcareo a 600 m.s.n.m., mes Junio flor, leg. Bisse, Rojas et Duek") and seem to be more congruent with the barely legible label on the photo of the isotype. But, instead of the word "Bacunago" something like "Benajagua" or "Demajagua" can be made out on that label.

Shrub or low tree 1.2 - 4 (- 6) m tall, said to be stiffly rigid or bushy, (trunk of a tree 4 m tall was 15 cm in diameter at its base); bark (Shafer 416) very uneven and irregularly scaly, dirty gray on the outside, in its interior brown or partially black; twigs terete, gray, brown or blackish, covered with a brown indumentum (similar to that on the buds but less dense) when young, soon glabrescent; lenticels on twigs scattered, elongated, salient, dark or blackish; older twigs smooth or with longitudinally fissured, gray, brown to blackish bark; buds, twig apices and very young leaves densely covered with long, ± straight or flexuose, ± spreading, light brown hairs concealing the surface; **leaves** alternate, with brochidodrome venation; petioles (1.5 -) 3 - 5 (- 7) mm long, (1 -) 1.5 - 2 (- 3) mm thick, brown, wrinkled when dry, ± flat or with a faint longitudinal grove adaxially, soon glabrescent when mature; leaf lamina broadly obovate or elliptic, sometimes lanceolate, rarely ± circular, (0.8 -) 2.5 - 6 (- 10.5) cm long, (0.5 -) 1.5 - 4 (- 7.2) cm wide, (0.9 -) 1.3 - 1.7 (- 2) times longer than wide, coriaceous; adaxial leaf surface medium densely covered with ± spreading, slightly flexuose hairs on the veins when young, soon glabrescent, dark, pale or bright green when mature and fresh, gray-brown or dark brown and dull when dry and then often partially or completely covered with a layer of white, minute crystals (e.g., Kjellmark 156); abaxial leaf surface with a persistent indumentum, light green or brown when fresh, light brown or brown when dry; leaf apex broadly rounded or obtuse, less frequently slightly acute or emarginate, rarely truncate, very rarely with a small mucro; base of the lamina shortly attenuate or rounded, less frequently attenuate, rarely truncate or slightly cordate; leaf margin entire, slightly revolute when dry, with a strong, irregularly sinuate marginal vein; flachnectaria on abaxial leaf surfaces 0 - 2 (- 7) (missing on many leaves; often hardly visible due to the indumentum, color, and structure of the surface), arranged in the proximal fourth of the lamina, light brown to brown, ± sunken, surrounded by a thick vein which is connected to several other veinlets, sometimes located laterally on the major veins; midvein impressed (sometimes at least partially ± flat) adaxially, markedly prominent abaxially, often covered with weathered remnants of indumentum, but usually soon glabrescent adaxially, abaxially scattered or more densely covered with slightly flexuose, ± appressed, light brown hairs (the larger, translucent ones with a ferruginous core); secondary veins

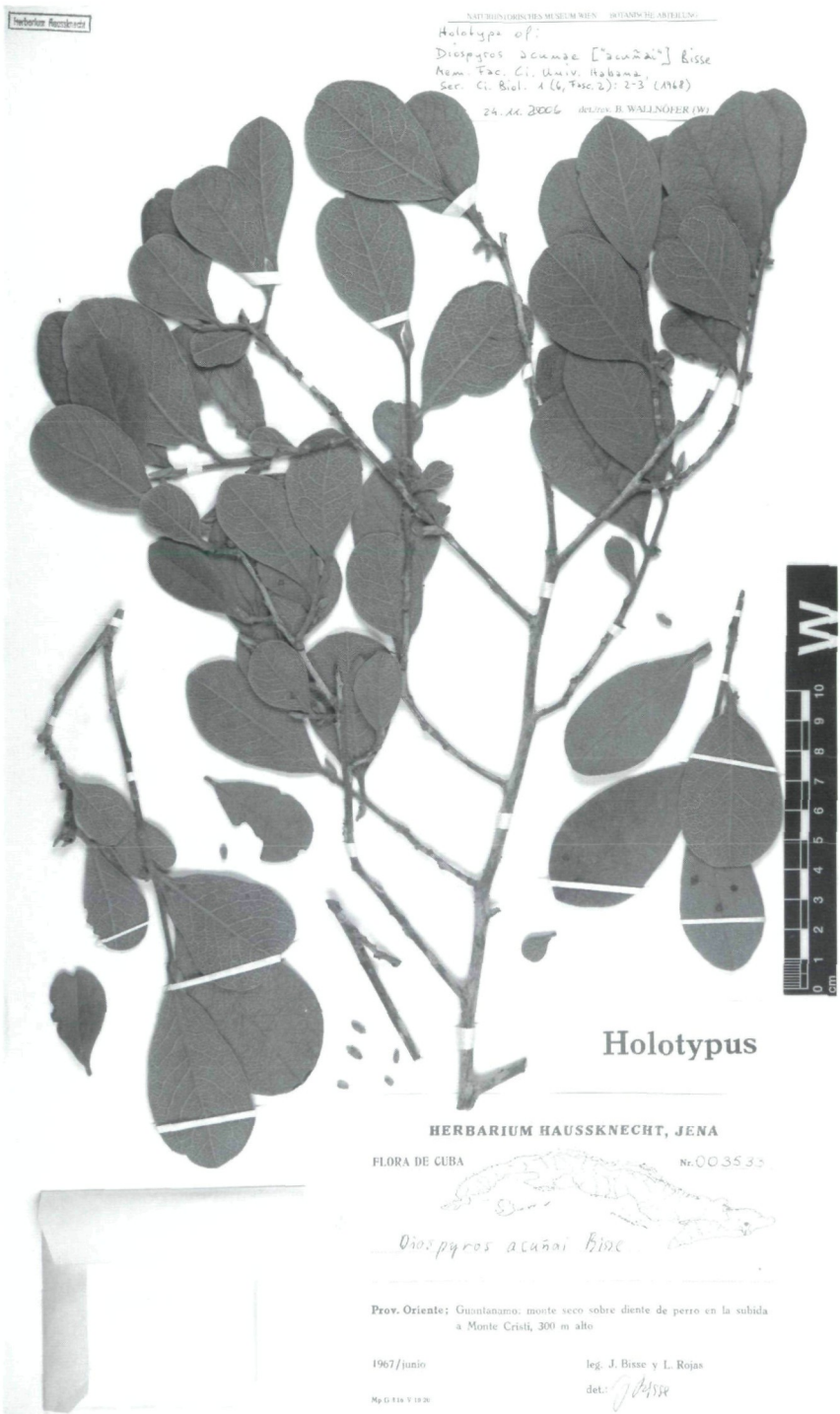
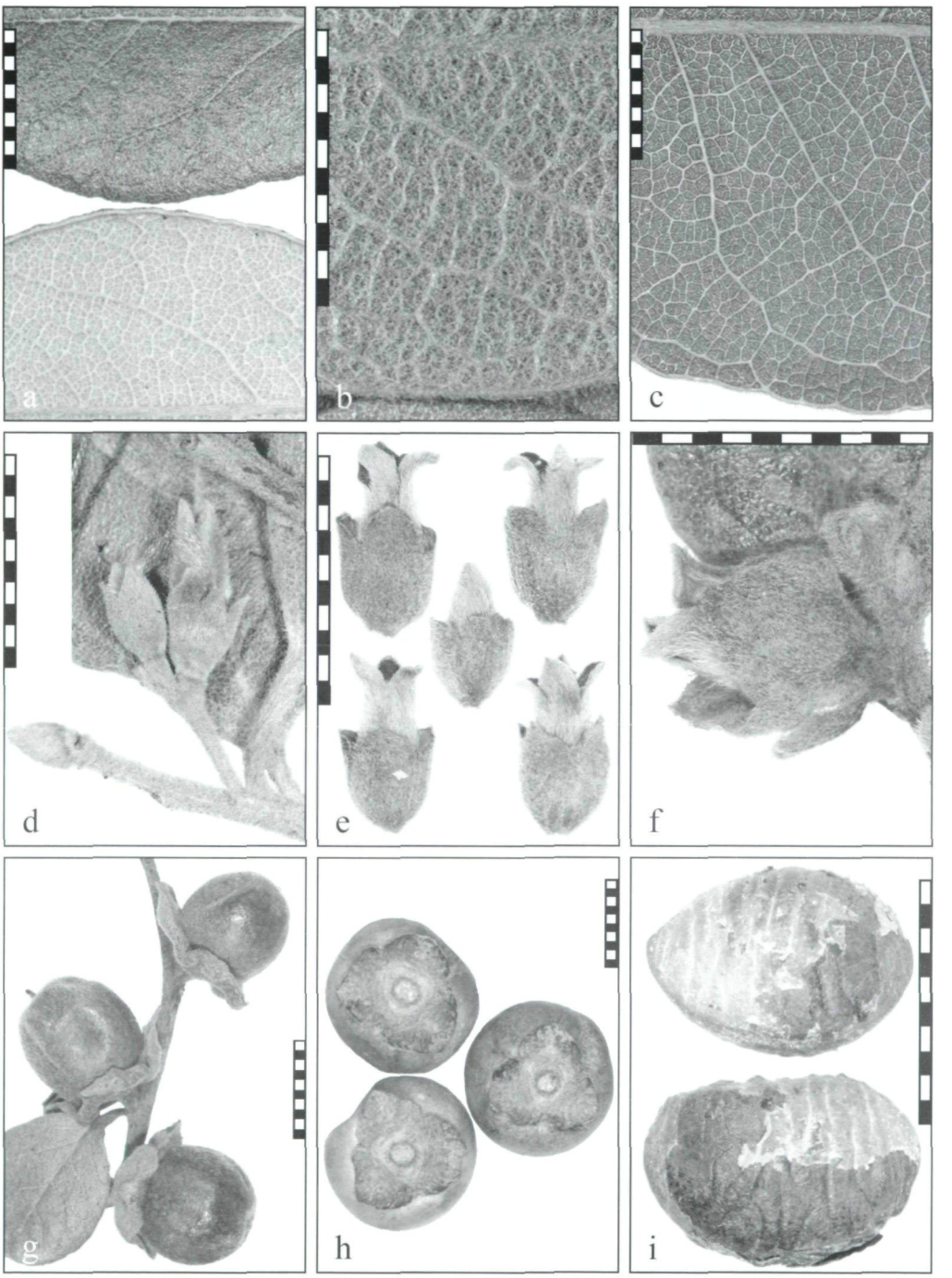


Fig. 4: Holotype of *Diospyros acunae* BISSE.

5 - 7 (- 8) on each side, adaxially slightly prominent (but area along the veins sunken in respect to the rest of the lamina), abaxially raised, the basal ones straight, the others slightly curved, with the same indumentum as the midvein; intersecondary veins inconspicuous; tertiary and quaternary veins markedly reticulate on both sides, slightly prominent and lighter adaxially, strongly raised and thickened, and loosely covered with ± appressed hairs abaxially; areas between the veinlets ± flat or slightly sunken adaxially, deeply alveolate abaxially; alveoles larger than in ssp. *kubal*, with veinlets decreasing in thickness and disposed on different levels, their bottom usually not completely concealed by the ± medium dense indumentum composed of 0.1 - 0.25 mm long, flexuose, spreading or horizontally oriented (with respect to the leaf axis), blond to light brown hairs; alveoles on leaves from reiterating- or water-shoots, or from plants growing in the shady understorey quite large, with only a sparse indumentum composed of ± straight and quite short (at minimum 0.06 mm long) hairs, or sometimes nearly glabrous; **inflorescences** arranged in the axils of regular leaves on young, a few cm long shoots or in the axils of minute or a few mm long leaves near the base of these shoots, 3 (- 4)-flowered on male plants, 1-flowered on female plants; peduncles, pedicels, bracts and bracteoles densely covered with the same kind of indumentum than on the twig apices; peduncles of male inflorescences 2 - 6 mm long and ca. 1 mm thick, enlarged and somewhat flattened distally; pedicels ca. 1.5 mm long and 0.8 mm thick; bracts ca. 2 mm long and ca. 1 mm wide, acute, glabrous adaxially, soon caducous; stalks (peduncle and pedicel) of female inflorescences ca. 1.5 mm long and ca. 1 mm thick; bracteoles 3 - 4.5 mm long and 1.5 - 2.3 mm wide, acute, on both sides covered with indumentum; **flowers** 3 (- 4)-merous, the male ones 7 - 8 mm long at anthesis, "cream-colored", "butterscotch-brown" or white when alive; calyx 5 mm long, ca. 3.5 mm wide, undivided in the proximal ca. 3.5 mm, outside densely covered with light brown, quite short, appressed or ± spreading, straight or slightly flexuose hairs of different lengths, inside glabrous; calyx lobes broadly triangular, ca. 1.5 mm long and ca. 2.5 mm wide; corolla ca. 7.5 mm long; corolla tube 5 mm long, ca. 3 mm wide, widest below the middle, somewhat inflated (with a ± large hollow inside), outside densely covered with long (up to 1 mm), ± straight, appressed, light brown hairs, partially glabrous near the base, inside glabrous; throat markedly narrowed; corolla lobes 2.5 mm long and 1.8 mm wide, obtuse distally, on abaxial side (outside) with similar indumentum as that on the tube but hairs shorter, glabrous adaxially (inside); stamina 9 (+ 1 rudiment) of different sizes and lengths, 1.5 - 3 mm long, glabrous; filaments 0.2 - 1 mm long, their proximal ca. 0.5 mm adnate to the base of the corolla tube; anthers 0.6 - 2 mm long and up to ca. 0.5 mm wide, narrow, usually with an irregular outline, sometimes slightly curved, widest below the middle, tapering and ± acute distally; rudiment of the ovary densely covered with spreading, short hairs; **female flowers** 8 - 9 mm long at anthesis; calyx 7 mm long, 6 mm wide, undivided in the proximal 3.5 mm, with indumentum similar to that of the male flowers, but more dense and hairs somewhat longer; calyx lobes broadly triangular,

Fig. 5: *Diospyros crassinervis* ssp. *crassinervis*: **a**: adaxial (on top) and abaxial (bottom) leaf surface (from Correll 43483 [NY]); **b**: abaxial leaf surface (from Bisse & Rojas 3533, holotype of *D. acunae* [JE]); **c**: abaxial surface of a nearly glabrous leaf (from Ekman 14168 [S]); **d**: male inflorescence (from Ekman H 8562 [S]); **e**: male flowers (from Correll & Proctor 48771 [DUKE]); **f**: female flower (from Correll & Proctor 48904 [NY]); **g**: fruits (from Correll 43504 [TEX]); **h**: fruits (from Wilson 7406 [NY]); **i**: seeds (from Shafer 416 [US]); bar = 1 cm.


a
b
c
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i

2.5 mm long and 5 mm wide, markedly thickened; area below the sinuses in-between the calyx lobes markedly expanded; corolla 7 mm long; corolla tube 4.5 mm long and 3.5 mm wide, ± cylindrical, covered outside with the same kind of indumentum as that on the male flowers, inside and near the base on the outside glabrous; corolla lobes 3 mm long and ca. 1.8 mm wide, acute, on abaxial side (outside) with similar indumentum as that on the tube but hairs shorter and smaller, glabrous adaxially (inside); staminodia 3, equal in shape and size, glabrous; filaments 1.3 mm long, their proximal 0.5 mm adnate to the base of the corolla tube; aborted anthers flat, 1.2 mm long, 0.8 mm wide, ovate, acute distally; connective darker, visible only proximally; ovary subglobose, 2.8 mm wide and 2.3 mm high, 6-locular, densely covered with appressed, straight, parallel, translucent hairs (their core usually ferruginous); stylodia 3, ca. 1.8 mm long, cleft distally; stalk of the **fruits** up to ca. 4 mm long and ca. 2 - 3 mm thick; fruits ± globose, up to 2 (- 2.5) cm in diameter, green, greenish-yellow or yellow (mature?) when fresh, usually shiny, light brown or rarely blackish when dry, densely covered with brown, ± appressed, sub-parallel, straight or slightly flexuose, short and long hairs (their core darker brown to ferruginous) when young, glabrescent with age, but especially near base and apex with weathered remnants of the indumentum, 2 - 5-seeded; fruit wall ca. 0.8 mm thick, smooth, with tightly adhering epidermis; calyx as a whole up to 15 mm wide and 2 - 4 mm high, undivided in the proximal ca. 3 mm, lacking longitudinal ridges running down from the sinuses abaxially, on the outside sparsely to densely covered with light brown, appressed or ± spreading, flexuose hairs, inside with a dense, light brown indumentum composed of longer, more flexuose, spreading hairs (not spreading on parts where the calyx tightly adheres to the fruit); area below the sinuses in-between the calyx lobes often inconspicuous or on some collections (also on young fruits!) moderately expanded and protruding outwards; calyx lobes up to 9 - 11 mm wide and 5 - 6 mm long, broadly rounded, obtuse or sometimes acute, often with slightly raised, longitudinal venation externally; marginal parts of the lobes ± flexed outwards or less frequently appressed to the fruit; seeds 10 - 11 mm long, 7 mm wide and 5 - 6 mm thick, dark gray to blackish-gray, with irregular, transversal (sometimes branched) furrows deriving from the deep ingrowths of the testa (fig. 5i, endosperm ruminate); testa covered with a dense, minute, thin, black reticulum (areas in-between gray, irregular in outline and usually elongated).

This subspecies has a quite variable venation and indumentum on the abaxial leaf surfaces. The leaves of some collections (e.g., Brace 4184, Correll 44358, Gillis 10664, etc.) are markedly scleromorphic, with remarkably thick veins of higher order, and, as a consequence of this, with very small alveoles. On the other hand, leaves on reiterating- or water-shoots, or on plants growing in the shady understorey are usually much larger and less scleromorphic, with thinner veinlets and slightly larger alveoles (cavities). The indumentum on these leaves is very sparse (bottom of the alveoles well visible) or sometimes almost absent (e.g., Nickerson 4212) and consists of usually smaller, often straight hairs. Herbarium specimens with such leaves (largest leaf lamina 7.6 × 5 cm) have been collected in the Bahamas (e.g., Booth et al. 5-15, Brace 6658, Britton & Millspaugh 3026, Reis 213, Small & Carter 8863, 8900, all of them with sterile twigs!). Very similar, also sterile, specimens with leaf laminae up to 10.5 × 7.2 cm, have been collected in the mountain ranges of eastern Cuba (e.g., Areces et al. 29972, Bisse & Köhler 7665, Ekman ser. III 2002, 4813, 14168, Morton 9671, Roig 1516). Bisse (1968) assigned

some of these collections to his new species *D. acunae*, the type of which (Bisse & Rojas 3533 with male flower buds), with respect to leaf size (largest leaf lamina 6.5 × 4 cm), falls, however, within the average leaf-size of *D. crassinervis*. In the key, he apparently compared his new species only with plants from western Cuba (here assigned to ssp. *kubal*). If, instead, he would have compared the specimens of his *D. acunae* with collections from the Bahamas and the eastern part of Cuba (also including twigs from understorey-plants and from water-shoots), he would have had serious problems in separating them. Therefore, due to the lack of any clear-cut characters, BISSE's species can not be maintained as a separate entity. – In Haiti this subspecies is only known from a small area around Thomazeau, where it has been found in open forests on rocky hillsides on oligocene limestone. These populations exhibit the least scleromorphic leaves within the subspecies. The leaf lamina does not exceed 5.5 × 3.8 cm in size and has quite thin veins and a less dense indumentum on abaxial side. As can be seen on his revision labels, Frank White obviously intended, back in 1968, to assign these collections to a separate subspecies ("ssp. *venosa*", ined.). The diagnostic characters on which he would have based his conclusion are not known. – Concerning the differences in habit between *D. crassinervis* and *D. caribaea*, see the note under the latter.

Figure: fig. 474 in CORRELL & CORRELL (1982).

Vernacular names and use: **Bahamas**: "boa-wood" (CORRELL & CORRELL 1982), "featherbed", "feather-bed" (Eldridge s.n., Gillis 10664, Kessler et al. 2711, Nickerson 4212, Reis 213, CORRELL & CORRELL 1982); "hard-bark" (Nickerson 4212); "hardcock" (Byrne 273, 462); "hardleaf" (Byrne 273); – use: aphrodisiac (Byrne 462). **Cuba**: "tagua-tagua de carrascal" (Ekman ser. III 5942); "ebano carbonero" (SAUGET & LIOGIER 1957-1963, BARRETO VALDÉS et al. 2005); – use: medicine, timber, honey (GODÍNEZ CARABALLO et al. 2005).

Distribution, habitat, ecology, and phenology: *D. crassinervis* s.str. is known from the Bahamas (except for the islands in the north and southeast), from the central and eastern part of Cuba and from southern Haiti (fig. 6), where it grows at low altitudes (up to 400 m in Cuba, 500 m in Haiti). In the Bahamas it grows in coppices, scrublands and thickets on limestone, especially near the coast. It has frequently been collected in rocky places, on slopes, hills, and ridges, but it has also been observed in the shrub-understory in pinewoods. In Cuba it is known from coastal thickets, dry forests ("monte seco") on limestone and according to the collector Ekman from "carrascales (tibisiales)". BISSE (1968) reports *D. crassinervis* (s.lat.!) from the manigua costera and from the cuabales (serpentine hills), whereas he recorded his *D. acunae* only on limestone soil. BORHIDI (1996) reports *D. crassinervis* as a member of at least four different plant associations in central and eastern Cuba. According to GODÍNEZ CARABALLO et al. (2005) it grows in the "bosque siempreverde micrófilo (bosque seco)", a wood which reaches a height of 15 m. BARRETO VALDÉS et al. (2005) consider it a pioneer species which very much increases its population size after disturbances. – *D. crassinervis* s.str. has been collected in flower from April to July, and in fruit from June to April. The subspecies is not deciduous, but a major phase of sprouting of new leaves seems to occur in March (Brace 6658), May (Ekman 7354, Correll 51378) and apparently (?) also in July (Nickerson 4212).

The collection Britton & Wilson 5603 from Casilda (Sancti Spíritus) represents the westernmost, very isolated locality of this subspecies. As a mix up of labels and speci-

mens cannot be excluded, more material from this area is needed for study to confirm the presence of this taxon. As can be seen in fig. 6 (compare also mapa 2 in BISSE 1968), there seems to be a large gap in central Cuba between the areas of distribution of ssp. *crassinervis* and ssp. *kubal*.

Specimens examined: **Bahamas**, Andros, North Andros, road to Morgan's Bluff, [25°10' N, 78°2' W], (st), 4 Mar. 1907, **L.J.K. Brace 6658** [F, NY], "shrub ...; gum black shiny sooft"; – just W of Nicholls Town, [25°8' N, 78°1' W], in coppice, (fr), 16 Dec. 1974, **D.S. Correll & D. Evans 44000** [F, NY], "tree ca. 3.5 m"; – just S of Mastic Point, [25°3' N, 77°58' W], low coppice; roadside, (flbuds male), 10 Jul. 1975, **S.R. Hill 3335** [NY], "shrub 2 m; flowers butterscotch-brown"; – along Stafford Creek just S of bridge, [24°53' N, 77°54' W], dense rocky coppice, (fl male), 27 May 1977, **G.R. Proctor 36936** [GH, MO], "shrub 3 m"; – same locality, in coppice in open pinelands, (defl male), 5 Dec. 1976, **D.S. Correll & G.R. Proctor 47764** [LL, NY], "sterile sapling 2.5 m"; – same locality, in coppice; on rock flats, (fr), 7 Dec. 1976, **D.S. Correll & G.R. Proctor 47816** [NY], "plants 2 m"; – pineland ca. 2 miles S of Forfar Field Station [near Stafford Creek] near main road, [ca. 24°53' N, 77°54' W], pinewoods with shrub understory; limestone rock and thin clay soil, (defl male), 19 Jul. 1991, **E. Kjellmark 156** [DUKE], "small shrub or tree 1.5 m tall"; – along main road S of Blanket Sound settlement, [24°51' N, 77°54' W], old pine stand; limestone rock and organic debris, (st), 21 Jul. 1990, **E. Kjellmark 35** [DUKE], "small to medium, slender shrub"; – Savannah, near Staniard Creek, [24°50' N, 77°53' W], (st), 1 - 3 Feb. 1910, **J.K. Small & J.J. Carter 8863** [F, GH n.s., K, NY, P, US], "shrub 1 m tall or less; leaves bright green, rough"; – same data & coll., **8900** [F, K, NY, P, US], "shrub 1 - 2 m tall; leaves bright green, rough"; – Fresh Creek, [24°42' N, 77°46' W], (flbuds male), 10 Jun. 1890, **J.I. Northrop & A.R. Northrop 640** [A, F, G, GH, K, NY]; – just S of Somerset Bay, [ca. 24°41' N, 77°46' W], in thin coppice over smooth flat rocks, (fl male), 20 May 1980, **D.S. Correll 51378** [F, MO, NY], "shrubs to ca. 2.5 m"; – South Andros, just S of The Bluff, [24°7' N, 77°33' W], in open coppice on pitted rocks, (fr), 27 Sep. 1974, **D.S. Correll 43594** [BRIT, GH, NY], "rigid shrub ca. 2.5 m; leaves heavily coriaceous"; – Deep Creek, [24°1' N, 77°33' W], (yfr), 18 Aug. - 10 Sep. 1906, **L.J.K. Brace 5202** [F, NY]; – along Crown Road between Kemp's Bay and Black Point, [23°59' N, 77°33' W], in low coppice, (fr), 24 Sep. 1974, **D.S. Correll 43504** [BRIT, F, NY, TEX], "sapling 4 m; leaves heavily coriaceous"; – Pure Gold, [23°58' N, 77°32' W], (st), 18 Aug. - 10 Sep. 1906, **L.J.K. Brace 5082** [F, NY]; – slopes just S of Little Creek, [23°57' N, 77°32' W], coppice-covered rocky slopes, (st), 23 Sep. 1974, **D.S. Correll 43483** [NY], "sterile, stiffly rigid shrub with coriaceous leaves". – New Providence, New Providence, [25°2' N, 77°24' W], (st), 3 - 5 Sep. 1952, **S. von Reis 213** [MICH], "shrubby"; – (flbuds male), 28 Apr. 1879, **L.J.K. Brace 15 (243)** [F, MO]; – Village Road, [25°2' N, 77°24' W], coppice, (st), 30 Aug. 1904, **N.L. Britton & L.J.K. Brace 366** [F, K, NY]; – vicinity of Blue Hills, [25°3' N, 77°23' W], (flbuds male), 28 - 29 May 1909, **P. Wilson 8242** [F, K, NY]. – Eleuthera, Governor's Harbour, [25°10' N, 76°14' W], (st), 14 Nov. 1890, **A.S. Hitchcock s.n.** [F (fragm. ex MO)]; – same area, (fr), 18 Nov. 1890, s.coll. [probably **A.S. Hitchcock**] s.n. [MO]; – Rock Sound area, east of Rock Sound settlement, 24°51.656' N, 76°9.075' W, (st), 3 Nov. 2006, **M.A. Vincent & C. Kwit 13342** [MU n.s., W]. – Exuma and Cays, Great Guana Cay, Exuma Chain, Great Guana Bay, [ca. 24°3' N, 76°22' W], rocky coppice, (st), 21 - 22 Feb. 1905, **N.L. Britton & C.F. Millspaugh 2886** [F, NY, US]; – Great Exuma, Farmers Hill, [23°36' N, 75°54' W], (st), 14 Aug. 1975, **J. Eldridge s.n.** [DAV, US]; – Sevute land, Hayures road [barely leggible!], [ca. 23°35' N, 75°55' W], scrub lands, (st), 22 - 28 Feb. 1905, **N.L. Britton & C.F. Millspaugh 3026** [F, NY]; – hills W of Moss Town, [23°31' N, 75°51' W], coppice-covered high rocky hills, (fr), 14 Dec. 1976, **D.S. Correll & H.B. Correll 47917** [NY], "erect stiffish shrub 2 m"; – near Rolletown [23°28' N, 75°42' W], (st), 21 Aug. 1976, **J. Eldridge s.n.** [MO]; – on Sheep Cay, [ca. 23°28' N, 75°52' W], in coppice, (fr), 8 Jan. 1975, **D.S. Correll 44041** [F 2×, NY], "stiff shrub 2.5 m tall"; – Hummingbird Cay, [ca. 23°27' N, 75°58' W], dry upland parts of the island, (fr), 31 Mar. 1968, **B. Kessler, N.H. Nickerson & D. Sammons 2711** [A, MO], "understory shrub with thick foliage"; – same island, top of Emory Heights, [ca. 23°27' N, 75°58' W], dry top, (yfr), 18 Jul. 1968, **N.H. Nickerson, R. Barker & W.L. Nickerson 2854** [A, MO], "shrub to 2 m"; – same island, behind Mr. Bernhard's house, [ca. 23°27' N, 75°58' W], inland forest, (fr), 23 Jan. 1969, **N.H. Nickerson & R. Gross 3020** [A], "understory shrub"; – same island, behind the citrus

grove [ca. 23°27' N, 75°58' W], (st), 11 Jul. 1975, **N.H. Nickerson 4212** [DS, GH]; – Culmer's Cay, Exumas, [23°27' N, 75°55' W], in open with dense leaves, (st), 14 Jan. 1970, **S. Nickerson, N.H. Nickerson & M.T. Case 3249** [MO]. – Cat Island, Wilsons Bay, [24°36' N, 75°39' W], coastal thickets, (fr), 16 Nov. 1967, **R. Byrne 462** [A, WIS], "small tree; leaves pale green above, brown below"; – without details, [ca. 24°20' N, 75°25' W], occasionally in coppices especially near coast, (yfr), 22 Aug. 1967, **R. Byrne 273** [A, WIS], "leaves dark green above when fresh, light green below"; – hills just E of Old Bight, [24°15' N, 75°21' W], coppice-covered hills, (st), 24 Nov. 1975, **D.S. Correll 46290** [NY], "sterile shrub 2 m; scattered". – San Salvador, San Salvador Island (Watling's Island), along roadway about 1 mile N of Riding Rock Inn, [24°4' N, 74°32' W], in coppice, (fr), 13 Feb. 1976, **D.S. Correll & D.C. Wasshausen 45720** [BRIT, GH, NY, US], "stiff shrubs 3 m tall"; – between Riding Rock Point and Cockburn Town, [24°2' N, 74°31' W], in coppice, (fr), 19 Nov. 1974, **D.S. Correll 43784** [BRIT, F 2×, NY], "tree 3.5 m tall"; – Riding Rock Observation Tower, [24°2' N, 74°31' W], coppices and rocky scrublands, (st), Feb. 1973, **Booth, Hanley, Chichester, Lammert & Darlington 5-15** [WIS], "1 m, frequent"; – Cockburn Town and vicinity, [24°2' N, 74°31' W], coppice (scrub lands), (st), 12 - 13 Mar. 1907, **N.L. Britton & C.F. Millspaugh 6051** [F, NY], "tree 4 m, 1,5 dm at base; bark shaggy"; – along Queen's Highway, paralleling Pigeon Creek, [24°2' N, 74°30' W], edge of coppice, (yfr), 20 Feb. 1976, **D.S. Correll & D.C. Wasshausen 46869** [F, NY, US], "a waxy bushy shrub 3 m tall"; – same locality, habitat, date and collector, (fr), **46870** [MO], "a rigidely erect shrub 3 m tall"; – Graham's Harbor, [24°7' N, 74°29' W], (fr), 26 Nov. 1907, **P. Wilson 7247** [F, GH, NY]; – near shore of French Bay at south end of island, [23°58' N, 74°31' W], thicket near shore, (fr), 31 Dec. 1969, **W.T. Gillis 8743** [A, MO], "small tree; fruits greenish-yellow, still somewhat immature"; – SE-End, [23°58' N, 74°29' W], (fr), 27 - 28 Nov. 1907, **P. Wilson 7304** [F, K, NY]; – at Sandy Point House (erroneously called Watling's Castle), [23°57' N, 74°34' W], in crevices in coral rock, (fr), 20 Mar. 1966, **W.T. Gillis 6220** [A]. – Long Island, Long Island, slopes overlooking the coast at the end of the Buckley's Road to the east coast, Deadman's Cay, [23°10' N, 75°5' W], in sand and rock, (fl female, yfr), 1 Jul. 1974, **S.R. Hill 2384** [NY], "shrub 5 ft.; leaves very coriaceous"; – Atwood Cay [= Samana Cay], [23°6' N, 73°42' W], (fr), 3 - 4 Dec. 1907, **P. Wilson 7406** [F, GH n.s., K, NY]. – Ragged Island, Great Ragged Island, [22°11' N, 75°43' W], (fr), 24 - 25 Dec. 1907, **P. Wilson 7860** [F, K, NY]. – Crooked Island, Landrail Point, [22°50' N, 74°21' W], (fr), 9 - 13 Jan. 1906, **L.J.K. Brace 4558** [F, NY, US]; – along road ca. 3 miles E of Landrail Landing, [22°50' N, 74°18' W], edge of coppice, (fl male), 6 Jun. 1977, **D.S. Correll & G.R. Proctor 48771** [DUKE, MO, NY], "plant 2 m tall; flowers cream-color"; – along road between Church Grove and Turtle Sound, [22°46' N, 74°15' W], in coppice, (fr), 4 Jun. 1977, **D.S. Correll & G.R. Proctor 48705** [MO, NY, US], "small tree "; – NE of Cabbage Hill, [22°45' N, 74°13' W], on summit of high rocky ridge along coast just NE, (fr), 18 Feb. 1975, **D.S. Correll 44358** [F 2×, NY], "shrubs 2.5 m"; – on Macki's Bluff near Airport, [ca. 22°45' N, 74°11' W], in open coppice, (fl female), 10 Jun. 1977, **D.S. Correll & G.R. Proctor 48904** [DUKE, MO, NY, US], "female shrub 2 m tall"; – Mosswell Bluff, [ca. 22°43' N, 74°10' W], limestone headland, (fr), 21 Apr. 1971, **W.T. Gillis 10664** [S], "abundant shrub, but in fruit only on bluffs; flowers cream"; – Long Cay, Cove road, [ca. 22°37' N, 74°20' W], (fr), 7 - 12 Dec. 1905, **L.J.K. Brace 4184** [F, NY], "shrub"; – Island of Fortune [= Long Cay], [22°37' N, 74°20' W], (fr), Nov. 1890, **A.S. Hitchcock s.n.** [F, MO]. – Acklins, Acklin's Island, Spring Point, [22°27' N, 73°58' W], (fr), 21 Dec. 1905 - 6 Jan. 1906, **L.J.K. Brace 4368** [F 2×, NY, PH, US]; – same data & coll. **4368bis** [F]; – without further data, (st), **L.J.K. Brace 244 ["410"]** [NY]; – Low Coppet [not located], (st), 24 Jun. 1903, **W.C. Coker 150** [NY], "Canabis bark".

Cuba, Sancti Spíritus, "Santa Clara", Casilda, [21°45' N, 79°59' W], coastal thicket, (st), 16 Mar. 1910, **N.L. Britton & P. Wilson 5603** [NY], "shrub 2.5 m". – Camagüey, vicinity of Gloria [La Gloria], [ca. 21°44' N, 77°39' W], (fr), 15 Feb. 1909, **J.A. Shafer 416** [F, NY, US], "shrub 20 ft."; – same area, (defl male), 14 Feb. 1909, **J.A. Shafer 428** [F, NY, US], "shrub 10 ft."; – Pastelillo beyond Nuevitas, [21°32' N, 77°15' W], (fr), 15 - 16 Mar. 1909, **J.A. Shafer 844** [A n.s., F, GH n.s., NY, US], "shrub 4 ft.; fruit green". – Las Tunas, Manatí, [ca. 21°18' N, 76°56' W], coastal thickets, (defl male), 3 - 5 Jan. 1937, **J.S.S. Frère León 16698** [US]. – Granma, Nagua, at Rio Yara, [20°7' N, 76°55' W], in thickets, (st), 5 Jul. 1922, **E.L. Ekman 14168** [S], "shrub". – Holguín, Holguín, Cerro de Fraile, ca. 275 m, [20°53' N, 76°17' W], in

declivibus coll., (fr), 29 Oct. 1914, **E.L. Ekman ser. III 3275** [AAU, S], "frutex"; – same locality, in fruticetis, (yfr), 25 Aug. 1916, **E.L. Ekman ser. III 7554** [LL, MICH, S], "frutex vel arbor parva"; – Antilla, [20°50' N, 75°44' W], in sylva litoral., solo calcareo, (flbuds male), 22 May 1916, **E.L. Ekman ser. III 7354** [AAU, S], "arbor parva"; – same area, (st), 18 Aug. 1918, **J.T. Roig 1516** [NY]. – Santiago de Cuba, Bayate, Sabana Resueña prope Rio Piedra, [ca. 20°23' N, 75°55' W], (st), 18 Jul. 1914, **E.L. Ekman ser. III 2002** [S], "frutex"; – Sierra de Nipe, ad Arr. [= Arroyo] Piedra, [ca. 20°23' N, 75°55' W], in charrascales, (st), 1 Mar. 1915, **E.L. Ekman ser. III 4813** [S], "frutex"; – same Sierra, ad Rio Piedra, ca. 200 m, [ca. 20°23' N, 75°55' W], in charrascales, (fr), 22 Oct. 1919, **E.L. Ekman ser. III 10007** [S], "arbor parva"; – same Sierra, Loma de la Estrella, [20°31' N, 75°40' W], in carrascales (tibisiales), (flbuds male), 8 Jun. 1915, **E.L. Ekman ser. III 5942** [AAU, BR, S], "arbor parva"; – Monte Picote, a foothill at the southern end of Sierra de Nipe, near Palmarito del Cauto, 400 m, [20°21' N, 75°48' W], (st), 29 Jan. 1956, **C.V. Morton 9671** [US]. – Guantánamo, Guantánamo, Baitiquiri por el camino a la mina del Yeso, [20°1' N, 74°51' W], monte seco, (st), May 1968, **J. Bisse & E. Köhler 7665** [JE 2×]; – San Antonio del Sur, 4 km WNW del pueblo, 200 - 400 m, [20°3' N, 74°49' W], (st), 10 Feb. 1976, **A. Areces, J. Bisse, J. Gutiérrez & H. Manitz 29972** [JE].

Haiti, Ouest, Massif des Matheux, Thomazeau, Morne à Cabrits, ca. 200 m, [18°41' N, 72°10' W], oligocene limestone, (defl male), 24 Oct. 1926, **E.L. Ekman H 7135** [A n.s., EHH n.s., F, G, GH, K, LL, NY, S, US], "small tree, branched above, rounded crown", "True *M. caribaea* is branched from the base up, even when a tree, and habitually quite distinct from this."; – same locality, 200 m, rocky hillside, light forest, (fl male), 3 Jul. 1927, **E.L. Ekman H 8562** [S, U], "small tree; fl. (few) white"; – same area, 1500 ft., woods on slope, (st), 3 Jul. 1927, **W.J. Eyerdam 2** [F, GH, US], "tree ca. 12 ft. high", "new species discovered by Ekman, this is the second locality".

Diospyros crassinervis **(KRUG & URB.) STANDL. ssp. *kubal* B.WALLN., ssp.n.,** [fig. 6 - 8].

Diagnosis: A *Diospyro crassinerve* s.str. indumento denso pilis brevissimis, centripetaliter dispositis, griseis, rectis consistente alveolas paginae inferioris foliorum obtectante differt.

Typus: Cuba, Prov. Pinar del Río [today: Prov. La Habana], Rio Mosquitos, [23°1' N, 82°43' W], on shaded rocks, (fl female), 13 Jun. 1921, **E.L. Ekman 12898** [holotype: S (fig. 7, 8c), isotypes: G, K, NY], "small tree".

Shrub or small tree, 1 - 4 (- 9) m tall (according to BORHIDI 1996, up to ca. 20 m tall); twigs terete, dark brown or black, slightly flattened near the nodes, loosely covered with ± appressed hairs of different lengths when young, soon glabrescent; lenticels on twigs scattered, elongated, salient, usually gray or light brown; older twigs with longitudinally fissured, ± gray bark; buds and very young leaves densely covered with appressed or ± spreading, straight or slightly flexuose, light brown hairs concealing the surface; lateral buds transversally flattened; **leaves** alternate, with brochidodrome venation; petioles 2 - 4 (- 6) mm long, 1.5 mm thick, dark brown, slightly flattened, covered with the same kind of indumentum as that on twigs and buds, glabrous when old, adaxially with a faint longitudinal grove; leaf lamina obovate, or sometimes ± elliptic, rarely lanceolate, (1 -) 2 - 7 (- 9.7) cm long, (0.7 -) 1.5 - 4 (- 5) cm wide, (1.2 -) 1.4 - 2.5 (- 3.2) times longer than wide, coriaceous, darker brown and ± shiny adaxially, abaxially lighter brown and dull when dry, on the adaxial side with some scattered hairs on veins, soon glabrescent, sometimes partially covered with dense efflorescences of white crystals, abaxially with a persistent indumentum; leaf apex broadly rounded, obtuse or slightly acute, rarely emarginate or with a small mucro (protruding from the midvein); base of the lamina attenuate; leaf margin entire, slightly revolute when dry, with a strong, irreg-

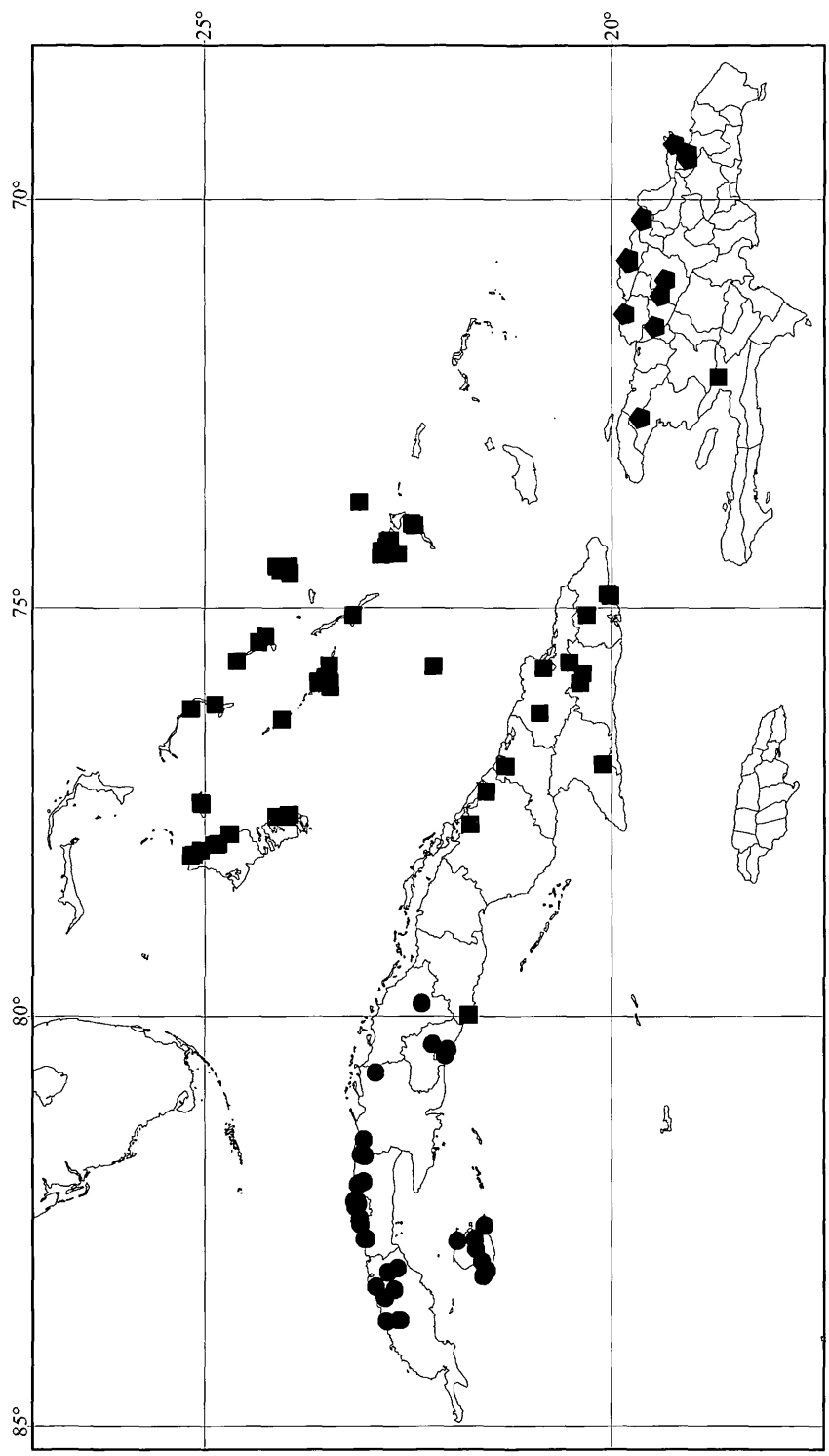


Fig. 6: Distribution of *Diospyros crassinervis* (KRUG & URB.) STANDL. ssp. *crassinervis* ■; – *D. crassinervis* (KRUG & URB.) STANDL. ssp. *kubal* B.WALLN. ●; – *D. crassinervis* (KRUG & URB.) STANDL. ssp. *urbaniana* (LEONARD) ALAIN ◆.

ularly sinuate marginal vein; flachnectaria on abaxial leaf surfaces 0 - 3 (- 7) (often completely missing), arranged in the proximal third of the lamina (sometimes directly on the midvein), light brown, flat or slightly sunken, surrounded by a thick, raised vein; midvein on adaxial side impressed, on abaxial side markedly prominent, loosely covered on both sides with the same kind of indumentum as that on young twigs, adaxially soon glabrescent; secondary veins 5 - 7 on each side, adaxially flat or slightly prominent, abaxially raised, the proximal ones straight, the others slightly curved; intersecondary veins not conspicuous; tertiary and quaternary veins markedly reticulate, on the adaxial side lighter than the surroundings and well visible, flat or slightly prominent, soon glabrescent, on the abaxial side strongly raised and thickened, with remote, ± appressed, long hairs; areas between the veinlets flat or slightly sunken adaxially, usually deeply alveolate abaxially; alveoles small and ± regular, densely covered with very small, 0.04 - 0.08 (- 0.13) mm long, straight, whitish, ± appressed hairs (± pointing towards the center or the base of the alveoles and usually completely concealing the bottom of the latter); alveoles on reiterating or water-shoots (e.g., Gonzales 553) only with scattered hairs and their bottom well visible; **inflorescences** arranged on young shoots, on male plants 3 - 4 (- 20)-flowered, either solitary in the axils of regular leaves or clustered at the base of shoots (in the axils of scale-like leaves), 1-flowered and in the axils of regular leaves on female plants; peduncles, pedicels and bracts densely covered with the same kind of indumentum as that on young twigs; peduncles of male inflorescences 1.5 - 4 mm long and 0.5 - 1 mm thick, enlarged and somewhat flattened distally; pedicels 1 mm long and 0.5 mm thick; bracts 1.5 - 2.5 mm long and 0.8 - 1.6 mm wide, acute, glabrous adaxially, soon caducous; stalks (peduncles and pedicels) of female inflorescences 2.5 mm long and 1 mm thick; bracteoles 1.5 mm long and 1 mm wide; **flowers** 3 (- 4)-merous, the male ones 8 - 9.5 mm long at anthesis, white when alive; calyx 4 - 5 mm long, ca. 3 mm wide, undivided in the proximal 3 - 3.5 mm, outside densely covered with blond to slightly light brown, appressed, straight to slightly flexuose hairs of different lengths, inside glabrous except for the distal parts of the lobes; calyx lobes broadly triangular, 1 - 2 mm long and 2 - 2.5 mm wide; corolla ca. 8.5 mm long; corolla tube 6 mm long and 2 mm wide, widest above the middle, outside densely covered with thicker, longer, ± straight, appressed, light brown, translucent hairs (their core not or only slightly ferruginous), glabrous proximally; corolla lobes ca. 2.5 mm long and ca. 1 mm wide, obtuse distally, outside with hairs similar to those on the calyx, inside glabrous; stamina 11, of different size and lengths, 1.5 - 3.5 mm long, glabrous; filaments 0.5 - 1 mm long, their proximal ca. 0.3 mm adnate to the base of the corolla tube; anthers 1 - 2.5 mm long and up to ca. 0.5 mm wide, narrow, widest below the middle, tapering and ± acute distally; rudiment of the ovary densely covered with spreading, short hairs; **female flowers** with the same kind of indumentum as that on male flowers, 10 mm long at anthesis; calyx 6 - 7 mm long, ca. 6 mm wide, undivided in the proximal 4 mm, inside densely covered with hairs similar to those of the corolla tube, glabrous proximally; calyx lobes broadly triangular, 3 - 3.5 mm long and 6 mm wide; area below the sinuses in-between the calyx lobes moderately expanded and protruding outwards; corolla 9 mm long, with indumentum similar to that on male flowers; tube 6.5 mm long and ca. 3 mm wide, widest in the lower portion; corolla lobes 2.5 mm long and ca. 1.5 mm wide, acute distally, inside glabrous; staminodia 5, differing in size, 3 - 3.5 mm long, glabrous; filaments 1.5 - 2 mm long, their proximal ca. 0.5 mm adnate to the base of the

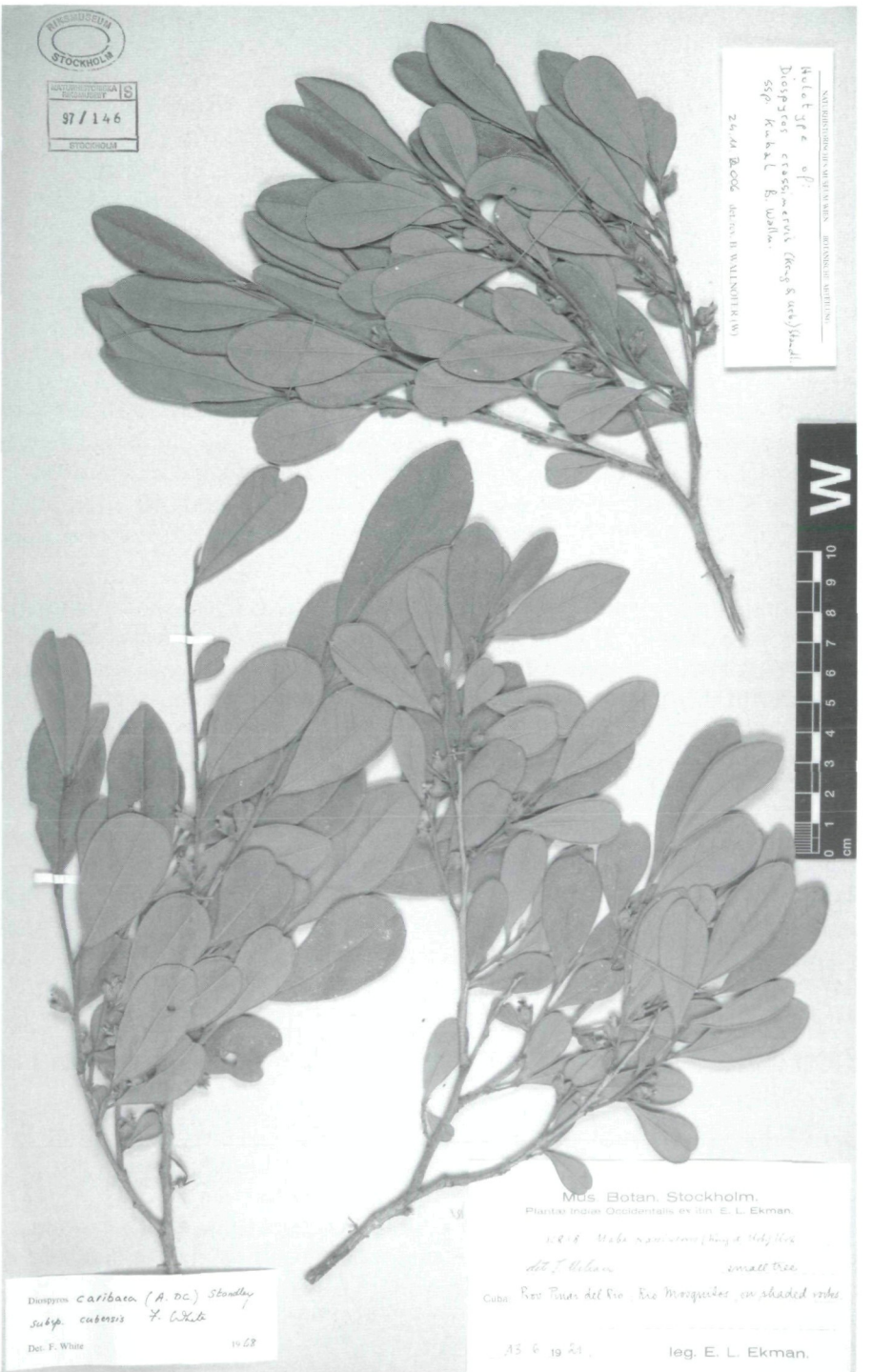


Fig. 7: Holotype of *Diospyros crassinervis* (KRUG & URB.) STANDL. ssp. *kubal* B.WALLN.

corolla tube; aborted anthers flat, 1 - 1.5 mm long, 0.3 mm wide, narrow, widest in their lower portion, slightly acute distally; ovary subglobose, 3.5 mm in diameter, 6-locular, densely covered with appressed, straight, parallel hairs (their core ± ferruginous); stylodia three, ca. 1.5 mm long, widening into the ovary, distally split for ca. 0.5 mm; stalk of **fruits** up to 2 - 6 mm long and 2 mm thick in the middle; fruits ± globose, up to 2 (- ca. 2.5) cm in diameter, smooth, 4 - 5-seeded, yellow with grayish bands when alive (Webster 3725), medium densely covered with light brown, appressed, long hairs when young, glabrescent with age, but then, especially near base and apex with remnants of the indumentum; fruit wall ca. 0.5 mm thick, with tightly adhering epidermis; calyx as a whole up to 18 mm wide and up to 5 mm high, often nearly triangular in outline, undivided in the proximal 4 mm, lacking longitudinal ridges running down from the sinuses abaxially, covered outside with a scattered, inside with a more dense indumentum; area below the sinuses in-between the calyx lobes usually inconspicuous or on some collections moderately expanded and protruding outwards; calyx lobes 7 - 10 mm wide and 6 - 8 mm long, obtuse or acute, often with slightly raised, obscurely reticulate venation externally; marginal parts of the lobes either flat and ± tightly appressed to the fruit or especially the distal parts (apices of lobes) flexed outwards; seeds 10 - 13.5 mm long, 6 - 8.5 mm wide and 4 - 6 mm thick, with some irregular, transversal furrows deriving from the ingrowths of the testa (endosperm ruminate, fig. 1f, 8f).

The collection León & Fortún 8661 from northwestern Villa Clara shows reiterating- or water-shoots with an atypical indumentum (hairs slightly longer as usual) on the leaves. Ekman 18864, a sterile collection from Villa Clara, was collected near the eastern border of the area of distribution of this subspecies, and shows an indumentum on abaxial leaf surfaces which seems intermediate between ssp. *kubal* and ssp. *crassinervis*. It may therefore, represent a hybrid between the two, but more and especially fertile material from that area is needed to verify this.

Male inflorescence units are usually composed of a terminal, bractless, and two subterminal (lateral), subopposite flowers, each in the axil of a small bract. The two collections Jack 7521 and Salvoza 150, probably collected from the same tree, exhibit multibranched, up to 20-flowered male inflorescences resembling dichasia (fig. 8d). Here, the two lateral flowers in each unit are substituted by two other units, the lateral flowers of which are again substituted. This occurs up to four times. The terminal flower of each unit is never substituted.

Vernacular names: "ebano carbonero" (León 13737, Sagra 221); "vigueta naranjo" (León & Fortún 8661).

Distribution, habitat, ecology, and phenology: This species is only known from Western Cuba, where it occurs from sea level to elevations of 300 meters (fig. 6). All the western localities of "*D. crassinervis*", shown in the distribution map in Bisse (1968: mapa 2), may belong to this subspecies. According to herbarium labels, it grows in coastal thickets, in rocky places on limestone, in cuabales (on serpentine), in scrub on diorite hillsides, in palm barrens and in forests. In western Cuba, Borhidi (1996) reports it (sub *D. crassinervis*) from "semi-deciduous mesophytic forests with annual rainfall 1200 - 1700 mm and dry seasons of 3 - 6 months duration". There, it is said to be a member of at least 12 different plant associations, many of them occurring on limestone. In the tall semideciduous forests, on coastal limestone reefs of the Guanahacabibes Peninsula, it is

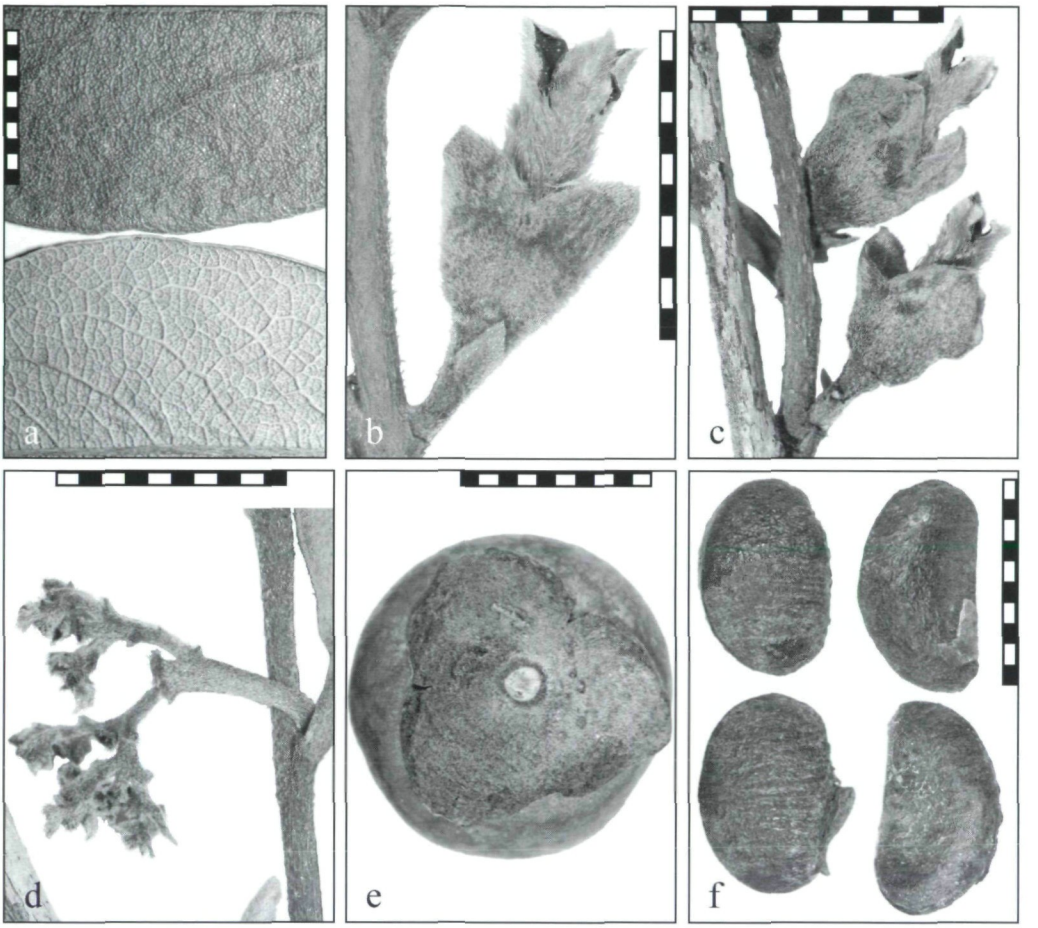


Fig. 8: *Diospyros crassinervis* ssp. *kubal*: **a**: adaxial (on top) and abaxial (bottom) leaf surface (from Ekman III 391 [S]); **b**: female flower (from Wright 1331 [GH]); **c**: female flowers (from Ekman 12898, holotype [S]); **d**: atypical male inflorescence (from Jack 7521 [S]); **e**: fruit (from Frère León 8510 [NY]); **f**: seeds (from Jack 7828 [A]); bar = 1 cm.

reported to be part of the canopy, attaining a height of about 20 meters (BORHIDI 1996: association "Bombacopsi-Catalpetum punctatae BORHIDI & MUÑIZ", table 134, fig. 295). BISSE (1968) reports *D. crassinervis* (in the broad sense) from the manigua costera and from the cuabales (serpentine hills). It has been collected with flower buds in March and April, in blossom from May to July and with fruits of different stages of maturity from December to August and in October.

Specimens examined: **Cuba**, Pinar del Río, Esperanza [= Puerto Esperanza], [ca. 22°46' N, 83°43' W], coastal thicket, (st), 13 Sep. 1910, **N.L. Britton & C.S. Gager 7339** [NY], "tree 4 m"; – Mogote de la Bandera, Viñales, [ca. 22°36' N, 83°42' W], on rocky crest, (flbuds female), 30 Mar. 1953, **E.E. Liogier (= Alain) 2887** [GH, NY]; – on top of Sierra del Jíbaro [22°37' N, 83°42' W] [US label], on top of Sierra del Ruiseñor [not located] [GH label], Viñales, dog-tooth limestone rocks, (defl male), 21 May 1955, **E.E. Liogier (= Alain) 4312** [GH, US]; – Loma Pelada de Cajálbana, La Palma, [ca. 22°47' N, 83°26' W], ser-

pentine barrens, (st), 10 Feb. 1951, **E.E. Liogier (= Alain) 1769** [GH n.s., NY]; – same area, serpentine barrens, (fr), 10 Jun. 1950, **E.E. Liogier (= Alain) & J. Acuña 1400** [GH, NY]; – Sierra de Güira, mogotes cerca de las Cabañas de los Pinos, 300 m, [22°40' N, 83°20' W], (st), 28 Dec. 1970, **J. Bisse & H. Lippold 18484** [JE 2×]; – Toscano [HOWARD 1988: "north coast E [correct is W!] of Bahía Honda & near Guajaibón"], [22°55' N, 83°19' W], (fl female, yfr), 20 Jul. 1866, **C. Wright 1331** [a mixture of at least 5 different gatherings belonging partly here, to this subspecies (specimens at BM, GH, MA n.s.: digital photo seen, NY 2×, S, US, W) and partly to *D. caribaea*, collected in eastern Cuba]; – top of Peña Blanca Mt., [22°45' N, 83°7' W], (flbuds male), 5 Apr. 1925, **J.T. Roig 3560** [NY], "low tree"; – Rio Taco-Taco, between Chambergo and Guaiquibá, [ca. 22°38' N, 83°4' W], in palm barrens, (fr), 16 Oct. 1923, **E.L. Ekman 17674** [S], "shrub; fl. white". – La Habana, Mariel prope pharum (= at the lighthouse), [23°1' N, 82°43' W], (fr), 27 Mar. 1920, **E.L. Ekman ser. III 10578** [G, K, NY, S], "frutex"; – same area, Mariel, Rio Mosquitos, [23°1' N, 82°43' W], on shaded rocks, (fl male), 13 Jun. 1921, **E.L. Ekman 12903** [F, LL, S, US], "small tree"; – same area, Playa de Mosquitos, [23°2' N, 82°43' W], (fl male), 20 Jun. 1921, **E.L. Ekman 12931** [G, NY, S], "small tree"; – Majana, Campo Florido (Havana), [ca. 23°7' N, 82°3' W], silicious hill, (st, but female), 6 Dec. 1928, **J.S.S. Frère León 13737** [PH, WIS (MAD)], "shrub 2 m high"; – Cuabal (serpentine hill) E of Tumba Cuatro, Campo Florido (Havana), [ca. 23°6' N, 82°2' W], serpentine hill, (fr), 5 Dec. 1918, **J.S.S. Frère León 8510** [NY], "shrub 1 m"; – Loma de la Pita, San Miguel de Casanova (Habana) [within Municipio Jaruco], [ca. 23°3' N, 82°1' W], (st), 20 Jun. 1924, **J.S.S. Frère León 11636** [NY], "shrub". – Ciudad de La Habana, near St. Fé, W of Havana, [23°5' N, 82°32' W], in thickets, (fr), 13 Jan. 1916, **J.S.S. Frère León 6015** [FHO (fragm.), GH n.s., NY]; – Playa de Marianao, [23°6' N, 82°28' W], coastal thicket, (fr), 29 Mar. 1911, **N.L. Britton & J.F. Cowell 10338** [NY], "shrub 1.5 m"; – same area and habitat, (flbuds male), 25 May 1916, **J.S.S. Frère León 6234** [GH, NY], "shrub 2.5 m"; – between El Morro and Cojímar, [23°9' N, 82°19' W], coastal thickets, (fr), 24 May 1917, **J.S.S. Frère León 7216** [GH, NY], "3 m tall; foliage dark green before drying"; – same area, in fruticetis, (fr), 27 Apr. 1914, **E.L. Ekman ser. III 376** [AAU, S], "frutex vel arbor parva"; – same data & collector, (flbuds male), **ser. III 391** [S], "frutex raro occurr."; – Guanabacoa, Lomas de las Jatas, [23°7' N, 82°17' W], (st), 24 Apr. 1914, **E.L. Ekman ser III 261** [S], "frutex"; – same area ("La Jata Hills"), (yfr), 31 Aug. 1916, **J.S.S. Frère León & M.F. Roca 6793** [GH, NY]; – sea coast between Cojímar and Playa de Bacuranao, [23°10' N, 82°15' W], (fr), 26 Dec. 1910, **J.S.S. Frère León 1937** [NY]; – same area ("between rio Cojímar and" etc.), dense coastal thicket, (fr), 26 Dec. 1910, **P. Wilson 9537** [NY, US], "shrub 5 ft."; – W of Chorrera river, not far from Havana, [ca. 23°8' N, 82°15' W], (fr), Jan. 1913, **J.S.S. Frère León 3653** [NY], "shrub 2 m"; – cult. HAJB (Botanical Garden of La Habana), (st), 17 Mar. 2000, **H. Rainer s.n.** [W], used for molecular studies in DUANGJAI et al. (2006). – Isla de la Juventud, Isla de la Juventud (= Isla de Pinos), Rocky Point, Ensenada de Siguanea, [ca. 21°35' N, 83°10' W], limestone rocks, (st), 13 Mar. 1916, **N.L. Britton & P. Wilson 15393** [NY, US]; – Milian, Caleta Grande, [21°32' N, 83°6' W], (st), 18 Aug. 1919, **J.T. Roig & Cremata 1845** [NY]; – Cayo del Res, on the southern side of Cienaga Lanier, [21°36' N, 82°59' W], in the forest, (st), 2 Dec. 1920, **E.L. Ekman 12449** [S]; – Vivijagua [= Bibijagua], [21°54' N, 82°44' W], on rise in savanna, (fr), 18/20 Mar. 1916, **N.L. Britton & P. Wilson 15606** [F, GH n.s., NY (+ carp), US]; – Loma La Daguilla, [21°41' N, 82°43' W], base of hill; barren, (st), 3 Mar. 1916, **N.L. Britton, E.G. Britton & P. Wilson 15174** [NY], "shrub 1.5 m"; – Hato Nuevo, Punta del Este, [21°34' N, 82°33' W], (yfr), 14 Aug. 1919, **J.T. Roig & Cremata 1811** [NY]; – without further data, [ca. 21°40' N, 82°50' W], (fr), s.d., **J. Blain 128** [F]. – Matanzas, NW of Pan de Matanzas, SE of Canasí [= Arcos de Canasí], [23°2' N, 81°42' W], in very sterile rocky places; in cuabales, (fl male), 31 May 1923, **E.L. Ekman 16512** [F, MICH, S]; – Cuabal de Figueras, near Canasí, [23°5' N, 81°41' W], (flbuds male), 31 May 1928, **J.S.S. Frère León 13393** [GH, NY]; – vicinity of Matanzas, Playa, [23°3' N, 81°30' W], (fr), 12 Mar. 1903, **N.L. Britton, E.G. Britton & J.A. Shafer 93** [NY]; – "? Bay 3 Mil? fr." [barely leggible] Matanzas (NY: ad mare prope Matanzas), [23°3' N, 81°30' W], (fr), Feb. 1849, **F.I.X. Rugel 662** [BM, NY], "arbuscula"; – Prov. Matanzas, Socorro, Minas de Hierro, ca. 3 mi. SW of Canasí, [not located], common in scrub on diorite hillsides, (fr), 11 Jul. 1951, **G.L. Webster 3725** [MICH, US], "shrub ca. 2 m high; fruit yellow with grayish bands". – Villa Clara, Cayo Bonito, Loma de Motembo (Sta. Clara), [ca. 22°54' N, 80°41' W], (st), 4 Jan. 1919, **J.S.S. Frère León & G.M. Fortún 8661** [NY], "3 m tall"; – Manajanabo, Sierra de Agabama [=

Sierra Alta de Agabama], at Loma de Palma Sola, [ca. 22°20' N, 79°50' W], in a carrascal, (st), 26 Mar. 1924, **E.L. Ekman 18864** [S], "shrub or sometimes a small tree". – Cienfuegos, Castillo de Jagua, Cienfuegos Bay, [22°3' N, 80°28' W], (fr), 20 Feb. 1930, **J.G. Jack 7709** [A, S, US], "small tree 10 ft. high"; – vicinity of Soledad, Gavilan [= Punta Gavilan], [22°1' N, 80°24' W], coastal pasture, (fr), 11 Feb. 1942, **A. Gonzales 553** [A, B, BM, MICH, NY], "shrub"; – Iguana Point, Caunao River, [22°12' N, 80°20' W], (st), 9 Apr. 1927, **J.G. Jack 5121** [A, P, US], "small tree 25 - 30 ft. high"; – Caunao river to Cienfuegos bay, [22°12' N, 80°20' W], (fl male), 22 Jul. 1929, **J.G. Jack 7521** [A, NY, S, US], "small tree 10 - 12 ft. high; flowers white"; – same locality and collector, (fr), 3 Apr. 1930, **7828** [A, F, FHO, K 2×, NY, P, PH, S, UC], "tree 20 ft. high"; – along Caunao River, [22°12' N, 80°20' W], (flbuds male), 22 Jul. 1929, **F.M. Salvoza 150** [A], "small trees; leaves pubescent; flowers white". – without further data, (fr), 1842/1849, **F.I.X. Rugel 173** [MO, NA n.s.]; – (st), s.d., **R. de la Sagra 221** [P].

Diospyros crassinervis (KRUG & URB.) STANDL. **ssp. *urbaniana*** (LEONARD) ALAIN, Phytologia 63 (1): 65 (1987); [fig. 6, 9 - 10].

≡ *Maba urbaniana* LEONARD, J. Wash. Acad. Sci. 14 (17): 414 - 415 (1924).

Typus: Dominican Republic, Hato Mayor, San Lorenzo Bay and vicinity, south coast of Samaná Bay, sea level, [19°05' N, 69°26' W], (fl male), 26 Apr. 1922, **W.L. Abbott 2235** [holotype: US (photo NY: N.S. 6907 at FHO, NY; fig. 9), with 3 wood samples on the sheet, isotypes: BM, C, F (fragm.), GH 2×, NY].

Shrub or small tree, up to 6 (- 8) m tall (already flowering, when ca. 2.5 m tall); crown of an eight m tall tree reported to be less than 1 m in diameter (Zanoni & Pimentel 27892); bark outside ± gray, inside dark brown; sapwood brownish when dry; heartwood without annual rings; branches said to be upright or spreading (Liogier 16138, 16264, 16578); twigs terete, slightly flattened near the nodes when young, gray, brown or blackish, covered with a brown indumentum (similar to that on buds, but less dense) and with scattered, elongated, gray to blackish lenticels when young, soon glabrescent, usually ± smooth or finely fissured longitudinally; buds, very young leaves and twig apices densely covered with a mixture of flexuose or strongly curled and ± spreading, light brown hairs (the larger, translucent ones with a ferruginous core) completely concealing the surface; **leaves** alternate, with brochidodrome venation; petioles (2 -) 4 (- 6) mm long, ca. 1.5 mm thick, densely covered with a brown indumentum, glabrescent with age; leaf lamina broadly obovate or ± elliptic, sometimes semicircular, less frequently narrowly obovate, (0.8 -) 2 - 5 (- 6.8) cm long, (0.6 -) 1.5 - 3.5 (- 5.4) cm wide, (1.08 -) 1.4 - 2 (- 2.9) times longer than wide, coriaceous, gray-brown, dull or slightly shiny (shiny dark green when alive) and glabrous adaxially when mature, abaxially with a persistent brown indumentum when dry (light green with "khaki-brown" hairs when alive); leaf apex broadly rounded or obtuse, often emarginate or truncate; base of the lamina shortly attenuate or rounded, less frequently attenuate; leaf margin entire, flat or ± revolute when dry, with a strong, irregularly sinuate marginal vein; flachnectaria on abaxial leaf surfaces 0 - 2 (often completely missing and usually hardly visible when present, due to surface structure and color), in general minute (ca. 0.2 mm in diameter), arranged in the proximal fourth of the lamina, sometimes directly on major veins, brown or dark brown, only slightly sunken, surrounded by a thick vein which is connected to several other veinlets; midvein impressed adaxially, markedly prominent abaxially, glabrescent adaxially (but often covered with weathered remnants of the indumentum), abaxially with persistent indumentum (similar to that on buds, but much less dense), glabrescent on very old leaves; secondary veins ca. 4 - 6 on each side, adaxially slightly sunken,

Fig. 9: Holotype of *Diospyros crassinervis* (KRUG & URB.) STANDL. ssp. *urbaniana* (LEONARD) ALAIN.

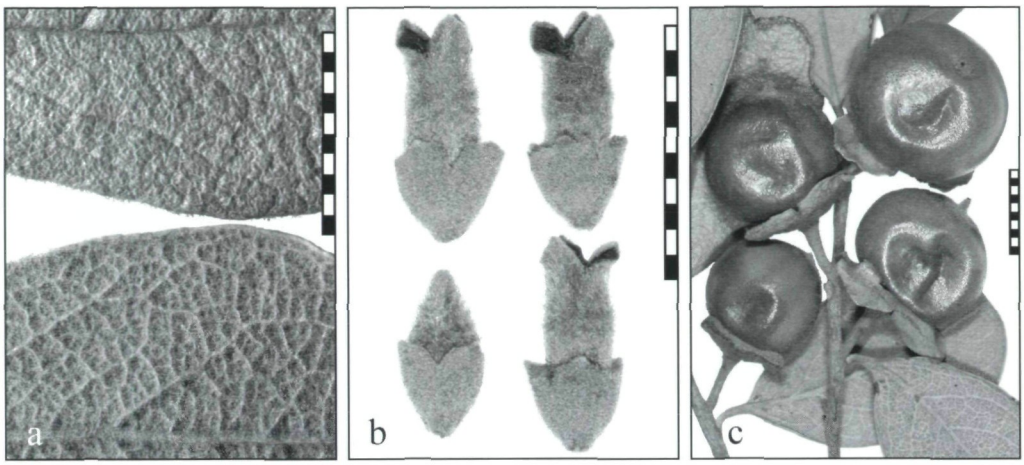


Fig. 10: *Diospyros crassinervis* ssp. *urbaniana*: **a**: adaxial (on top) and abaxial (bottom) leaf surface (from García & Jiménez 2778 [S]); **b**: male flowers (from Ekman H 15387 [S]); **c**: fruits (from García & Jiménez 2778 [S]); bar = 1 cm.

abaxially raised, curved (the basal ones ± straight); intersecondary veins not conspicuous; tertiary and quaternary veins markedly reticulate, on the adaxial side lighter than the surroundings and well visible, flat or slightly prominent, soon glabrescent, on the abaxial side strongly raised and thickened, disposed in one or two levels, with indumentum similar (but less dense) to that on the alveoles; areas between the veinlets flat or slightly sunken adaxially, deeply alveolate abaxially; alveoles small and ± regular, ± densely covered (their bottom often completely concealed) with twisted and strongly curled, light brown to ferruginous-brown hairs (grayish when very old; the larger, translucent ones with a ferruginous core); male **inflorescences** (1 -) 2 - 3-flowered, arranged in the axils of regular leaves on young (a few cm long) shoots or in the axils of minute leaves near the base of these shoots; peduncles, pedicels and bracts densely covered with the same kind of ferruginous-brown indumentum as that on apices of young twigs; peduncles 2 - 5 mm long and 1 - 1.5 mm thick, slightly enlarged distally; pedicels 1 - 2 mm long and ca. 1 mm thick; bracts ca. 2 mm long and 1 mm wide, obtuse, glabrous adaxially, soon caducous; female inflorescences not available for study; male **flowers** 3 (- 4)-merous, 8 - 9 mm long at anthesis when dry (10 mm when boiled up); calyx 4.5 mm long, undivided in the proximal ca. 3.8 mm, outside densely covered with a ferruginous-brown indumentum (the smaller hairs curled; the longer hairs ca. 0.5 mm long, flexuose and with a ferruginous core), inside glabrous (except near the apex of the lobes), often irregularly split longitudinally in-between the lobes; calyx lobes broadly triangular, 1 - 2 mm long and 2.5 - 3 mm wide; corolla 9 mm long; corolla tube 7 mm long and ca. 3 mm wide, widest above or near the middle, outside densely covered with up to 1.5 mm long, ± flexuose, light brown hairs (their core ferruginous), near the base and inside glabrous; corolla lobes rounded distally, 2 mm long, 2 - 2.5 mm wide, outside with shorter hairs (like those on the calyx), inside glabrous; stamens 11, of different sizes, 2 - 4.5 mm long, usually glabrous (except for a few solitary hairs on the connectives); filaments 0.5 - 2 mm long, their proximal 0.3 - 0.8 mm adnate to the base of

the corolla tube; anthers 1.5 - 2.8 mm long and up to ca. 0.5 mm wide, narrow, widest below the middle, tapering and pointed distally (apex of the connectives up to ca. 0.5 mm long); rudiment of the ovary densely covered with spreading, short hairs; female flowers not available for study; stalk of the **fruits** 3 - 7 (- 10) mm long and 1 - 1.5 (- 2) mm thick near the base (distally thicker); fruits subglobose, up to 2 (- 2.2) cm in diameter, shiny green or yellowish green when unripe, yellowish-brown when ripe and fresh, ± shiny, brown to dark brown when dry, densely covered with brown, appressed to slightly spreading, sub-parallel, slightly flexuose, short and long hairs (their core ferruginous) when young, smooth and glabrescent with age but especially near the base and apex with weathered remnants of the indumentum; calyx accrescent, 1.7 - 2 cm wide, up to ca. 5 mm high, undivided in the proximal 4 - 5 mm, lacking longitudinal ridges running down from the sinuses abaxially, outside covered with the same (but more weathered) kind of indumentum as that on flowers, inside with slightly longer, ferruginous-brown, ± spreading, strongly curled hairs; hairs on parts where the calyx tightly adheres to the fruit ± flexuose, sub-parallel and appressed; area below the sinuses in-between the calyx lobes often inconspicuous or, on some collections (also on young fruits!), moderately expanded and protruding outwards (protrusions almost reaching the base of the calyx in Liogier 16578); calyx lobes up to 5 - 6 (- 7) mm long and 9 - 12 mm wide, obtuse or acute, with slightly raised, longitudinal venation externally; marginal parts of the lobes either flexed outwards or flat and ± tightly appressed to the fruit; fruit wall ca. 0.3 mm thick, with tightly adhering epidermis; seeds blackish when dry, 8 - 10 mm long, 6 - 7 mm wide and 5 - 6 mm thick, with irregular, transversal furrows deriving from the ingrowths of the testa (endosperm ruminate).

Ekman H 12618 is a sterile specimen showing reiterating- or water-shoots with very large leaves, the indumentum of which is sparser as usual and composed of somewhat longer hairs.

Distribution, habitat, ecology, and phenology: This species is known from the Dominican Republic and from Haiti (fig. 6), where it has been collected in thickets, light forests and in broad-leaved wet woods, on river banks, in ravines, on steep cliffs, and on hillsides. Several collections are from serpentine, a few others from limestone and one from lateritic ground. LIOGIER (1987) reports it from serpentine soil, both in the Dominican Republic and in Haiti. It grows at elevations between sea level and 500 (1000) meters. It has been collected in flower in March, April, and June and in fruit from September to November and in February.

Specimens examined: **Haiti**, Artibonite, Massif du Nord, Gros-Morne, Morne Chabre, ca. 1000 m, [ca. 19°40' N, 72°40' W], limestone ridge near the top, (st), 5 Oct. 1925, **E.L. Ekman H 5017** [EHH n.s., S, U], "shrub (young tree?), c. 1.5 m, (arbor parva); when drying the leaves turn pale yellowish-green, a rare thing in *Maba*".

Dominican Republic, Monte Cristi, Cordillera Septentrional, 1,7 km N del poblado Las Canas, 289 m, 19°51' N, 71°24' W, en una loma con suelo pedregoso, zona de bosque seco con *Acacia* y *Eugenia*, (fr), 5 Dec. 1985, **R. García & J. Pimentel 806** [MO, NY, S], "arbolito 3,5 m de alto; fruto verde y amarillento-marrón al madurar". – Puerto Plata, Cordillera Septentrional, Arroyo Francés, 4 miles W of Puerto Plata, 50 - 150 m, [19°48' N, 70°46' W], serpentine hills; common on hillside, (fr), 17 Sep.1969, **E.E. Liogier (= Alain) 16138** [GH n.s., NY, P, US], "small tree 5 - 6 m high; branches upright; old fruit only"; – same locality: serpentine hills, very common in thickets, (fr), 28/29 Oct. 1969, **E.E. Liogier (= Alain) 16578** [GH n.s., NY, US], "small tree 5 m high; branches upright; fruit yellowish green"; – same locality: hillsides, (flbuds

male), 13 Mar. 1930, **E.L. Ekman H 14405** [S], "small tree, common"; – same area: Loma Arroyo Frances, 6 km W de la ciudad de Puerto Plata (arriba de la playa de Cofresí), 60 - 108 m, 19°49' N, 70°44' W, zona de arbustos y arbolitos con muchas palmas *Zombia antillarum*, (fr), 1 Sep. 1982, **T. Zanoni, M. Mejía & J. Pimentel 22990** [GH, MO, NY], "2.5 - 3 m alto; haz de la hoja verde oscuro con brillo, envés verde claro con pelos khaki-marron; fruto verde"; – Cafemba, [19°48' N, 70°43' W], (st), 29 Sep. 1968, **E.E. Liogier (= Alain) & J. de Js. Jiménez 5551** ("5451") [NY], "shrub 1 m tall; sterile; uncommon". – Espaillat, Llanura de Nagua, 7 km E de Gaspar Hernández, próximo a La Ermita, 20 - 30 m, 19°38' N, 70°15' W, bosque semi-destruido, suelo serpentino, (fr), 13 Oct. 1982, **M. Mejía & J. Pimentel 23662** [NY, U], "arbolito y árbol de hasta 8 m de alto; fruto verde"; – Cordillera Septentrional, 8.5 km E de Gaspar Hernández en la carretera a Río San Juan, en un lugar llamado Río Piedras, 170 - 200 m, 19°38' N, 70°13' W, zona de serpentina, vegetación arbustiva con *Tabebuia*, *Psychotria*, *Croton* y *Randia*, (fr), 13 Feb. 1990, **R. García & F. Jiménez 2778** [S], "arbolito 6 m de alto; fr. verde con brillo". – Dajabón, Corral de los Indios, and Río de las Caritas, Partido, Dajabón, 150 m, [ca. 19°29' N, 71°33' W], on river banks, on lateritic soil, (st), 5 Oct. 1969, **E.E. Liogier (= Alain) 16264** [NY, P, US], "shrub 3 - 4 m high; branches spreading; uncommon". – Santiago Rodríguez ("Monte Cristi"), Cordillera Central, Monción, ca. 375 m, [19°25' N, 71°10' W], in thickets, (st), 26 May 1929, **E.L. Ekman H 12618** [A, LL, S, US], "small tree, alas [?], ster.". – Santiago, Río Amina to El Pinar, Inoa, San José de las Matas, 350 - 500 m, [19°21' N, 70°59' W], on serpentine soil, in a ravine, (st), 9 May 1968, **E.E. Liogier (= Alain) 11171** [GH n.s., NY], "shrub or small tree 4 - 5 m; flower buds only [not seen]". – Samaná, Península de Samaná, Samaná, Laguna, in Loma Zaramagua, c. 250 m, [ca. 19°15' N, 69°19' W], (st), 14 May 1930, **E.L. Ekman H 14970** [S]. – Hato Mayor, Los Haitises, Boca del Infierno, [ca. 19°5' N, 69°30' W], steep cliffs, light forest, (fl male), 23 Jun. 1930, **E.L. Ekman H 15387** [F, G, GH, K, LL, NY, S, US], "type locality; common"; – same area: en la costa cerca de la boca de la Bahía de San Lorenzo al oeste de Caño Salado (todo oeste de Sabana de la Mar), 0 - 5 m, 19°05' N, 69°28 - 29' W, farallones de roca de coral marino de caliza, con bosque latifoliado y húmedo, (fr), 9 Nov. 1983, **T. Zanoni & J. Pimentel 27892** [GH, MA, NY 2×, U], "árbol de 8 m; copa de menos de 1 m de diámetro"; – same area: en la Bahía de San Lorenzo, en los alrededores de la Cueva Arena, Parque Nacional de Los Haitises, 0 - 10 m, 19°05' N, 69°27' W, roca caliza, zona de húmedad alta, (fr), 27 Oct. 1982, **M. Mejía & J. Pimentel 23931** [GH, MO, NY], "arbolito 5 - 6 m; fruto verde".

Diospyros conzattii **STANDL.**, J. Wash. Acad. Sci. 12 (17): 399 - 400 (1922); [fig. 11 - 15].
Typus: Mexico, Oaxaca, Distrito de Pochutla, Cerro Espino [Cerro Espina], Cafetal San Rafael, 1100 m, [15°51' N, 96°24' W], (fr), 24 Apr. 1917, **C. Conzatti, B.P. Reko & E. Makrinius 3167** [holotype: US (photo NY: N.S. 6894 at FHO; fig. 11, 13a, 14b, 14f), isotypes: MO 2×, US n.s.]; – US-label: "N. V. = Zapote negro montés, da fruto esquisito [fruits delicious]"; MO-label: "Zapote negro Silvestre" and "Nota: árbol notabilissimo por la esquisitez de su fruto"; STANDLEY (1922): tree 10 tall; – The type locality is described in OLSON et al. (2005).

= *Diospyros pergamentacea* LUNDELL, Contr. Univ. Michigan Herb. 7: 44 - 45 (1942).
Typus: Mexico, Chiapas, Pico de Loro, near Escuintla, 2200 m, [15°29' N, 92°35' W], advanced forest, (fr), 25 - 29 Jun. 1941 (LL-label: 25 Jun. 1941), **E. Matuda 4278** [holotype: MICH (fig. 14c), isotypes: A, DS, F 2× (photo F 42494; W 1209, 1210), LL, MO, NY, US n.s.], "tree 10 m high".

= *Diospyros riojae* GÓMEZ POMPA, J. Arnold Arbor. 45 (4): 465 - 469, fig. 1 (1964).
Typus: Mexico, Veracruz, Sierra de Chiconquiaco entre Chiconquiaco y Misantla, 1350 m, [19°45' N, 96°49' W], en bosque de Encino [*Quercus*] y *Liquidambar* con *Magnolia*, *Meliosma*, *Juglans* y *Turpinia*, (fr), 13 Aug. 1964 [in the protologue as "1962"], **A. Gómez-Pompa 789** [holotype: A (fig. 12), isotypes: MEXU n.s., US], "árbol 10 - 15 m alto con frutos color verde".

= *Diospyros costaricensis* PROVANCE & A.C.SANDERS, Sida 22 (1): 291-294, fig. 4 (2006). **Typus**: Costa Rica, Guanacaste, Cantón Liberia, Parque Nacional de Guanacaste, Cordillera de Guanacaste, Cerro Cacao, Estación Cacao, 1100 m, 10°55'45" N, 85°28'15" W, (fr), 14 Jul. 1991, **C. Chávez & et al. 569** [holotype: MO n.s.], "árbol de 25 m × 1,4 m DAP; frutos inmaduros verdes".

= *Diospyros gomeziorum* PROVANCE & A.C.SANDERS, Sida 22 (1): 282 - 287, fig. 2 (2006).
Typus: Mexico, Queretaro, Municipio de Jalpan de Serra, 5 - 6 km al NW de San Juan de Los Durán, El Aroyo, 1500 - 1600 m, 21°48' N, 99°12' W, bosque de pino-encino, cedro blanco; orilla de arroyo, cañada, (fr), 21 Aug. 1991, **B. Servín 1274** [holotype: IEB n.s.], "escaso".

= *Diospyros tuxtlensis* PROVANCE & A.C.SANDERS, Sida 22 (1): 295 - 297, fig. 5 (2006). **Typus**: Mexico, Veracruz, Mun. San Andrés Tuxtla, borde de la cima del Cerro Mastagaga, al N del Ejido Ruíz Cortínez, Sierra de Los Tuxtlas, [18°36' N, 95°5' W], selva baja perennifolia, primaria; suelo negro arenoso; selva baja de montaña con elementos de bosque caducifolio, zona conservada, (fr), 30 May 1985, **J.I. Calzada 11855** [holotype: IEB n.s., isotypes: MEXU, XAL n.s.], "árbol 8 m, regular; [fruto] verde".

Tree 3 - 20 (- 30) m tall, dbh 20 - 60 cm (PACHECO 1981: trunk up to 2.5 m in diameter), deciduous (but some old leaves may persist); trunk "fluted" (White 9032 from Oaxaca) or "strongly grooved" (several collections from Costa Rica; see fig. in ZAMORA et al. 2004); bark gray, shiny, later on dark reddish-brown and finally black (for more details see PACHECO 1981), ± smooth; young twigs subterete, light brown, brownish-gray or blackish, loosely covered with the remnants of the same kind of indumentum as that on buds, and usually with minute, patent, stiff, translucent hairs, or sometimes ± glabrous; older twigs glabrous, grayish-brown, brown to blackish-brown (often covered with the grayish remnants of the epidermis), with blackish-bordered lenticels; buds moderately to densely covered with appressed or only slightly spreading, light brown or less frequently dark brown, ± straight hairs; **leaves** alternate, with brochidodrome venation; petioles (2 -) 3 - 5 (- 16) mm long, 1 - 2 mm thick, light brown to dark brown, with the same kind of indumentum as that on young twigs, glabrescent with age; scars of petioles markedly thickened; leaf lamina broadly lanceolate or ± elliptic, seldom narrowly lanceolate or obovate, (1.5 -) 4 - 10 (- 14.5) cm long, (1 -) 2 - 5 (- 5.7) cm wide, (1.2 -) 1.6 - 2.5 (- 3.9) times longer than wide, chartaceous; adaxial leaf surfaces glabrous, greenish-brown, grayish-brown to blackish-brown, dull or slightly shiny, often minutely granulate; abaxial leaf surfaces slightly lighter, usually dull, less frequently slightly shiny, with scattered, ± appressed, grayish hairs and glands when very young, glabrous or rarely with few light brown or blackish-brown hairs especially near the base when mature; leaf apex acuminate (with short drip tip, rounded distally) or acute (sometimes gradually narrowing), less often obtuse or rounded; base of the lamina shortly attenuate or sometimes slightly rounded, decurrent into the petiole; leaf margin entire, flat or slightly revolute especially near the base of the lamina when dry, with some long hairs when young, with a flat, somewhat sharp or in cross-section round, lighter brown colored, thickened marginal vein; flachnectaria on abaxial leaf surfaces 0 - 5 (- 11) (but missing on many leaves), arranged in the proximal half of the lamina; midvein

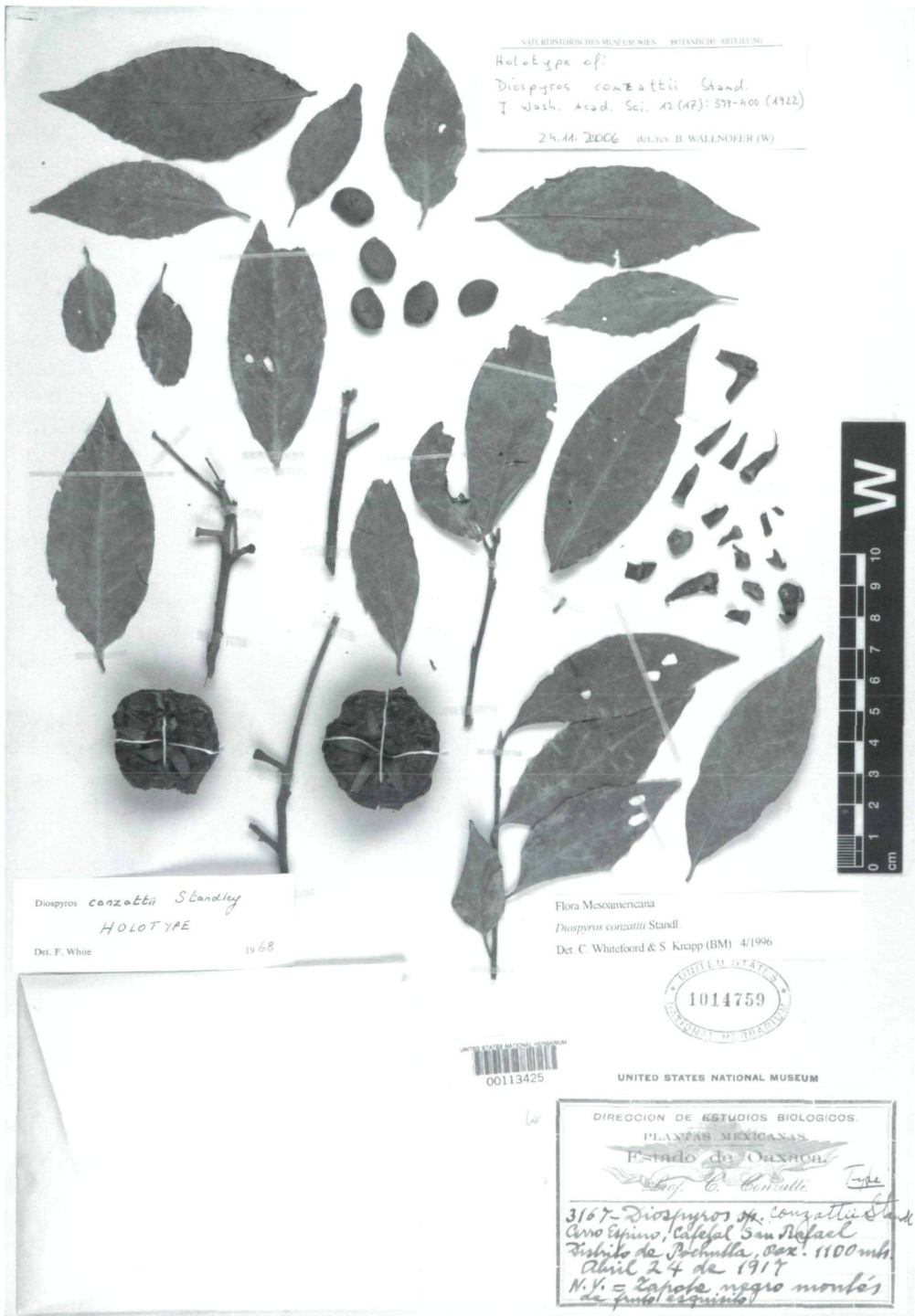
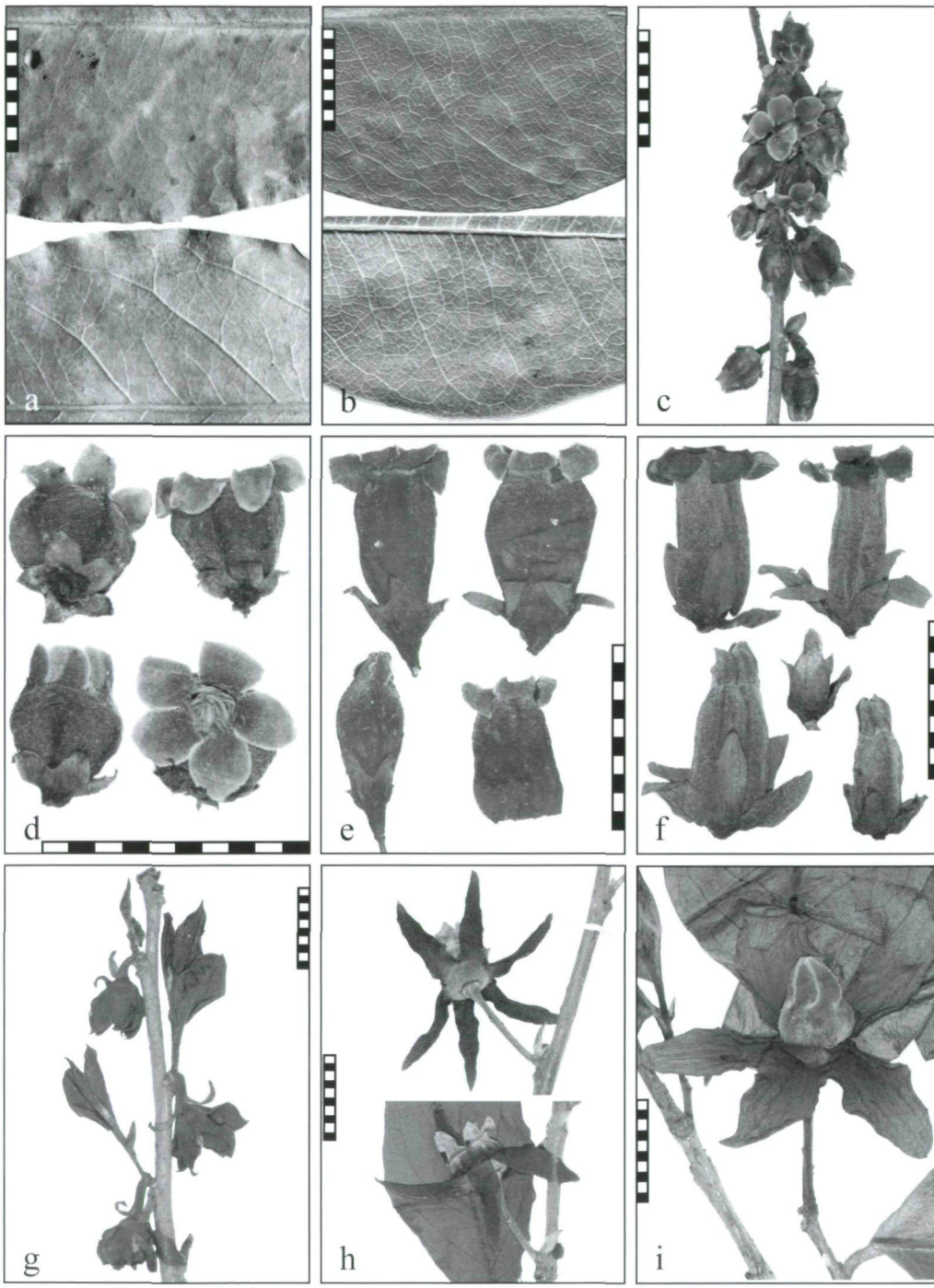


Fig. 11: Holotype of *Diospyros conzattii* STANDL.

impressed on the adaxial side, sometimes ± flat or, especially in the proximal half of the lamina, with slightly raised margins and a ± sunken central part, glabrous or with the same kind of minute, patent, light hairs as that on young twigs and, when young, often with gland-like structures, on the abaxial side markedly prominent, glabrous or, especially when young, with scattered, long, ± appressed, light brown or blackish brown hairs; secondary veins 6 - ca. 10 on each side, prominent on both sides; intersecondary veins less conspicuous; tertiary and quaternary veins inconspicuous or ± markedly reticulate (especially in some northern populations) and slightly prominent on both sides; **inflorescences** in the axils of soon caducous cataphylls, the male ones 1 - 3-flowered, solitary or arranged, a few together, near the base of sprouting, a few cm long, leafy shoots or on much shorter (only a few mm long), undeveloped, usually leafless shoots (their subtending leaf, except in Ventura 1011, already fallen); female inflorescences always 1-flowered, usually solitary (rarely 2 - 3 together) and located at the base of the sprouting shoots; peduncles, pedicels, bracts and bracteoles of both sexes covered with long, ± appressed or slightly spreading, ± flexuose, light brown or blackish-brown hairs together with minute, patent, stiff, translucent hairs and some gland-like structures; bracts and bracteoles glabrous adaxially, soon caducous; male plants: peduncle 3 - 6 mm long, and pedicels 3 - 5 mm long, both ca. 0.6 mm thick (stalk of the 1-flowered inflorescences 3 - 4 mm long); bracts 1.5 - 3 mm long and 1 - 2 mm wide, ovate; bracteoles (only present on 1-flowered inflorescences) 1.5 - 2 mm long and 0.2 - 0.3 mm wide, ± linear; female plants: stalks (peduncle and pedicel) 5 - 17 mm long and 1.5 mm thick; bracts 3 mm long and wide, ovate; bracteoles 5 - 7 mm long and 1.2 - 1.5 mm wide, ± linear; **flowers** (4 -) 5 (- 6)-merous; the male ones (Conzattii 5043, Fernández 2829, Haber 477, Ventura 1011, 7131) 6 - 13 mm long at anthesis, fragrant when alive; calyx 2 - 8 mm long, ca. 3 - 4.5 mm wide, undivided in the proximal 0.5 - 2 mm, ± glabrous near the base; calyx lobes broadly or narrowly triangular or ± linear, 1 - 6 mm long, 1 - 2 mm wide, scattered or medium densely covered with appressed, subparallel, straight, light or blackish-brown (the latter: Fernández 2829) hairs on the outside, inside glabrous; apex of lobes with a dense tuft of dark, flexuose hairs; corolla 5 - 10 mm long, white when alive; tube 3 - 9 mm long, 2 - 4 mm wide, widest in or above the middle, covered with minute, ± patent, stiff, light hairs on the outside, on the inside ± scattered hairy proximally and ± glabrous distally; throat only slightly narrowed, ca. 2 mm wide; corolla lobes 1.5 - 3 mm long and wide, rounded or sometimes ± truncate, rarely slightly emarginate distally, on the outside more densely covered with similar hairs as those on the tube (but hairs often appressed and the uncovered half of the lobes sometimes ± glabrous), on the inside with the same sort of indumentum (but less dense) or glabrous; stamina 10 - 32 (Conzattii 5043: 10, Fernández 2829: 19 - 20, Haber 477: 18, Ventura 1011: 18, Ventura 7131: 32), of different lengths, paired (the inner ones with shorter, the outer ones with longer filaments), 2.5 - 7.5 mm long; filaments 0.5 - 4.5 mm long, their proximal 0.3 - 3 mm adnate to the base of the corolla tube, loosely to medium densely covered with the same kind of patent hairs as that on the corolla; anthers 2 - 3 mm long and 0.6 - 1 mm wide, widest below the middle, pointed distally, opening by two lateral, short slits at the apex; rudiment of the ovary glabrous or with some scattered hairs, grooved, ca. 0.5 mm high and wide, or consisting of several lumps of tissue; **female flowers** (Alcorn 2522, Duke M3558, Haber et al. 4506, Hammel & Aguilar 18192, White 9032) 7 - 10 mm long; calyx 2 - 4 cm wide (if sepals expanded), green

Fig. 12: Holotype of *Diospyros riojae* GÓMEZ POMPA.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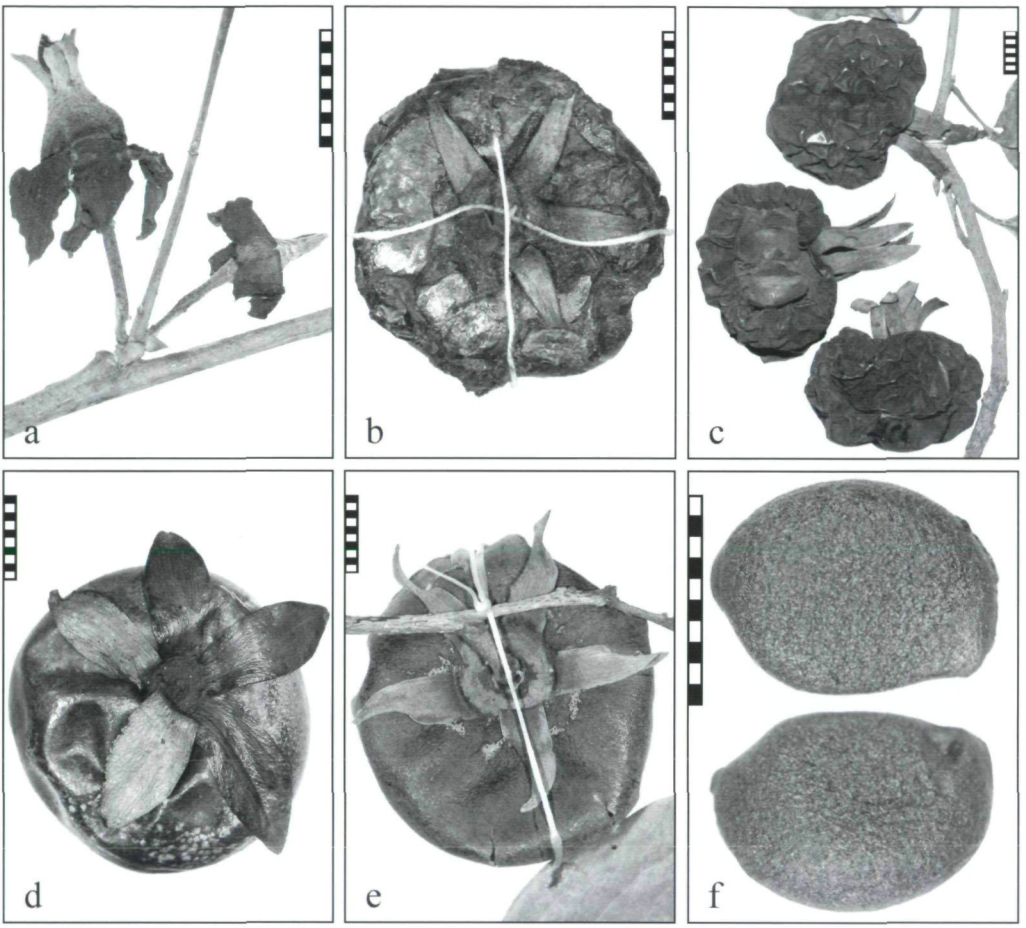

Fig. 14: *Diospyros conzattii*: **a**: female flowers (from Hammel & Aguilar 18192 [FHO]); **b**: fruit (from Conzatti et al. 3167, holotype [US]); **c**: fruits (from Matuda 4278, holotype of *D. pergamentacea* [MICH]); **d**: fruit (from Iltis & Simon 30656 [WIS]); **e**: fruit (from Bello 398 [MO]); **f**: seeds (from Conzatti et al. 3167, holotype [US]); bar = 1 cm.

when alive, undivided in the proximal 1.5 - 4 mm; lobes 7 - 24 mm long and 4 - 9 mm wide, lanceolate, acute or obtuse, abaxially with scattered, light or blackish-brown, ± appressed hairs (the apex often with a ± dense tuft of hairs), adaxially ± glabrous (only with some remote gland-like structures); corolla 7 - 12 mm long, white or "pale greenish-white outside, cream inside, turning dull brown" when alive, widely urceolate; tube 3 - 7 mm long and ca. (4 -) 7 - 9 mm wide, outside densely covered with light,

Fig. 13: *Diospyros conzattii*: **a**: adaxial (on top) and abaxial (bottom) leaf surface (from Conzatti et al. 3167, holotype [US]); **b**: adaxial (on top) and abaxial (bottom) leaf surface (from Iltis & Simon 30656 [WIS]); **c**: twig with male flowers (from Fernández 2829 [MEXU]); **d**: male flowers (from Fernández 2829 [WIS]); **e**: male flowers (from Ventura 1011 [DS]); **f**: male flowers (from Haber 477 [MO]); **g**: twig with female flower buds (from Duke M3558 [MO]); **h**: female flowers (from White 9032 [FHO]); **i**: female flower (from Alcorn 2522 [TEX]); bar = 1 cm.

± appressed hairs of different length, glabrous inside and near the base on the outside; throat narrowed; corolla lobes 4 - 7 mm long and 2.5 - 8 mm wide, semicircular or broadly lanceolate, rounded (sometimes slightly retuse) or obtuse apically, on the abaxial side with the same kind of indumentum as that on the tube, on the adaxial side glabrous or with shorter and less dense hairs; staminodia 0 or 2, attached at the base of the corolla tube, (the following applies to Duke M3558) 1 - 1.3 mm long, 0.3 mm wide, the distal ca. 0.8 mm free, very reduced, lanceolate, glabrous; (Haber et al. 4506: staminodia 2.5 mm long, 1.5 mm wide, flat and with an irregular outline, slightly lobed, scattered hairy abaxially, glabrous adaxially); ovary semiglobose, ca. 3 - 4 mm wide and 2 - 3 mm high, 8 or 10-locular, glabrous, rarely scattered hairy, green when alive; stylodia 5 (- 6), 1 - 1.5 mm long, with ± scattered, appressed, brown hairs; stalk of the **fruits** 5 - 15 (- 25) mm long and 2 - 3 (- 4) mm thick; fruits oblate-globose, up to 5.5 cm in diameter and up to 4.5 cm high when dry, green (inside yellowish) when unripe, green (according to Conzatti as quoted by STANDLEY 1922) or black when ripe and fresh, brown or black when dry, smooth, glabrous, up to 10-seeded (one fruit exceptionally with 11 seeds); fruit wall ca. 1 mm thick, firm when unripe, becoming soft when ripe, covered with a thin, adhering epidermis; calyx as a whole up to 5 cm wide, undivided in the proximal ca. 3 mm, often markedly thickened at the base; area below the sinuses in-between the lobes inconspicuous; lobes enlarged, 12 - 40 mm long and 6 - 13 mm wide, ± lanceolate, acute or obtuse, less frequently rounded apically, firm, glabrous, with slightly raised, longitudinal venation especially abaxially, spreading or flexed downwards, straight or arcuate (at least on herbarium material); seeds flattened, ± lenticular, ca. 17 mm long, 14 mm wide, 3.5 - 6 mm thick, brownish, with very fine structures on the surface.

This species exhibits a considerable range of morphological variation [as is for example also the case with the species Homo sapiens]. In my opinion, it is therefore not possible to split it furthermore. GÓMEZ POMPA (1964) described *D. riojae* as a new species, distinguishing it from *D. conzattii* by several characters (see his table), which, after a careful examination of a large number of specimens, turn out to be highly variable. PROVANCE & SANDERS (2006) splitted *D. riojae* and *D. conzattii* even much further (creating three additional, mere phantom-species) using very weak, unstable, variable and not clear-cut characters which, to my belief, are all within the normal range of morphological variation of *D. conzattii*. In their identification key, for example, these authors set "buttressed trees up to 35 m tall ..." (*D. costaricensis*) against "trees or shrubs, 8 - 10 m tall, lacking buttresses as far as known ..." (*D. conzattii*). However, on labels of specimens from Costa Rica seen in the course of this study, tree heights are stated to be 10, 12, 18, 20, 25, and 30 m. The same applies to the proximal part of the leaf margin, which is highly variable and too insignificant to distinguish taxa, and to the tertiary and quaternary venation especially on the adaxial surface of the leaves, which is often markedly reticulate in the northern populations, whereas it is more inconspicuous in the southern ones. Such differences could well be due to differing climatic conditions in the respective habitats. Many populations even exhibit an intermediate kind of reticulation. The color and brightness of dry leaves is similarly variable and depends on how they have been dried and whether the fresh specimens have been stored in alcohol or not. Length and width of sepals also show a wide range of variation. Their three-dimensional arrangement and flexion on living fruits is also variable and seems mainly to depend

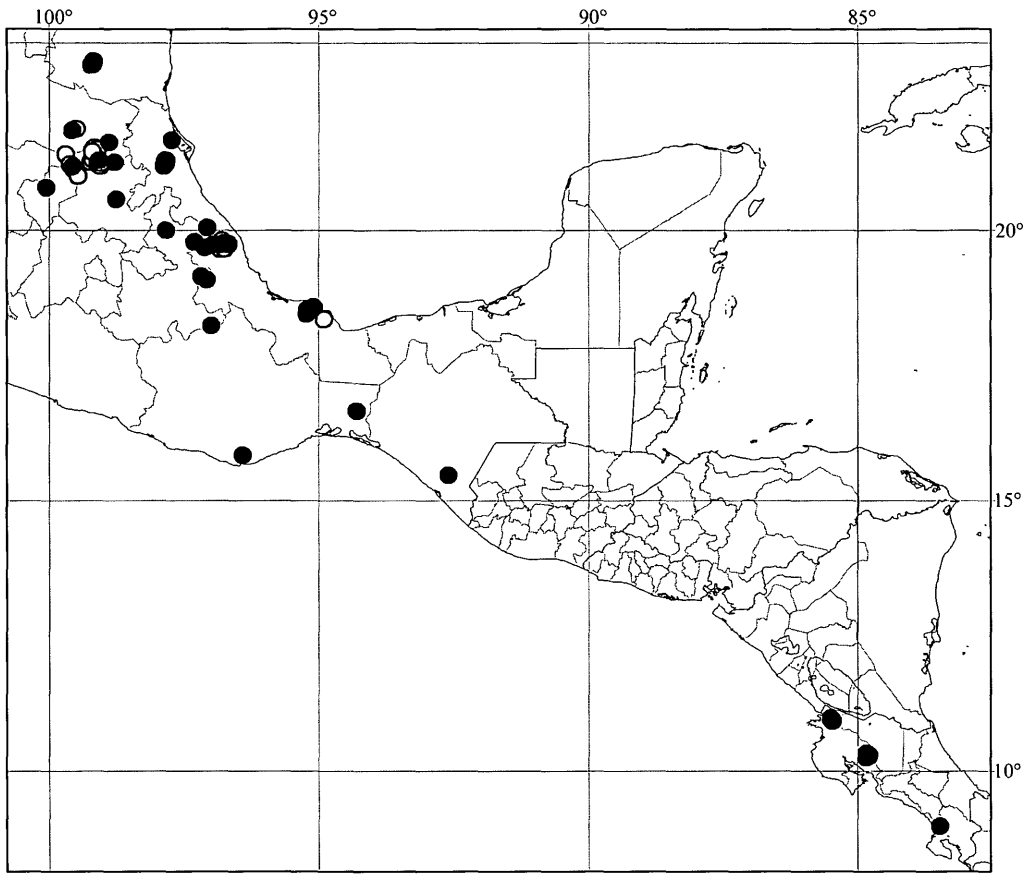

Fig. 15: Distribution of *Diospyros conzattii* STANDL. ●; – records from CARRANZA GONZÁLEZ (2000), PACHECO (1981), and PROVANCE & SANDERS (2006) O.

on the stage of maturity of the fruits, and can, on the other hand, hardly be determined from the shriveled and usually strongly deformed dry fruits on herbarium material alone. The sepals of the type collections of both, *D. tuxtlensis* and *D. pergamentacea*, are strongly reflexed and are ± orientated parallel to the pedicel for their whole length. The fruit wall of *D. riojae* is described as being coriaceous-ligneous, which again seems also to depend on the stage of maturity of the fruits. All this demonstrates the apparent uselessness of the above mentioned key.

The fruits are edible (Alcorn 1844, 2522; Castillo & Benavides 2265, Martinez & Hernandez 1302) and are said to be delicious (Conzatti et al. 3167, STANDLEY 1922, 1924). According to Conzatti, the tree has been cultivated with success in Oaxaca (TOMMASI 2004). On the label of his specimen numbered 9032, collected in Conzatti's garden, Frank White stated the following: "This is the only tree but it is producing fruit. According to Dr. Conzatti self-sown seedlings occasionally appear in the garden." This phenomenon requires further investigation.

Considering their palatability, it seems safe to assume that this species has been taken into cultivation (at least extensively) and was most likely propagated by the ancient tribes inhabiting Central America. In fact, the types of *D. conzattii* and *D. pergamentacea* seem to represent such cultivars. Cross-breeding between these cultivars and wild populations may, to a certain extent, also have been undertaken, increasing the current range of variation and blurring the original distribution range of the species. As can be suspected from the remarkable range of flower sizes in different populations, changes in ploidy level may also have occurred, but this has not been investigated to date. Subsequent to European colonization and decline of indigenous tribes, the cultivars could have survived on abandoned land, especially at lower altitudes, so as to confuse current researchers.

Figures: fig. 1 in GÓMEZ POMPA (1964); fig. 1g - 1h in PACHECO (1981); fig. 1 - 5 in PROVANCE & SANDERS (2006); page 277 in ZAMORA et al. (2004).

Vernacular names and use: **Mexico**: "granadilla" (Castillo & Benavides 2265); "munek' (Huastec name)" (Alcorn 1844, 2522); "sapote prieto" (Edwards 670); "zapote del monte" (PROVANCE & SANDERS 2006, quoted from Servín 206); "zapote negro montés", "zapote negro silvestre" (Conzatti et al. 3167, STANDLEY 1922); "zapotilla" (Martinez & Hernandez 1302); "zapote de monte", "zapote prieto", "zapotillo" (CARRANZA GONZÁLEZ 2000). The fruits are comestible (see above) and the plant is of medicinal use (Alcorn 1844, 2522). – **Costa Rica**: "guacalillo" (Haber & Bello 3140).

Distribution, habitat, ecology, and phenology: This species is known from Veracruz, southern Tamaulipas, eastern San Luis Potosí, central and northern Queretaro, eastern Hidalgo, eastern Puebla, from two places in Oaxaca and one place in Chiapas, as well as from Guanacaste and Puntarenas in Costa Rica (fig. 15). A distribution map with 11 localities for Queretaro is given in CARRANZA GONZÁLEZ (2000), and another one for Veracruz in PACHECO (1981). It has been collected at elevations between 100 and 2200 meters. In Mexico it grows in evergreen, semideciduous or deciduous forests and has been observed in oak-forests, cloud forests, secondary forests, and frequently in forest-remnants in ravines where, according to PACHECO 1981, it seems to have escaped the destruction of woodlands. Presumable cultivars have been collected in pastures or villages, or on abandoned land. According to SOSA et al. (1998), the population density of this species seems to be quite high: 21 individuals were counted in a 600 m^2 plot south of Plan de las Hayas in Veracruz. The climatic requirements of "*D. riojae*" are detailed in ANGULO & SOTO (1990). In Costa Rica, *D. conzattii* has been collected in primary and secondary forests, on forest edges and in pastures in the area of the "premontane moist forests" or "lower montane wet forests". It has been found in flower from March to May (June), during the flush of new leaves, and in fruit all over the year. In Queretaro, it flowers from February to April and has been observed with ripe fruits from May to November (CARRANZA GONZÁLEZ 2000).

Specimens examined: **Mexico**, Tamaulipas, Mun. Gomez Farias, top of Sierra Madre Oriental (Sierra de Guatemala), 1 - 2 km NW of Rancho del Cielo (Harrison's Ranch of Martin & Harrell), along dirt road to Julilo, 7 - 9 km NW of Gomez Farias, ca. 108 km SSW of Ciudad Victoria, 1160 - 1300 m, 23°06' N, 99°11 - 12' W, rugged, wooded, karstic limestone plateau with sink holes and big boulders; mesic, rather dry, mostly 2nd growth cloud forests (bosque mesofilo de montaña, sensu PUIG & BRACHO 1987) with 20 - 40 m canopy of deciduous trees (*Acer*, *Magnolia*, *Ostrya*, *Quercus*, *Carpinus*, *Turpinia*, *Carya*, *Cercis*), (fr), 12

Aug. 1991, **H.H. Iltis & B. Simon 30656** [WIS]; – Rancho del Cielo, 6 km NW Gomez Farias, 3500 ft., 23°07'52" N, 99°11'32" W, cloud forest, (fr), 27 Jun. 1965, **L.E. Gilbert 10** [TEX]; – same locality, 1100 m, (fr), 31 Aug. 1983, **I.N. Labat INL576** [P]; – same locality, (st), 24 Aug. 1950, **A.J. Sharp, E. Hernandez X. & F. Harrison 50126** [MEXU], "tree 10 m; large fruit"; – same locality, (fr), 28 Aug. 1952, **A.J. Sharp, E. Hernandez X., R.E. Shanks & J.N. Wolfe 52179** [MEXU], "small tree"; – same locality, (fr), 1 May 1964, **F.S. Webster & M. Webster 43** [TEX]; – same locality, near large, loose rock formation, (fl female), Apr. 1960, **J.A. Duke M3558** [MO 2×]; – Ejido San José, near Gómez Farías, [23°4' N, 99°13' W], (fr), 23 Jun. 1994, **D. Seigler & F.A. Jones DS14086** [MO], "tree ca. 3 m tall". – San Luis Potosí, Mun. Rayon, Hwy. Valles to Rioverde at km 81.5 on microondas road, 3.5 miles from hwy. at summit, 1340 m, [21°52' N, 99°34' W], (fr), 23 May 1981, **P.A. Fryxell & W.R. Anderson 3561** [MICH], "tree 7 m; fruits green, oblate; one tree seen"; – Mun. San Antonio, Tanjasnec, [21°38' N, 98°53' W], managed forest; bosque tropical perennifolio, (st), 26 Sep. 1978, **J.B. Alcorn 1844** [TEX], "tree 4 m"; – same locality and type of forest, roadside creek, (fl female), 16 Mar. 1979, **J.B. Alcorn 2522** [TEX], "tree 3 m"; – Clasuapa [only on MO + TEX label], Tamazunchale, [according to PROVANCE & SANDERS (2006): at 153 m], [21°16' N, 98°47' W], (st), 26 Jul. 1937, [MO + TEX label: (fr), 21 Jul. 1937], **M. T. Edwards 670** [DS, F, MO, NA n.s., TEX, US n.s.]. – Queretaro, [Municipio de] Colón, cerca vado río Colón, 1900 m, [20°48' N, 100°3' W], chaparral; milpa de alfalfa; suelo algo arenoso; asociada: Alfalfa, *Medicago* amarillo, *Aloe*, Cacti, Pirul, *Acacia* etc., (fr), 2 Apr. 1982, **E. Argüelles 1761** [DES n.s., MEXU], "árbol mediano; corteza gris, brillante, con fissuras longitudinales"; – Municipio de Pinal de Amoles, 3 km al S de Escanelilla, 1100 m, [21°11' N, 99°34' W], bosque mesófilo de montaña en cañada, (fl male), 19 Mar. 1985, **R. Fernández N. 2829** [ENCB n.s., G, GH, MEXU, NY, US n.s. WIS], "árbol de 4.5 m de alt. (escaso); flor blanca"; – [Municipio de] Landa [de Matamoros], El Humo, 2 km à l'Ouest d'El Humo, 1320 m, 21°18' N, 99°5' W, forêt mésophile de montagne; lithosol et sol noir peu profond; forêt haute et dense avec *Quercus* sp., *Juniperus flaccida*, *Lonchocarpus* sp. entre autres sur roche mère sédimentaire calcaire, (fr), 1 Oct. 1994, **J.-N. Labat & E. Carranza Gonzalez 2562** [IEB n.s. (digital photo seen)], "arbre bas de 6 m de hauteur; fruit vert; rare". – Hidalgo, Barranca de Meztitlán [= Metztitlán], 9 kms al NE [correct is: NW] de Mesquititlán [= Metzquititlán] a lo largo de una cañada, 2200 m, [20°35' N, 98°45' W], matorral espinoso con crasicaules, (fr), 3 May 1975, **F.G. Medrano & et al. 7932** [MEXU, NA n.s., SD n.s., UC, US n.s., WIS, XAL n.s.], "árbol de 4 m, muy abundante". – Puebla, Ahuacatlan, Agua Dulce, 4 km SE de Ahuacatlan, brecha a Zapotitlan, 1180 m, 20°01'00" N, 97°50'00" W, bosque mesofilo alterado; suelo de rendzina amarillo, (fr), 27 Feb. 1987, **G. Toriz A., A. Campos V., P. Tenorio L. & O. Vega T. 304** [MEXU n.s., W], "árbol 10 m, abundante; fruto inmaduro"; – Mun. Coyomeapan Ajalpan Grande, al NE de Coyomeapan, [≈ 2000 m], 18°15' N, 96°59' W, bosque de pino-encino; suelo calizo, (fr), 31 Dec. 1988, **P. Tenorio L. 15439** [MEXU n.s., W], "árbol 6 m; abund.: escaso; frutos inmaduros". – Veracruz, Ozuluama, La Laja, [21°41' N, 97°43' W], selva de *Manilkara*; suelo negro profondo arcilloso, (fr), 8 Nov. 1970, **F. Chiang 184** [CAS, F 2×, GH n.s., MEXU, XAL n.s.], "árbol 10 m; fruto negro quando maduro"; – Mun. Tantima, en la Sierra de Tantima, 740 m, 21°17' N, 97°51' W, selva alta subperennifolia, primaria; suelo cafe arcilloso; amb.: muy calido, (fr), 23 Aug. 1979, **J.I. Calzada 5550** [F, XAL n.s.], "árbol 7 m; abund.: regular; fruto verde"; – Mun. Tepetzintla, San José de Copaltitla, 7 km al NE [correct is probably: NW] de Tepetzintla, 350 m, 21°12' N, 97°52' W, veg. ruderal, secundaria; en patios de casas y orillas de caminos; suelo arcilloso amarillento profundo, (fr), 28 Aug. 1981, **G. Castillo C. & A. Benavides 2265** [F, XAL n.s.], "árbol 5 m, abundante; fruto verde"; – Mun. Tepetzintla, Sierra de la Peña Blanca, Sierra de Tantima, [according to PROVANCE & SANDERS (2006): at ca. 700 m], [21°15' N, 97°50' W], bosque mesofilo de montaña, primaria, en barranca, (fr), 21 Sep. 1989, **P. Zamora C., G. Castillo C. & S.S. Guevara 1217** [MEXU, XAL n.s.], "árbol 15 m; abund.: regular; [fruto] verde"; – Mun. Martínez de la Torre, Maluapan [= Maloapan], 100 m, [20°4' N, 97°4' W], bosque de encino en cañada, (flbuds male), 15 Mar. 1978, **F. Ventura A. 15078** [IEB n.s., MEXU, XAL n.s.], "arbusto erecto, 8 m de alto; abund.: escaso; flor blanca"; – Mun. de Jalacingo, Ocotepec, cerca de Cerro, 1750 m, [ca. 19°48' N, 97°18' W], bosque de hilite; ladera de cerro, (fl male), 4 May 1970, **F. Ventura A. 1011** [DS], "arbusto de 3 m; abund.: escaso; flores de color blanco y olor agradable"; – Mpio. Jalacingo, El Cuizalín, 150 m [correct is probably 1500 m], [ca. 19°48' N, 97°18' W], bosque de encino; en ladera de cerro, (fl male), 22 May 1970, **F. Ventura A. 7131** [IEB n.s.,

MEXU, MO, XAL n.s.], "arbusto de 5 m de alto; abund.: escaso; flores blanquecinas"; – Mun. Tatatila, camino de herradura de Tatatila a Escalona (o Puente Caballos), [according to PROVANCE & SANDERS (2006): at 1500 m], [ca. 19°42' N, 97°6' W], bosque con *Pinus*, *Quercus*, Lauraceae, (fr), 14 Jan. 1986, **M. Chazaro & R. Acosta 3969** [MEXU, WIS, XAL n.s.], "árbol 10 m; abund.: bastante; fruto rojizo"; – Mun. Tlacolulan, abajo del Saucal, dirección Agustin Melgar, 1180 m, 19°45' N, 96°57' W, bosque caducifolio, primario; suelo rojizo, pedregoso; ladera de cerro, (fr), 14 Aug. 1990, **C. Gutierrez B. 4056** [NY, MO, XAL n.s.], "árbol 7 m; abund.: regular; fruto verde"; – Mun. Alto Lucero, Cruz Blanca, 900 m, 19°46' N, 96°40' W, suelo negro arcilloso con abundante materia organica; cerca de un potrero, (fr), 30 Apr. 1980, **L. Pacheco & J.I. Calzada 23** and **24** [both: F, XAL n.s.], "árbol 15 m; abun.: regular; fruto verde"; – Cerro del Sombrero, cerca de Plan de las Hayas, 1050 m, [19°45' N, 96°40' W], (fr), 23 Jun. 1972, **R. Hernández M. 1620** [F, MEXU], "abund.: regular"; – Mpio. Calcahualco, 4.2 km W of Escola [= Excola] on road to Jacal, 17.5 km by road NW of Coscomatepec, 2200 m, 19°10' N, 97°10' W, bosque de Pino-encino; woods with *Alnus acuminata* ssp. *arguta* etc.; with sporadic cutting, on very steep slopes with some *Pinus* on ridgetop, (yfr), 12 Jan. 1981, **M. Nee & G. Schatz 19777** [F, GH, MEXU, XAL n.s.], "tree 5 m tall; fruit green"; – Mun. Coscomatepec, 3 km al SE de la antigua Xicola, Cima del Cerro La Magdalena, 1900 m, 19°06'00" N, 97°04'00" W, bosque de encino, secundario; suelo cafe arcilloso; en potrero (cercado), (fr), 29 Apr. 1987, **J.L. Martinez & A. Hernandez 1302** [NY (+ carp.), XAL n.s.], "árbol 4 m; abund. regular; fruto verde, inmaduro con pulpa blanca, tornandose amarilla al contacto con el aire; forma redonda y alargado"; – Mun. San Andrés Tuxtla, Volcan San Martin, 1300 m, [18°33' N, 95°12' W], (fr), 15 Jun. 1985, **R. Cedillo Trigos 3259** [MEXU n.s., W], "arbolito 5 m"; – same area: senda para el Cerro Baxin, al N de San Andrés Tuxtla, Sierra de Los Tuxtlas, [18°28' N, 95°13' W], bosque caducifolio, primaria; suelo negro arenoso, pedregoso; bosque con elementos de selva alta perennifolia, con grandes desmontes para gandería y agricultura, (fr), 6 Mar. 1985, **J.I. Calzada 11929** [IEB n.s., MEXU, XAL n.s.], "árbol 10 m; abund.: escaso; [fruto] verde". – Oaxaca, Mpio. San Miguel Chimalapa, El Peñasco, ca. 3 - 4 km al O del paraje palmero "El Gringo", al N del Cerro Tres Picos, entre las cabeceras del los ríos Ostuta y Zanatepec, ca. 22 km en línea recta al NNE de Zanatepec, [≈ 1500 m], 16°40' N, 94°17' W, arroyo al lado E, bosque seco con *Cupressus*, bambú, *Quercus*, (fr), 13 Sep. 1986, **S. Maya J. 3885** [MEXU], "árbol 14 m, dap 38 cm; abundante; corteza blancuzca, lisa; brecha amarilla, cambiando ligeramente a azul, mal olor, exudado claro, albura [sapwood] color amarillo claro; fruto verde con carne amarilla, amargo"; – Pochutla, "hoy cultivado en Oaxaca", (fl male), Jun. 1934, **C. Conzatti 5043** [MEXU]; – garden of Conzatti, (st), 10 Mar. 1949, **M.C. Carlson 1442** [F], "tree 30' "; – growing in Prof. Conzatti's garden, obtained through the courtesy of his son, Dr. Silvio Conzatti, (fl female), 5 Mar. 1968, **F. White 9032** [FHO 3×], "tree 30' high; branches ascending, almost fastigiate but the tree has been heavily pruned from time to time and this has probably affected the form; bole fluted, 12" diam.; barck black, almost smooth, very finely fissured; fissures sinuous, 1 mm deep and 3 - 5 mm apart; flowering with the young leaves but some old leaves still present; flowers in the axils of fallen leaves and at the base of the current year's shoot; calyx lobes 5 - 6; corolla widely urceolate, lobes 5 - 6, revolute, pale greenish-white outside, cream inside, turning dull brown; ovary green; styles 4 - 5, slightly spreading, irregularly lobed at apex".

Costa Rica, Guanacaste, Parque Nacional Guanacaste, Estación Maritza, sendero a la cima del Volcán Orosí, 600 m, 10°57.6' N, 85°29.6' W, bosque primario y secundario, (fr), 2 Jul. 1989, **INBio 131** [FHO 2×, MO], "árbol 20 m × 60 cm DAP; fuste acanalado con coloracion negra, poco ramificado; frutos verdes con amarillo por dentro, latex amarillo y olor muy fuerte"; – Puntarenas, Monteverde, San Luis river valley below Monteverde on Pacific slope, 1000 m, 10°20' N, 84°50' W, lower montane wet forest, (fl female), 2 May 1986, **W.A. Haber, E. Bello C. & L. Lierheimer 4506** [FHO, MO, W], "tree 30 m, 25 cm dbh; flower white; calyx green; this tree in pasture"; – same area: 1100 - 1200 m, en bosque degradado, (fr), 29 Sep. 1985, **W.A. Haber & E. Bello C. 2906** [FHO, MO], "árbol 20 m; frutos de 42 mm de diam., verdes con savia amarilla al oxidarse"; – same area: 1200 m, moist forest; second growth, (fr), 20 Oct. 1985, **W.A. Haber & E. Bello 3140** [MO], "tree 10 m; fruit green, 40 mm diam.; calyx star-shaped"; – same area: 1200 m, premontane moist forest, (fr), 30 Dec. 1985, **W.A. Haber & E. Bello C. 4117** [FHO, MO], "tree 10 m, 20 cm dbh; fruit green, 55 mm in diam., sap white, but turns orange with oxidation; seed tan; "star calyx"; this tree in second growth"; – same area: 1000 m, in pasture, (yfr), 9 May 1986, **W.A. Haber, E. Bello C.**

& L. Lierheimer 5004 [MO], "tree; fruit green, immature"; – same area: 1000 m, forest edge, (fr), 19 Nov. 1986, **W.A. Haber & E. Bello C. 6302** [FHO, MO, W], "tree 12 m; fruit green, 46 mm diam., sap orange-cream; seeds brown"; – same area: 1000 m, moist forest, (fr), 19 Nov. 1986, **W.A. Haber & E. Bello C. 6304** [FHO, MO, W], "tree 18 m; fruits green; this tree in pasture"; – same area: 1200 m, (fr), 1 Aug. 1996, **H. van der Werff & OTS Class "1996" 14013** [BM, MO n.s.], "tree 25 m; young fruits green"; – same area: 900 m, 10°16' N, 84°49' W, orilla del bosque, (fr), 24 Jun. 1988, **E. Bello 398** [FHO, INB, MO], "árbol; fruto verde, se oxida naranja; semillas cafe"; – same area: Guacimal valley below, 800 m, [10°15' N, 84°50' W], (fl male), 3 Apr. 1981, **W. Haber 477** [MO], "medium tree"; – Cantón de Osa, Fila Retinta frente a Palmar Norte, a lo largo de Quebrada Benjamín, 150 m, 8°59'00" N, 83°28'00" W, (fl female), 1 Apr. 1991, **B. Hammel & R. Aguilar 18192** [FHO, INB, MO, W], "árbol 25 m × 40 cm DAP; fuste acanalado, griz oscuro; subcorteza negra; madera amarilla; corola verde-palido".

Acknowledgements

I wish to thank Walter Till (WU) and Friedrich Lauria (W) for critically reading the manuscript, the former also for correcting the Latin diagnosis. I also wish to thank Heimo Rainer (WU) for helping with the preparation of the photos and distribution maps, and H. Walter Lack (B) for sending rare literature. The kind cooperation of Federico Selvi (FI), Fred W. Stauffer (G) and J. Rzedowski (IEB), who supplied digital images of herbarium specimens, is thankfully acknowledged. I am also grateful to the directors and curators of 75 herbaria who kindly made their herbarium material available for study.

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