

A revision of neotropical *Diospyros* (Ebenaceae): part 4

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Abstract

In the course of a revision of New World Ebenaceae for "Flora Neotropica" and other regional floras, specimens from ca. 75 herbaria have been studied. The Central American-Caribbean species *Diospyros tetrasperma* Sw. (synonyms: *D. cuneata* STANDL., *D. obovata* JACQ., *D. schippii* STANDL., *D. tetrasperma* var. *pisocarpa* URB., "*Menziesia triflora* BERTERO ex SPRENG.") and the North-Central American species *D. texana* SCHEELE (synonyms: *Brayodendron texanum* (SCHEELE) SMALL, *D. cuneifolia* HIERN) are here described in detail. Lectotypes for *D. tetrasperma* and *D. tetrasperma* var. *pisocarpa* are selected. Figures, distribution maps, and lists of specimens are presented.

Key words: Ebenaceae, *Brayodendron texanum*, *Diospyros cuneata*, *D. cuneifolia*, *D. obovata*, *D. schippii*, *D. tetrasperma*, *D. texana*, *Menziesia triflora*, revision, taxonomy, flora of North and Central America.

Zusammenfassung

Im Rahmen einer Revision der neuweltlichen Ebenaceae für "Flora Neotropica" und andere Regionalfloren konnten Herbarbelege aus ca. 75 Herbarien studiert werden. Die mittelamerikanisch-karibische Art *Diospyros tetrasperma* Sw. (Synonyme: *D. cuneata* STANDL., *D. obovata* JACQ., *D. schippii* STANDL., *D. tetrasperma* var. *pisocarpa* URB., "*Menziesia triflora* BERTERO ex SPRENG.") und die nord-mittelamerikanische Art *D. texana* SCHEELE (Synonyme: *Brayodendron texanum* (SCHEELE) SMALL, *D. cuneifolia* HIERN) werden hier im Detail beschrieben. Lectotypen für *D. tetrasperma* und *D. tetrasperma* var. *pisocarpa* wurden ausgewählt. Abbildungen, Verbreitungskarten und Listen der gesehenen Herbarbelege werden ebenfalls präsentiert.

Introduction

In the Americas, the Ebenaceae are represented by the genera *Diospyros*, with about 100–130 species, and *Lissocarpa* with 8 species. In the course of an ongoing revision of Ebenaceae (WALLNÖFER 2001a, 2001b, 2003b, 2004a, 2004b, 2004c, 2006, 2007, 2008a, 2008b, 2009a, 2009b, 2010a, 2010b, 2010c, WALLNÖFER & MORI 2002, ESTRADA & WALLNÖFER 2007; see also DUANGJAI et al. 2006, 2009) for "Flora Neotropica", "Flora of Ecuador", "Flora of the Guianas", "Flora de Paraguay" and "Flora ilustrada de la Península de Yucatán" several new species have already been described (WALLNÖFER 1999, 2000, 2003a, 2005).

Note: Additions are given in brackets; coordinates given in brackets were determined during this revision; acronyms of herbaria according to HOLMGREN & HOLMGREN (1998–2010); data from herbarium labels are cited here in a standardized way; – abbreviations: defl = deflorate; fl = flowering; flbuds = with flower buds; fr = fruiting; st =

sterile; yfr = with young fruits; carp = fruit in the carpological collection; n.s. = not seen; s.n. = without number; s.d. = without date; s.coll. = without collector; 2× = 2 sheets.

***Diospyros tetrasperma* Sw.**, Prodr. 62 (1788); [fig. 1–5].

Protologue: "Jamaica" (with a very brief description of leaves and fruits only).

Typus: "Jamaica: Swartz - *Diospyros tetrasperma* Sw.z." and on an additional small label: "duospyros 4 sperma", (apparently fl male, fr), s.d., **O.P. Swartz s.n.** [lectotype (here selected: the twig with the broken fruit near the upper right corner of the sheet, as well as the fragments of the broken fruit in the pocket): S n.s. (dig. photos + photo NY: N.S. 6910 at FHO, NY), isolectotypes: G-DC 2×, LE (fig. 1), SBT n.s. (dig. photo)].

Note: In the Swartz herbarium kept at S there is another sheet (without any geographic information) which bears on the reverse beside the species name also the following handwriting "a celeb. D. Doct. Ol. Swartz" This sheet seems also to be part of the type collection(s). An image of the SBT-specimen can be seen at: http://www.bergianska.se/index_forskning.php.

= *Diospyros obovata* JACQ., Pl. hort. schoenbr. 3: 34, tab. 312 (1798).

Iconotypus: Pl. hort. schoenbr. tab. 312; – apparently no original specimens are preserved (compare D'ARCY 1970); – obviously indicated by error from Hispaniola ("crescit in Domingo"); no other records are given by MOSCOSO (1943) and LIOGIER (1989) for Hispaniola.

= *Diospyros tetrasperma* Sw. var. *pisocarpa* URB., Symb. antill. 2 (3): 455–456 (1901).

Typus: Jamaica, St. Mary, near Charlottenburg [= Charlottenburgh], 2000 ft. (NY-label: 700 m), [18°15' N, 76°53' W], (yfr), 17 Sep. 1897 (NY-label: 19 Sep. 1897), **W. Harris 6797** [holotype: B? (destroyed); lectotype (here selected): NY; isotypes: BM, F], "shrub 8 ft. high (NY-label: 2.6 m)"

= *Diospyros cuneata* STANDL., Publ. Field Mus. Nat. Hist., Bot. Ser. 8 (1): 33 (1930).

Typus: Mexico, Yucatán, without further data, (fl male), 1917–1921, **G.F. Gaumer 24098** [holotype: F (fig. 2; photo F 59336; photo NY: N.S. 6903 at FHO, NY), isotypes: A, BM, C n.s., G, GH, K, MA n.s. (dig. photo), MICH, MO, NY, S n.s. (dig. photo), UPS, US].

= *Diospyros schippii* STANDL., Publ. Carnegie Inst. Wash. 461 (4): 80–81 (1935).

Typus: Belize, Toledo [District], Camp 34, British Honduras-Guatemala boundary (B.H.-G survey), 2600 ft., [16°23' N, 89°12' W], growing on hillside in forest shade, (fr), 11 Jun. 1934, **W.A. Schipp 1281** [holotype: F (fig. 3; photo F 52495; photo NY: N.S. 6902 at FHO, NY), isotypes: A, BM, BRH n.s., FHO (fragm.), G, GH, K, MICH, MO n.s., NY, S, Z], "large tree with rather a compact crown, 50 ft., 10 in. diam., rare; wood hard and close grained, dark brown color; fruits brown"; (concerning the locality see: LOWDEN 1970).

– *Menziesia triflora* BERTERO ex SPRENG., Syst. veg., ed. 16, 2: 202 (1825), nom. illeg. & superfl.

Bertero's specimens (see specimen-list below) bearing this name belong to *Diospyros tetrasperma* and not to *Andromeda octandra* Sw. [= *Lyonia octandra* (SW.) GRISEB., Ericaceae] as indicated by SPRENGEL.

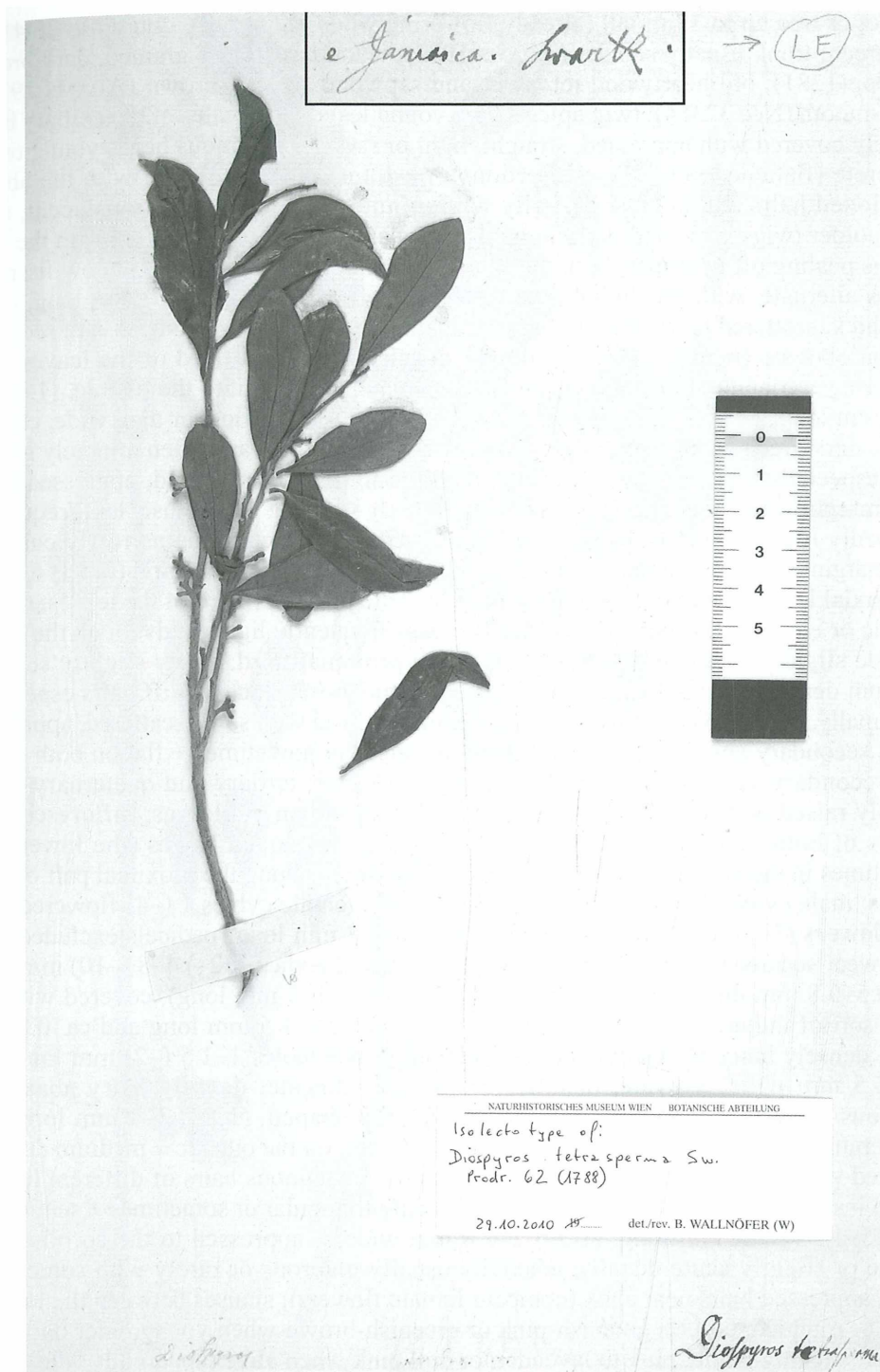
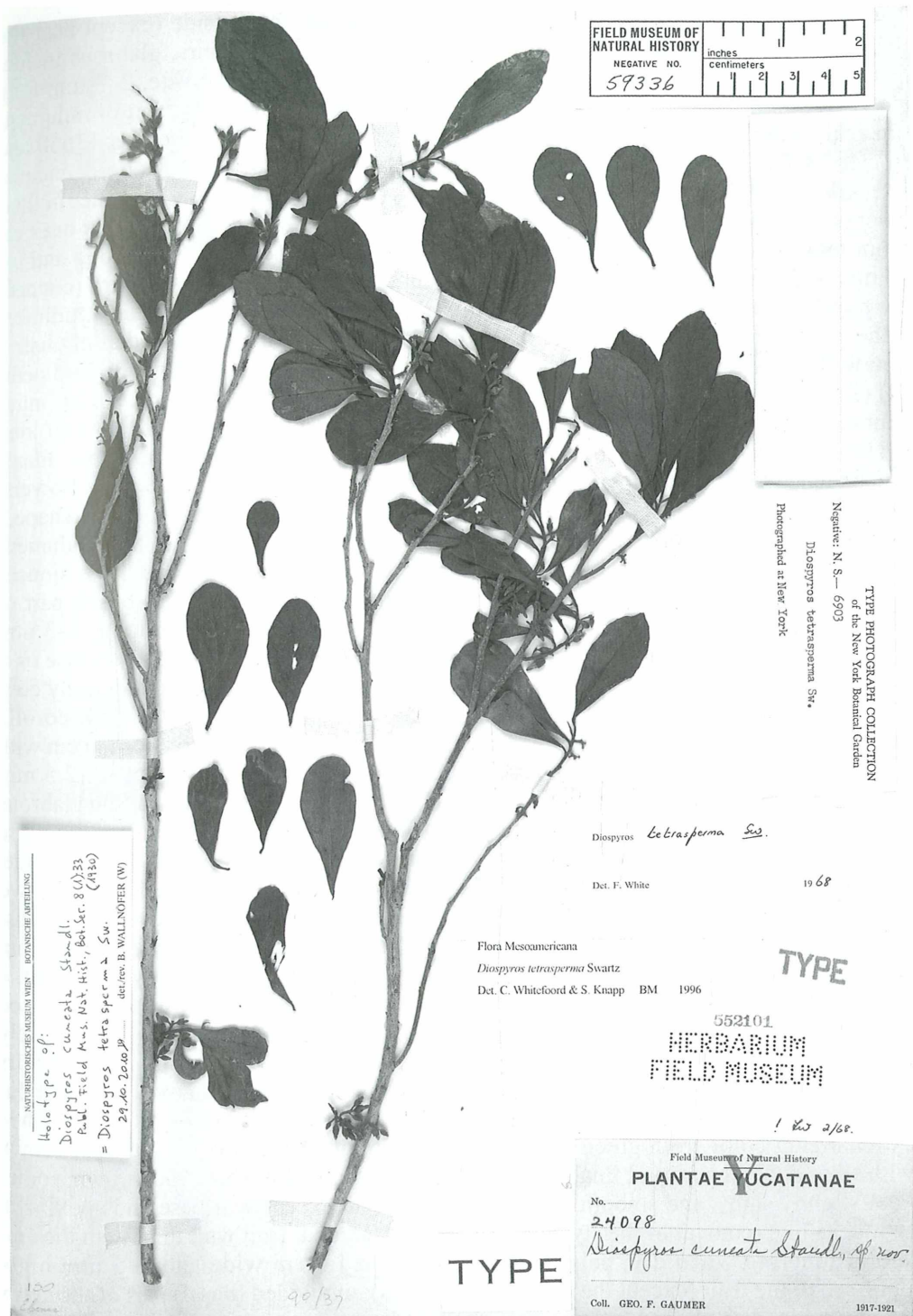


Fig. 1: Isolectotype of *Diospyros tetrasperma* Sw. [LE], (insert: the writing on the verso).

Treelet or tree up to 17 m tall (already flowering when 1.2 m tall), dbh up to 25.4 cm, evergreen; trunk usually slender (ADAMS 1972); wood hard, close grained, dark brown (Schipp 1281); old heartwood jet-black and sapwood pinkish-brown (ADAMS 1972); bark smooth (Nee 32384); twig apices, very young leaves and scales of the axillary buds densely covered with appressed, straight, light or rarely ferruginous hairs; young twigs subterete (flattened below leaf insertions), medium densely covered with the above mentioned hairs and at least partially with minute, patent, whitish-translucent, stiff hairs; older twigs gray, with longitudinal lenticels, \pm glabrescent, later on with the epidermis peeling off in stripes; bark of old twigs \pm smooth, later on with shallow fissures; **leaves** alternate, with brochidodrome venation; petioles (2–) 3–4 (–5) mm long, ca. 1 mm thick, scattered hairy, flat or slightly canaliculate adaxially; leaf scars \pm raised; leaf lamina obovate (margins often \pm straight distally, the apical third of the leaves thus appearing \pm triangular in outline), rarely lanceolate, tapering into the petiole, (1–) 4–7 (–12) cm long, 1–3.6 (–4.5) cm wide, (1.4–) 1.6–3 (–4) times longer than wide, chartaceous, dark green when alive, dull or slightly shiny, glabrous, and often minutely granulate (especially when young) adaxially, dull and light, with scattered, appressed hairs (glabrescent when old) abaxially; leaf apex slightly tapering and obtuse, less frequently \pm broadly rounded, rarely retuse or emarginate; base of the lamina narrowly cuneate; leaf margin entire, revolute especially near base when dry; flachnectaria (0–) 1–6 (–16) on abaxial leaf surfaces (fig. 4b), present only in the proximal third of the leaves, round, elliptic or elongated, usually dark when dry, less frequently light; midvein on the adaxial side slightly prominent, often \pm flat in the proximal third, rarely slightly sunken, medium densely covered with minute, patent, whitish-translucent, stiff hairs especially proximally, on the abaxial side markedly prominent, and with some scattered, appressed hairs; secondary veins 5–7 per side, glabrous, raised or sometimes \pm flat on both sides; intersecondary veins similar to the former but shorter; tertiary and quaternary veins slightly raised or flat on both sides, only hardly visible on old leaves; **inflorescences**: cymes of both sexes solitary in the axil of \pm fully developed leaves (the lowermost sometimes in the axil of bracts or small leaves) arranged along the proximal part of new shoots; male cymes 2–3 (–5)-flowered (fig. 4c - d); female cymes 1 (–4)-flowered (fig. 4f); **flowers** (3–) 4 (–5)-merous; male flowers 6.5–8 mm long (pedicels excluded; fig. 4e), sweet-scented (Adams 9774); stalk (peduncle and pedicel) (2–) 4–8 (–10) mm long and 0.5–0.8 mm thick (pedicels of the lateral flowers 1–3 mm long), covered with the same sort of indumentum as the young twigs; bracts ca. 1.5 mm long and ca. 0.8 mm wide, densely hairy abaxially, glabrous adaxially; bracteoles 1–1.5 (–2) mm long and 0.8–1.5 mm wide, \pm ovate, distally rounded or truncate, densely hairy abaxially, glabrous adaxially, caducous; calyx narrowly cup-shaped, (2.5–) 3–4 mm long and 2.5–3 mm wide, undivided in the proximal 2–2.5 mm, on the outside \pm medium densely covered with \pm appressed, straight, light or rarely ferruginous hairs of different length, on the inside glabrous; calyx lobes usually broadly triangular or sometimes \pm semicircular, 0.5–1.5 (–2.5) mm long, (1.5–) 2–2.8 mm wide, \pm appressed to the corolla tube, obtuse or slightly acute distally, adaxially usually glabrous or rarely with some scattered, appressed hairs near apex (compare female flowers); sinuses between the lobes \pm acute or rounded; corolla greenish-pink or greenish-brown when young, later on white, whitish, creamy-white, pink to lavender, or dull pink when alive (apparently "dull buff" or coffee-brown when deflorate), black when dry; tube 5–6 mm long, narrowly barrel-



FIELD MUSEUM OF NATURAL HISTORY
 NEGATIVE NO. 59336
 inches 1 2 3 4 5
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TYPE PHOTOGRAPH COLLECTION
 of the New York Botanical Garden
 Diospyros tetrasperma Sw.
 Negative: N. S. - 6903
 Photographed at New York

Diospyros tetrasperma Sw.
 Det. F. White 1968

Flora Mesoamericana
Diospyros tetrasperma Swartz
 Det. C. Whitford & S. Knapp BM 1996

TYPE
 552101
 HERBARIUM
 FIELD MUSEUM

12/20/68.

Field Museum of Natural History
 PLANTAE YUCATANAE
 No. 24098
Diospyros cuneata Standl. sp. nov.
 Coll. GEO. F. GAUMER 1917-1921

TYPE

Fig. 2: Holotype of *Diospyros cuneata* STANDL. [F].

shaped, widest in the middle and there 2.5 mm wide, on the outside (except near the glabrous base) densely covered with appressed, straight, light hairs, glabrous inside; aperture of the corolla narrowed, ca. 0.5 mm wide; corolla lobes ovate, 2–3 mm long and 1.5–1.8 mm wide, acute distally, abaxially covered with the same sort of indumentum as the tube, glabrous adaxially; stamens 8 (only few flowers of Webster 13660 and Proctor 23701 dissected), adnate to the corolla tube ca. 0.5 mm above its base, unequal in length, usually united in four, episepalous pairs (both filaments fused together in their lower parts); outer stamens 4 mm long (with filaments 1.5 mm long), the inner ones ca. 3 mm long (with filaments ca. 0.8 mm long), glabrous; anthers 2–2.5 mm long and ca. 0.8 mm wide, widest in the proximal third, abruptly tapering in the distal third (connective pointed distally), opening by lateral slits already in the older flower buds; rudiment of the ovary irregularly shaped, ca. 0.5 mm high and 1 mm in diameter, densely hairy; **female flowers** 7–8 mm long (pedicels excluded; fig. 4f - g); stalk (peduncle and pedicel) (1.5–) 2–4 (–8) mm long and 0.8–1 mm thick, covered with the same sort of indumentum as the young twigs; bracts as on the male flowers; bracteoles 1–1.5 mm long and 0.8–1.3 mm wide, ± ovate, obtuse distally, densely hairy abaxially, glabrous adaxially, attached on the distal half of the stalks or sometimes at the base of the flowers, caducous, leaving u- or v-like scars; calyx 3–5 mm long, 2.5–4 mm wide, cup-shaped, undivided in the proximal 2.5–3.5 mm, covered on the outside with the same indumentum as the male flowers, lacking longitudinal ridges running down from the sinuses abaxially; sinuses between the lobes inconspicuous, ± acute; undivided (basal) part of the calyx on its inside (adaxial side) glabrous; calyx lobes 0.8–2 mm long, 2–3 mm wide, distally broadly truncate (and sometimes with a small mucro), rarely retuse or ± semicircular, with scattered, appressed hairs abaxially, medium densely to densely covered with straight, appressed, long hairs adaxially (compare male flowers); corolla greenish or whitish when young, later on yellowish-brown ("tawny") or flesh to tan with silvery pubescence when alive, black when dry; tube 3.5–5 mm long and 2–2.5 mm wide, widest near the middle, narrowed distally, on the outside (except near the glabrous base) covered with the same indumentum as the male flowers, glabrous inside; aperture of the corolla ca. 1 mm wide; corolla lobes ovate, 2–2.5 mm long and 1–1.5 mm wide, acute distally, densely hairy abaxially, glabrous adaxially; staminodia 5–7 (only two flowers of Lundell & Lundell 7943 dissected), 2–3 mm long, slightly widened in the distal third, adnate to the corolla tube 0.5–0.8 mm above its base, glabrous; ovary 2 mm long and 1.5 mm in diameter, ± densely covered with appressed or slightly spreading, ± straight, light hairs, 4-locular (but 3- and 5-merous flowers could not be analyzed regarding this); stylodia 2, ca. 2 mm long, fused together ± up to the middle, densely hairy (sometimes glabrous in the distal half); stigmata deeply bilobed; stalk of the **fruits** (2–) 3–5 mm long and 1.5 mm thick, longitudinally ± furrowed, still covered with indumentum; fruits (fig. 4h - i) oblate-globose to ± globose, up to 1.5 cm in diameter when dry, changing color from green to yellowish-green, greenish-orange, greenish-brown (with silky pubescence) and finally to brownish or dark brown when ripe, brown, sometimes slightly shiny, and smooth when dry, glabrescent except near base and apex, with the mucro-like remnant of the style distally, up to 4-seeded; fruit wall thin, with the epidermis adhering when dry; calyx as a whole up to 1.3 cm wide and 3–5 mm high, appressed to the fruit (except the distal part of lobes); undivided (basal) part of the calyx 4–5 mm wide, dish-shaped (often ± funnel-shaped near the insertion of the stalk), with-

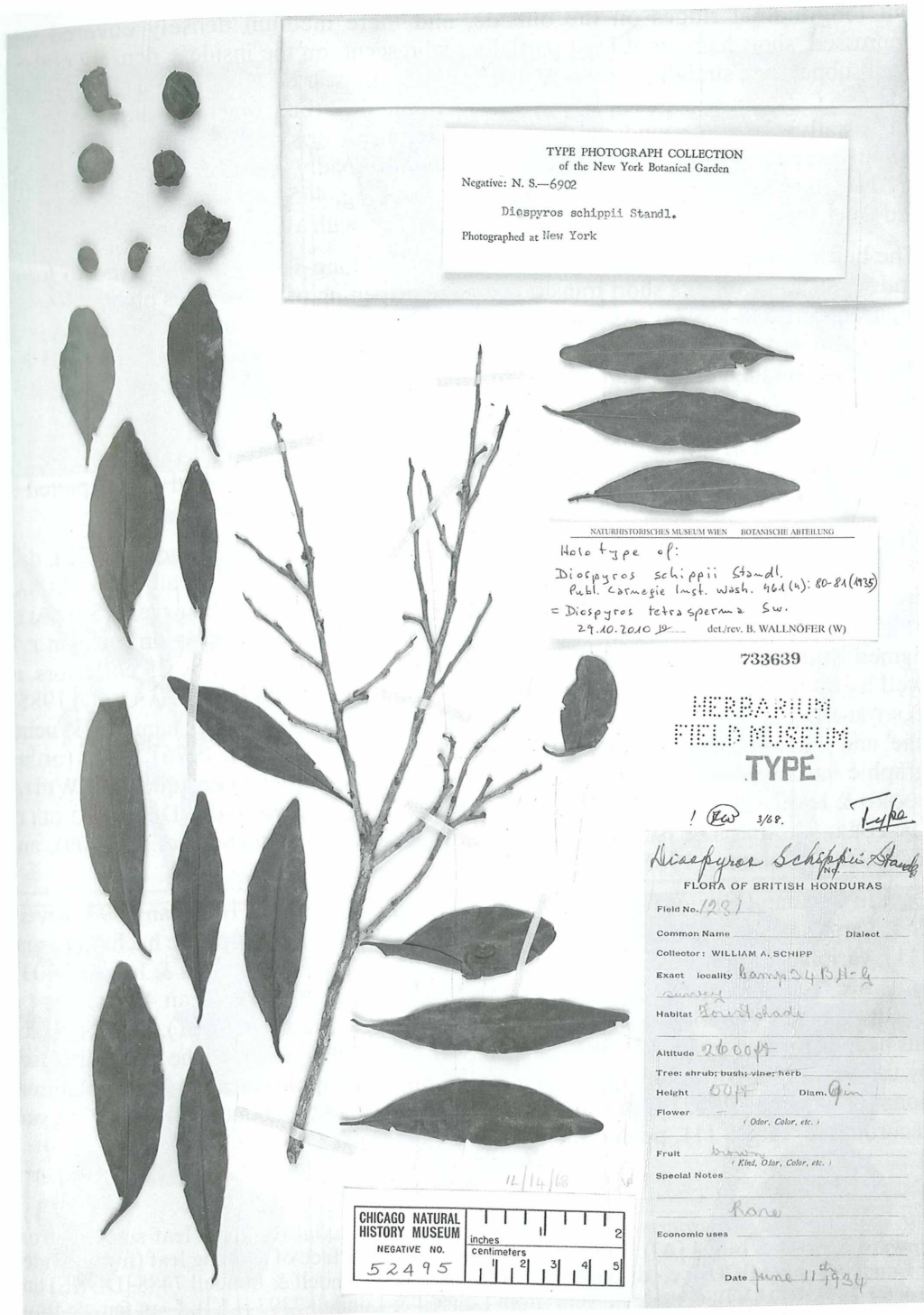


Fig. 3: Holotype of *Diospyros schippii* STANDL. [F].

out longitudinal ridges on the outside, and there medium densely covered with appressed, short hairs or at least partially glabrescent, on the inside \pm densely covered with subparallel, straight, appressed hairs, \pm glabrous near base; lobes 2–3 (–4) mm long and 5–6 (–7) mm wide, usually \pm appressed to the fruit (but sometimes slightly spreading distally), broadly rounded, less frequently truncate or sometimes emarginate, rarely slightly tipped distally; sinuses between the lobes broadly rounded and inconspicuous; seeds \pm like the segments of an orange, 6–9 mm long, 4–5 mm wide, 3.5–4 mm thick, red when fresh (Eggers 3506), dark brown when dry, with a finely texture on the surface.

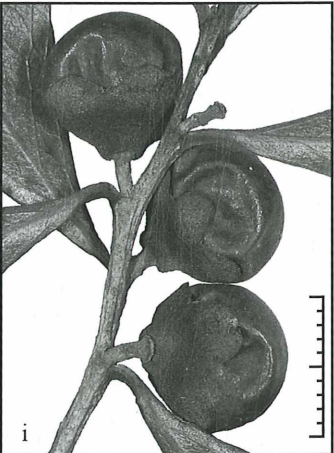
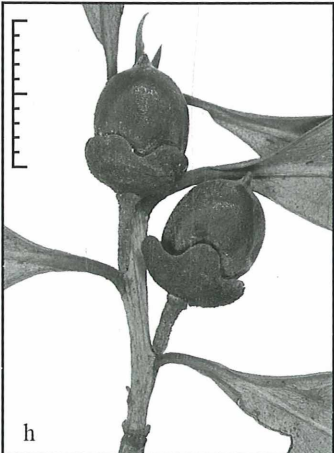
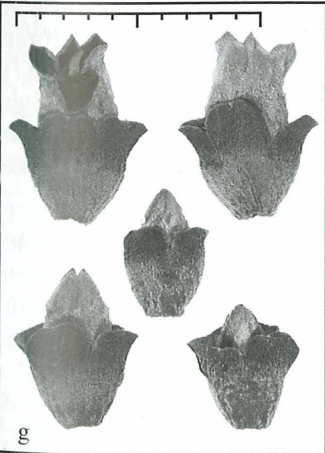
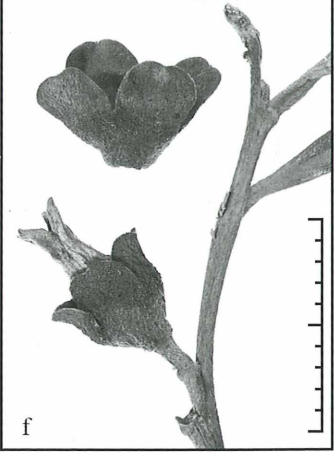
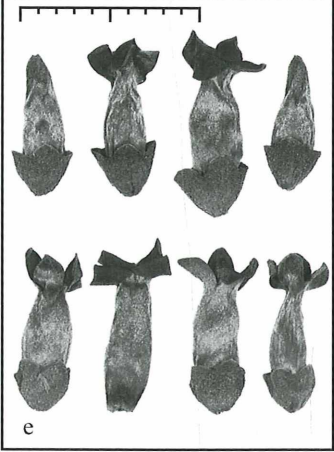
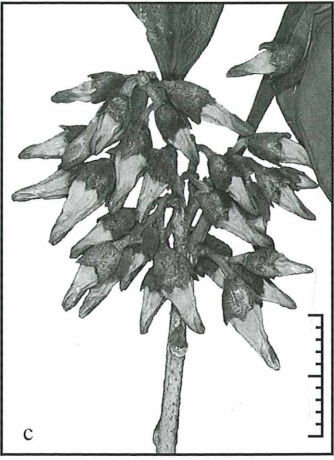
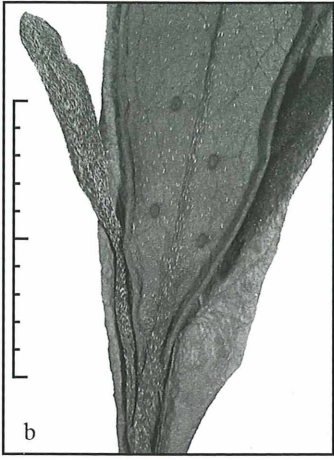
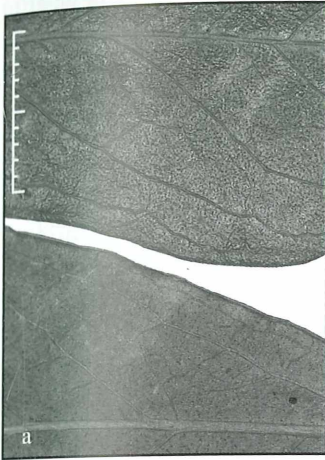
The borderline between single growth-segments of long-shoots is often hard to locate and seems to be more a short transitional zone. Ripening of fruits takes obviously more than one growth-season. As can be seen from several herbarium specimens (and as noted also by Flores s.n.), flowers and fruits may occur together (e.g., on Campos 2845); the former on the youngest and the latter on the next older, already leafless segments of the twigs.

Figures: flowering twig, male flower (JACQUIN 1798: tab. 312); pollen (DE LOS ANGELES SÁNCHEZ-DZIB et al. 2009). The fruit (especially its calyx) described and depicted in GAERTNER (1807: 138 + tab. 208) does clearly not belong to *D. tetrasperma*!

Vernacular names: In Jamaica it is called: clamberry (ADAMS 1972, Harris 11733), date plum (LUNAN 1814, Yuncker 17657), pigeon wood (Yuncker 17657), wattle-tree (LUNAN 1814) or white wattle (KELLY & DICKINSON 1985), and in Cuba: ebano real (SAUVALLE 1873, SAUGET & LIOGIER 1957) or ebano carbonero (SAUVALLE 1873). In Yucatán it is named: siliil (orthographic variants: siliil, sibil, silib [?], zilil, tzilil) by 23 collectors, as well as by STANDLEY & WILLIAMS (1966), BARRERA et al. (1976), SOSA et al. (1985), PORTER-BOLLAND (2001), and WHITEFOORD & KNAPP (2009). Further names are: uchul che' and x-uchul che' (SOSA et al. 1985), uchiche' (BARRERA et al. 1976), pisi'it (orthographic variant: pisiit) (SOSA et al. 1985, Vargas 111), tzililche (Enriquez 60, WHITEFOORD & KNAPP 2009), "dzipche = zilil" (Enriquez 17), tzilil/sac-tzilil (DE LOS ANGELES LA TORRE-CUADROS & ISLEBE 2003), sak siliil (ZAMORA CRESCENCIO et al. 2009), and xkakilche (SANABRIA 1986).

Use: In Yucatán (Mexico) it is used as timber (Ucan 4608 and 4710, Chan 2897, Rivera 261, Vargas & Sima 471), for besoms (Rivera 261), "instrumentos-pie de hacha" (Vargas 111), various "handmade crafts" (DE LOS ANGELES LA TORRE-CUADROS & ISLEBE 2003), or as fire wood (SANABRIA 1986, ZAMORA CRESCENCIO et al. 2009, Ucan 4608). It is (as *D. cuneata*) an important melliferous species (PORTER-BOLLAND 2001), and its pollen has been described by DE LOS ANGELES SÁNCHEZ-DZIB et al. (2009). The leaves are used by the Mayas for curing dermatological problems like pimples, scabies, and inflammations (ANKLI et al. 2002). The fruits are edible (LUNAN 1814, BARRERA et al. 1976), and according to Vargas 111, people suck them.

Fig. 4: *Diospyros tetrasperma*: **a**: adaxial (on top) and abaxial (bottom) leaf surface (from Howard & Proctor 14004 [A]); **b**: flachnectaria on abaxial surface of a young leaf (from Lundell & Lundell 7393 [MICH]); **c** - **d**: male inflorescences (from Lundell & Lundell 7488 [DUKE] and Proctor 23701 [DAV]); **e**: male flowers (from Lundell & Lundell 7393 [LL]); **f** - **g**: female flowers (from Howard & Proctor 14518 [A] and Howard & Proctor 14004 [NY]); **h** - **i**: fruits (from Contreras 8812 [RSA] and Adams 10210 [M]); scale = 1 cm.



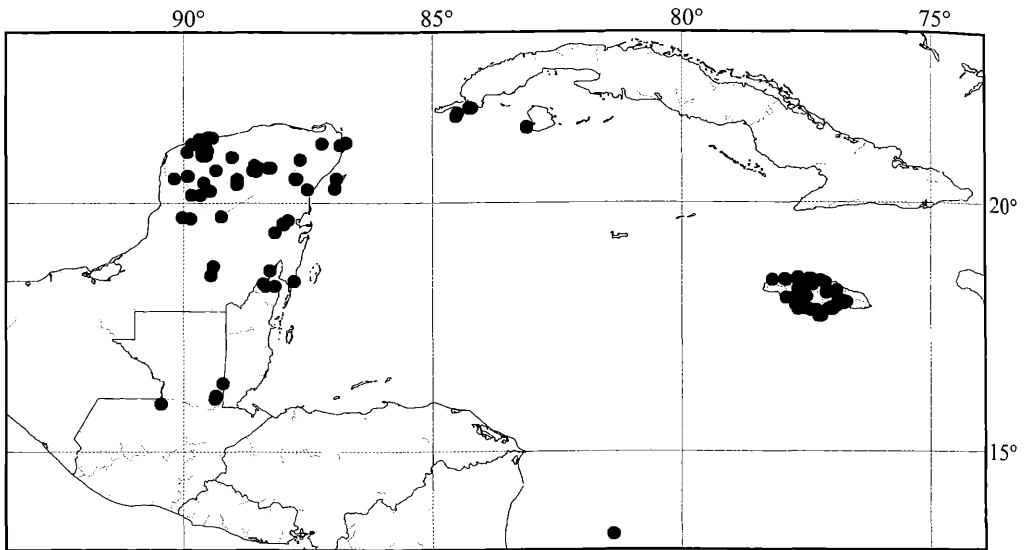


Fig. 5: Distribution of *Diospyros tetrasperma* (●).

Distribution, habitat, and ecology: This species is known from the Yucatán peninsula (Campeche, Yucatán and Quintana Roo in Mexico, Alta Verapaz and Petén in Guatemala, as well as Belize), from the westernmost part of Cuba (Península de Guana-hacabibes in the state of Pinar del Río, as well as from the Isla de la Juventud), from most areas of Jamaica, and from the Isla de Providencia (Colombia, San Andrés y Providencia [E of Nicaragua!], compare also RUIZ et al. 2005), (fig. 5). – It grows from sea level up to an elevation of ca. 800 meters. According to numerous herbarium-labels, it was collected in dry, usually low (less frequently high) forests, in thickets and scrubs on limestone. It occurs also frequently on coastal dunes and in dry coastal woodland on limestone, dry hill-sides, rocky slopes, hill-tops, as well as in secondary growth. It has rarely been found in dry coastal thorn forests, thorn scrubs and cactus scrub. In Guatemala it has been reported from a vegetation type called zapotal (climax forest dominated by *Manilkara zapota*) on top of hills (for further details see LUNDELL 1937). In Yucatán (Mexico) it has been collected in low to medium tall (less frequently high) primary or secondary ("acahuales"), evergreen, semi-evergreen or deciduous forests on limestone or on calcareous, often thin and rocky, red, brown or black soils (suelo Tzekel or K'ankab).

D. tetrasperma has usually relatively high population densities. According to ZAMORA CRESCENCIO et al. (2008), it was (as *D. cuneata*) one of the most common and frequent species in their area of study in Yucatán and reached the third highest number of individuals per hectare! Compare also DE LOS ANGELES LA TORRE-CUADROS & ISLEBE (2003) and WHITE & HOOD (2004). In western Cuba, BORHIDI (1996) reports it as a member of the association "Mastichodendro-Dipholietum salicifoliae BORHIDI & MUÑIZ" (table 124) and "Metopio brownei-Swietenietum mahagoni BORHIDI & MUÑIZ" (table 126). ASPREY & ROBBINS (1953), LOVELESS & ASPREY (1957) and ASPREY & LOVELESS (1958) indicated that this species is in Jamaica a frequent component in ever-

green bushlands and in dry evergreen thickets (scrub forests) especially on limestone hills as well as in littoral evergreen bushlands. MCLAREN et al. (2005) reported it to be also an important member of the vegetation and "the dominant species in the sapling and seedling flora" of a dry limestone forest in Jamaica.

Phenology: *D. tetrasperma* has been found flowering from April to October and in December. According to PORTER-BOLLAND (2001), however the flowering period ranges from May to June. LUNAN (1814) reported it to be flowering in October and November and states: "Some [individuals] have both male and hermaphrodite flowers, and others contain them separate" It has been collected in fruit from January to March and from Mai to December.

Specimens examined: **Cuba**, **Pinar del Río**, Guanahacabibes, Maria la Gorda, I. Reserv., [ca. 21°49' N, 84°29' W], in silv. litt. calc., (fr), 14 Jan. 1970, **A. Borhidi, O. Muniz & S. Vazquez s.n.** [BP n.s. (dig. photo)]; – pr. Cabo Corrientes, [21°45' N, 84°31' W], in silv. siccis calc. cars., (fr), 15 Jan. 1970, **A. Borhidi, O. Muniz & S. Vazquez s.n.** [BP n.s. (dig. photo)]; – Peninsula de Guanahacabibes, west of Yayales, [21°55' N, 84°15' W], in coastal thickets, (fl male), 19 Mar. 1924, **E.L. Ekman 18793** [F, G-DEL, K, NY, S, US]; – at Yayales S of Remates, [21°55' N, 84°12' W], on coral limestone, (fl male), 11 Jun. 1920, **E.L. Ekman 11190** [S]; – Pinar del Río, Zapele [Fapele? not located], jurisdicción Guanes, "fr dull reddish bitterish", (fr), 21 Dec. 1856/1857, **C. Wright 348** [BM, BREM n.s. (dig. photo), G, GH, GOET, K, NY, S, UC, W], "a bush 10–15' t" – Isle de la Juventud, Isle of Pines, Caleta Grande, [21°31' N, 83°6' W], (fr), 24 Jan. 1924, **C.D. Mell s.n.** [NY]; – Milian, N of Caleta Grande, Isle of Pines, [21°32' N, 83°6' W], (yfr), 18 Aug. 1919, **J.T. Roig & Cremata 1843** [NY]; – without locality, (flbuds female, fr), s.d., **C. Wright s.n.** [BM].

Mexico, **Campeche**, Municipio Halachó, carretera Sihó-Tankuché, 2 km desde Sihó, ca. 1 m, ca. 20°29'40" N, 90°10'50" W [?], selva baja caducifolia con árboles como *Bursera simaruba*, *Metopium brownei*, *Gynopodium floribundum*, varias especies de *Croton*, Cactaceae como *Nopalea* spp. y epifitas como *Tillandsia brachycaulos*, (fr), 2 Feb. 2001, **G. Carnevali, J. Solomon, F. May-Pat & L. Abdala 6321** [CICY, MO n.s.], "árbol 3–6 m; frutos verdes; localmente común"; – Mun. Hopelchen, Xeochkax [= Xcochkax], 30 m, [ca. 20°10' N, 89°50' W], forêt basse caducifoliee, (yfr), 9 Mar. 1987, **I.N. Labat INL 1927** [P]; – 11 miles E of San Antonio Cayal, 100 ft., 19°43' N, 90°03' W, scrub woods on limestone, (yfr), 27 Jul. 1972, **G.L. Webster & S. Lynch 17514** [DAV], "shrub ca. 2 m tall"; – Mun. Hopelchen, 5 km S of center of Hopelchen along road to Dzibalchen, 100 m, 19°42' N, 89°51' W, low forest on limestone hills, (fr), 30 Dec. 1985, **M. Nee 32384** [FHO, NY], "slender tree 7 m, with several stems, to 6 cm diam.; bark smooth; fruit green"; – Mpio. Calakmul, loc. a 4 km al S de la Nueva Vida, camino a Xpujil, en el puente Papagayo, 297 m, 18°44'15" N, 89°23'32" W [?], selva mediana subperennifolia, (yfr), 2 Aug. 1997, **E. Martínez S., D. Alvarez & S. Ramírez 27979** [COL n.s. (dig. photo)], "arbusto 4 m"; – Mun. Hopelchen, carretera de Xpujil al aserradero Zoh-Laguna, 300 m, 18°33' N, 89°26' W (changed in CICY: ca. 18°33'00" N, 89°26'20" W), selva alta perennifolia, primaria; suelo negro delgado rocoso, calizo; asociada *Swietenia macrophylla*, *Bursera simaruba*, *Bucida buceras*, *Brosimum alicastrum*; calido húmedo, (fr), 13 Nov. 1980, **J.I. Calzada, E. Ucan, C. Chan, I. Espejel & M. Burgos 6840** [CICY], "árbol 3 m; abund. regular; frutos verde" – Yucatán, Progreso, sand dunes near the port, [21°17' N, 89°40' W], on low sand dunes, (fl male), Jul. 1938, **C.L. Lundell & A.A. Lundell 7393** [LL, MICH], "shrub 4 ft."; – Progreso, W of port, [21°17' N, 89°40' W], abundant in scrub, on low sand dunes, (fl female), 17 Jul. 1938, **C.L. Lundell & A.A. Lundell 7943** [A, LL, MICH, US], "shrub 6 ft. high"; – Progreso, [21°17' N, 89°40' W], sandy plain behind beach, (fl male), 11–15 Aug. 1932, **W.C. Steere 3098** [F (fragm. ex MICH), MICH]; – Mun. Chicxulub [added in CICY: Mun. Progreso], Uaymitun, 0–2 m, (added in CICY: 21°18'20" N, 89°30'40" W), matorral duna costera; suelo arenoso con acumulaciones de materia orgánica; assoc.: *Coccothrinax*, *Bravaisia*, *Metopium*, *Cirtopodium*; palmar de *Coccothrinax*, (fr), 12 Oct. 1985, **N. Ayora 80** [CICY]; – 1 km al O de Uaymitun [= Uaymitun], sobre la carretera Puerto Progreso-Dzilam de Bravo, [21°19' N, 89°30' W], duna costera, (fl female), 25 Jul. 1987, **E. Cabrera & H. de Cabrera 13802** [NY], "arbusto 4 m; fruto verde"; – a 13 km al E de Chicxulub Puerto sobre la carretera Progreso - Telchac Puerto, [21°19' N, 89°28' W], duna costera con abundante *Metopium* y *Opuntia*, (yfr), 30 Jun. 1985, **E. Cabrera & H. de Cabrera 8814** [MICH, MO], "arbusto 6 m; fruto verde"; – Mun. Telchac, Marlín en el área general de San Benito, 16 km E de Chicxulub,

21°19'15" N, 89°27'00" W, duna costera con especies como *Plumiera obtusa*, *Capparis flexuosa*, hierbas como *Mammillaria gaumeri* y *Tillandsia dasylyriifolia*, (yfr), 27 Nov. 1996, **G. Carnevali, I.M. Ramírez, R. Orellana, F. May & M. Gómez 4339** [CICY n.s., MO], "arbusto 2–5 m, localmente común; frutos verdes"; – (Mun. Dzemul), a 15 km al E [W!] de Telchac Puerto, sobre la carretera Progreso-Dzilam de Bravo, (added in CICY: 21°19'25" N, 89°24'30" W), duna costera, (fr), 24 Dec. 1985, **E. Cabrera & H. de Cabrera 10251** [CICY], "arbusto 3 m"; – (Mun.) Progreso, km 10–16 carr. Sierra Papacal a Chuburná Puerto, (added in CICY: 21°11'00" N, 89°49'00" W), selva baja inundable, primaria, (flbuds female, fr), 28 Apr. 1992, **G. Campos & P. Simá 2845** [CICY 2×], "árbol 4 m; abund. escaso; flor verdosa; fruto anaranjado"; – 10 km S de Puerto Progreso, carretera a Mérida, [21°12' N, 89°39' W], selva baja, (yfr), 25 Jul. 1987, **E. Cabrera & H. de Cabrera 13852** [MO], "arbusto 2 m; fruto verde"; – a 7 km S de la desviación a Yucalpeten, sobre la carretera Mérida - Pto. Progreso, [21°12' N, 89°39' W], selva baja con *Thouinia*, (fr), 25 Sep. 1985, **E. Cabrera & H. de Cabrera 9361** [RSA], "arbusto 6 m; fruto verde"; – San Ignacio, [21°09' N, 89°39' W], (fl female), 15 Sep. 1955, **F. Miranda 8227** [US]; – Mun. Chicxulub Pueblo, alrededores de unos vestigios arqueológicos mayas ya saqueados dentro de los terrenos de la Hda. Lactún, ca. 3 km al NW de la Hda., 4 m, 21°10'10" N, 89°33'10" W, vegetación de selva baja caducifolia; creciendo en suelo Tzekel o negro pedregoso, (yfr), 27 Jun. 1997, **F. Tun & J.A. González-Iturbe 314** [CICY], "árbol de 6 m; escasa abundancia; frutos de color café oscuros"; – same locality and data: **317** [CICY n.s., MO]; – Mun. Mérida, Xcanatún dentro del pueblo, 21°04'34" N, 89°37'41" W, (fr), 24 Sep. 1997, **P. Simá 2204** [CICY n.s., MO], "árbol ca. 6 m, abundancia regular; fruto verde inmaduro"; – Thien-Welden Dzibilchaltun [= Dzibilchaltún] Survey Site V, [21°5' N, 89°36' W], (fr), 10 Jan. 1979, **A. Bradburn & S. Darwin 1217** [BM, F, MO], "tree 6–7 m"; – 23 km al NE de Mérida, en los alrededores de la zona arqueológica de Dzibilchactum [= Dzibilchaltún], [21°5' N, 89°36' W], selva baja con *Gymnopodium*, (fr), 22 Dec. 1985, **E. Cabrera & H. de Cabrera 10181** [MO]; – 17 km N de Mérida, en los alrededores de la zona arqueológica de Dzibilchaltun [= Dzibilchaltún], [21°5' N, 89°36' W], selva baja caducifolia con *Crataeva tapia*, (fl male), 22 May 1985, **E. Cabrera & H. de Cabrera 8587** [MO], "arbusto 6 m; flor blanca"; – Mun. Mérida, alrededores de la zona arqueológica de Dzibilchaltún, 17 km NE de Mérida, (added in CICY: 21°05'25" N, 89°35'52" W), selva baja con abundante *Parmentiera* y *Crataeva*, (fr), 26 Sep. 1985, **E. Cabrera & H. de Cabrera 9409** [CICY, MO], "arbusto 8 m; fruto verde"; – Mun. Conkal, a 2,5 km al E de Conkal hacia Motul, (added in CICY: 21°04'40" N, 89°30'00" W), veg. arvense, secundaria; suelo: Tzekel de origen calizo, negro, poco desarrollado; asoci.: Malvaceae, Leguminosae, *Gymnopodium*, (fr), 7 Dec. 1984, **R. Rivera 261** [CICY], "árbol 2 m, muy abundante"; – Hunucma, 0.2 km W of road to Sisal, 3 km NW of Hunucma, 7 m, 21°02'47" N, 89°55'15" W, tropical and subtropical drought deciduous forest; dense deciduous forest, very few cacti, (fr), 14 Feb. 1996, **M.J. Way MJW137** [K]; – Mérida, [20°58' N, 89°37' W], (st), 29 Aug. 1865, **A. Schott 926** [F]; – Mérida, [20°58' N, 89°37' W], (fr), 20 Jan. 1947, **N. Souza 14569** [NY]; – Mun. Kanasin, 6.5–10 km E of Mérida (at beltway) on Hwy 180 to Cancun, ca. 25 m, ca. 20°58' N, 89°32' W, highly disturbed thorn scrub with *Mimosa* and *Lysiloma*; flat country with stony limestone soil, (fr), 10 Mar. 1990, **A.C. Sanders & J.C. Lyman 9598** [RSA, TEX], "ca. 3 m shrub; fruits green"; – Izamal, [20°56' N, 89°1' W], brushlands, (fl male, fl female), 1895, **G.F. Gaumer 700** [A, BM, F, MO, UPS, US], "shrub 10 ft.; flowers yellow"; – same locality: (flbuds male), s.d., **G.F. Gaumer 700bis** [F]; – Cuzamá, 4 km al S de Chunkaná, en un cenote, 20°40'05" N, 89°20'00" W, selva baja subcaducifolia; suelo tzekel con abundante materia orgánica; asociada a chacá; en la orilla del cenote, (fr), 19 Nov. 1995, **A. Dorantes & B. Ek 35** [CICY n.s. (photocopy seen)], "árbol 4 m; abund. escaso; fruto verde"; – Mun. Opichén ("Hopelchen"), en las grutas de Calcehtok, 100 m, 20°32' N, 89°54' W (changed in CICY: 20°33' N, 89°54'45" W), selva baja caducifolia, primaria; suelo negro delgado con rocas calizas, muy calido y seco; asociada *Gyrocarpus americanus*, *Guazuma ulmifolia*, (yfr), 10 Nov. 1980, **J.I. Calzada, E. Ucan, C. Chan et al. 6701** [CICY], "arbusto 3 m; abund. regular; fruto verde"; – vicinity of grotto above Calcehtok near Opichen, [20°33' N, 89°55' W], near path over limestone ledges, (fr), 5 Jan. 1982, **S.P. Darwin, E. Sundell & D. White 2156** [BM, F, MO, XAL n.s.], "shrub ca. 6 ft. tall"; – Mun. Opichén, carretera Calcehtok - Grutas de Oxkintok, unos 1–2 km al S del pueblo de Calcehtok, 30–100 m, ca. 20°33'00" N, 89°54'27" W, selva baja caducifolia sobre suelo superficial muy pedregoso y con abundantes afloramientos de rocas calcáreas; vegetación dominada por árboles y arbustos de las Fabaceae, Rhamnaceae, Malvaceae, *Plumeria* sp. y *Diospyros* sp.; lugares abiertos con abundantes rosetas de *Hechtia schottii*; trepadoras abundantes; epifitas muy escasas, (fr), 6 Nov. 1996, **G. Carnevali, I.M. Ramírez, F. May Pat & C. Espadas 4316** [CICY n.s., UPRRP n.s., W], "arbusto o árbol hasta 5 m; localmente común; frutos verdes"; – (Mun. Sacalum), 15 km E de Muna, (added in CICY: 20°24'55" N, 89°35'20" W), selva baja, caducifolia, secundaria, (fr), 2 Nov. 1990, **S. Escalante 941** [CICY], "fruto verde-amarillento"; – Grutas de Lol-tún, Oxkutz-

cab. (added in CICY: 20°15'15" N, 89°27'30" W), selva baja, caducifolia, secundaria; terreno serril; suelo litoso, pedregoso, (fr), 9 Nov. 1991, **J.C. Trejo, R. Durán & J. Granados 108** [CICY], "árbol"; – Mun. Santa Elena, Ruinas de Sayil, 100 m, 20°14' N, 89°47' W (changed in CICY: 20°10'37" N, 89°39'07" W), selva mediana, secundaria; suelo: Kankab (rojo); calido seco, (fr), 20 Dec. 1980, **C. Chan, M. Narvaez & A. Puch 80** [CICY], "árbol 4 m; abund. escaso; fruto verde"; – en los alrededores de la zona arqueológica de Sayil, 35 km SW de Oxkutzcab, [20°10' N, 89°39' W], Acahual maduro de selva mediana, (fr), 19 Jul. 1985, **E. Cabrera & H. de Cabrera 9036** [MO], "árbol 6 m; fruto verde"; – Mun. Yaxcaba, Tixcaltuyub, 24 m, 20°27' N, 88°54' W (changed in CICY: 20°29'34" N, 88°54'56" W), selva baja (cuadro no. 2), secundaria; suelo rojo, (fl male), 1 Jul. 1981, **C. Vargas & P. Sima 471** [CICY], "árbol 4 m; abund. regular; flor blanca"; – Mun. Yaxcaba, Ejido de Tixcaltuyub, 22 m, 22°27' N, 88°54' W [20°29' N, 88°55' W], selva baja caducifolia, primaria; suelo pedregoso de color rojo; seco y calido, (fl male), 30 Jun. 1981, **J.S. Flores, M. Burgos & C. Vargas 8770** [F], "árbol 2 m; abund. regular; flor blanca; fruto redondo, verde"; – Mun. Yaxcaba, Tixcaltuyub, Sta. Maria, 24 m, 20°27' N, 88°54' W (changed in CICY: 20°23'28" N, 88°55'28" W), selva baja, secundaria; suelo pedregoso; asociada sisilche, sak yaab, tsakan, (yfr), 25 Jul. 1980, **C. Vargas 111** [CICY], "árbol 5 m, abundante; flor blanca; fruto verde y negro"; – 8 km S of Dzitas, [20°46' N, 88°34' W], (fl male), 4 Jun. 1957, **O.G. Enriquez 17** [US], "árbol"; – Tinum, camino para las Grutas de Balancanché, 8 m, 20°35' N, 89°57' W (changed in CICY: 20°39'30" N, 88°32'05" W) [20°43' N, 88°29' W], selva baja caducifolia; suelo: K'ankab (rojo), (yfr), 7 Sep. 1983, **C. Chan 2897** [CICY], "árbol 5 m; abund. escaso; fruto verde"; – Chichen Itzá, [20°40' N, 88°36' W], (fl male), 26 Jun. 1929, **J. Bequaert 97** [A, F], "high bush; flowers white"; – Chichén Itzá, alrededor del Cenote Xholak, Tinum, 25 m, 20°40'15" N, 88°36'24" W, selva mediana; suelo moreno pedregoso, (defl female, fr), 25 May 1985, **C. Chan 5096** [CICY], "árbol 7 m; abund. escaso; fruto verde"; – Chichen Itzá, [20°40' N, 88°36' W], in old thicket covering the ruins, (fl male), Jun. - Jul. 1938, **C.L. Lundell & A.A. Lundell 7599** [A, DS, F, LL, MICH, MO n.s., US], "tree 12 ft. high, 2 in. diam."; – Chichen Itzá, [20°40' N, 88°36' W], (fl male), 19 Sep. 1955, **F. Miranda 8239** [US]; – [Municipio Tinum], Jardín Botánico de Balancanché, (added in CICY: 20°39'30" N, 88°32'05" W), selva mediana subcaducifolia, (fr), 9 Dec. 1989, **S. Escalante 727** [CICY], "árbol de 4 m; fruto pardo claro, cafe chocolate al madurar" (seeds cultivated at Royal Botanic Gardens Kew, Living Collection 1991–1597, DnaBank no. 14254); – Pixoy, al km 1,5 rumbo a Uayma, Valladolid, 22 m, 20°42' N, 88°14' W (changed in CICY: 20°43' N, 88°17'20" W), selva baja caducifolia, secundaria; suelo rojo, pedregoso, (st), 26 Sep. 1986, **E. Ucan 4710** [CICY], "árbol 5 m; abund. escaso"; – near Yokdzonoot [= Yokdzonot], [20°43' N, 88°14' W], in advanced deciduous forest, (fl male), May - Aug. 1938, **C.L. Lundell & A.A. Lundell 7488** [A, BRIT, DS, DUKE, F, MICH, MO, NY, TEX, US, WIS n.s.], "tree 25 ft. high, 4 in. diam.; corolla creamy-white"; – Xcan, [20°53' N, 87°39' W], (fr), 29 Sep. 1955, **O.G. Enriquez 60** [US]; – ca. 15 km S of Becanchen, [ca. 19°46' N, 89°14' W], (fr), 11 Jan. 1983, **S.P. Darwin 2534** [BM, NY], "tree ca. 15 ft. tall; fruits yellow-green"; – without further data, (fr), Feb. 1934, **R.S. Flores s.n.** [F], "arbusto 5–6 m; se diferencia de los otros de su especie en que sus frutos no salen de las axilas sino a lo largo de los ramos"; – (fl male), 1917–1921, **G.F. Gaumer 23955** [A, BM, F, G, GH, MA n.s. (dig. photo), MO, NY, UPS, US]; – (fbuds male), 1917–1921, **G.F. Gaumer 24211** [BR, CAS, DS, E, F, FHO, G, K, UC, US, W]; – (st), 1937, **M. Steggerda 23B** [F]. – **Quintana Roo**, Mpio. de Lazaro Cardenas, Yalahau Region, El Eden Reserve, ca. 30 miles NW of Cancun, old Cenote Azul trail, ca. 800 m SE of station, 21°12.51' N, 87°11.64' W, 6 m, Acahual with *Metopium browniei*, *Lonchocarpus rugosus*, *Lonchocarpus xuul*, *Mimosa bahamensis*, *Croton* spp., *Coccoloba* spp., *Rehdera trinervis*, *Gymnopodium floribundum* and *Bursera simaruba*; limestone substrate; soil very thin & rocky, (yfr), 3 Aug. 1999, **G.P. Schultz & H. Violi 1291** [MO n.s., UCR n.s., WIS], "Hat 8 m; common tree in upper stratum; fruits green; leaves unscented"; – a 1 km E de Cd. Cancún, [21°10' N, 86°50' W], veg. secundaria, (fr), 12 Sep. 1982, **E. Cabrera & H. de Cabrera 3484** [MEXU n.s., W], "arbusto 3–4 m"; – 500 m al N de Playa Lancheros, sobre el camino al Restaurant Hacienda Gomar, Isla Mujeres, [21°13' N, 86°43' W], ecotono entre manglar - selva baja - duna costera, (yfr), 6 Jan. 1988, **E. Cabrera & H. de Cabrera 15444** [MO], "arbusto 3 m; fruto verde"; – Coba, along Dzitnup trail near Dzitnup, [ca. 20°30' N, 87°45' W], in second growth, (yfr), Jun. - Jul. 1938, **C.L. Lundell & A.A. Lundell 7851** [LL, MICH, US], "small tree"; – en las ruinas de Cobá, [20°30' N, 87°44' W], veg. secundaria, (fr), 19 Oct. 1980, **O. Téllez & E. Cabrera 3787** [BM, CAS], "árbol de 4 m"; – Coba, E of ruins, [20°30' N, 87°43' W], advanced deciduous forest; abundant in this locality, (fl male), Jun. - Jul. 1938, **C.L. Lundell & A.A. Lundell 7637** [A n.s., DS, F, LL, MEXU n.s., MICH, MO], "tree 45 ft., 10 in. diam."; – [Mun. Solidaridad], zona arqueológica de Cobá, Solidaridad, 15 m, (added in CICY: 20°29'30" N, 87°43'55" W), selva alta perennifolia, primaria; suelo moreno pedregoso; asociada a los ramos (Moraceas), (fr), 12 Aug. 1981, **E. Ucan 1413** [CICY], "árbol 17 m; [abundancia] regular; fruto verde";

– [Mun. Solidaridad], zona arqueológica de Cobá, Solidaridad, 30 m al S de Nohoch muul, 30 m, 20°29'30" N, 87°43'55" W, vegetación secundaria; selva alta subperennifolia; suelo negro pedregoso; asociada a *Lonchocarpus rugosus*, (fl male), 20 Jun. 1986, **E. Ucan 4608** [CICY], "árbol 5 m; flor en botones café; abundante"; – Mun. Cozumel, en el grupo Maya, 20°30' N, 87°42' W [ca. 20°30' N, 86°55' W], selva mediana subperennifolia, secundaria; suelo negro muy pedregoso, (fr), 14 Feb. 1981, **M. Narvaez, M.J. Ordóñez & R. Rangel 277** [CICY], "arbusto 3 m; abund. regular; fruto verde redondo"; – 2 km al N de la desviación al faro de la Punta Celarain, Isla de Cozumel, [20°18' N, 86°57' W], selva baja con *Amyris, Esenbeckia*, (fr), 15 Mar. 1986, **E. Cabrera, O. Téllez & H. de Cabrera 11133** [MICH, MO], "arbusto 4 m; fruto verde"; – (Mun. Solidaridad), Cobá, Balcheil, campamento chiclero, km 9 Tulum-Cobá, 20 m, (added in CICY: 20°16'45" N, 87°29'50" W), selva mediana subperennifolia, secundaria; substrato calizo, (fr), 10 Mar. 1974, **E. Barrera et al. 172** [CICY], "árbol"; – Mun. Felipe Carrillo Puerto, Reserva de la Biosfera Sianka'an, km 29 de Vigía a Carrillo, [19°40' N, 87°53' W], selva mediana subperennifolia, primaria, (fr), 8 Sep. 1983, **R. Durán & I. Olmsted 479** [CICY], "árbol 8 m; abund. regular; frutos café, 1 cm de diam."; – 6 km NE de Felipe Carrillo Puerto, en el ejido Carrillo Puerto, [19°36' N, 87°59' W], al lado del camino, (fr), 2 Nov. 1984, **F. Chiang, I. Olmsted, R. Durán, T. Wendt, M.A. Marmolejo, D. Neill, D. Frame & R. Sanders 952** [MO], "arbolito 5 m"; – Mun. of Carrillo Puerto, 7 km E of Carrillo Puerto, 19°50' N, 87°40' W [19°35' N, 87°58' W], secondary semi-evergreen forest, (fr), 2 Nov. 1984, **D. Neill, T. Wendt, I. Olmsted, F. Chiang & R. Duran 5765** [HUA n.s. (dig. photo), MO], "tree 7 m"; – Felipe Carrillo Puerto, San Andrés, 4 km hacia Noh Cah, 19°25'00" N, 88°09'00" W, selva mediana subperennifolia, primaria, dentro del monte; suelo moreno no muy pedregoso; asociada a wayan cox, (fr), 4 Nov. 1985, **F. Balám 611** [CICY], "árbol 7 m, abundante; fruto verde"; – a 4 km S de Laguna Guerrero, [18°39' N, 88°15' W], veg. secundaria, (fr), 28 Sep. 1982, **E. Cabrera & H. de Cabrera 3645** [MO], "arbusto 3 m"; – 22 km al N de Chetumal, sobre el camino a Laguna Guerrero, [18°39' N, 88°15' W], veg. secundaria, (yfr), 19 Aug. 1983, **E. Cabrera & H. de Cabrera 5374** [MO], "arbusto 3 m; fruto verde"; – Mun. Othón P. Blanco, camino blanco de X-calak, rumbo a Majahual, 18°26' N, 87°56' W (changed in CICY: ca. 18°30'00" N, 87°45'40" W) [18°26' N, 87°46' W], dunas costeras de mar, primaria; suelo arenoso, calido húmedo, (fr), 23 Nov. 1980, **E. Ucan, J.I. Calzada & C. Chan 637** [CICY], "árbol 5 m; abund. regular; fruto verde" – without any further data, (fr), s.d. (1968), **F. White 9080** [FHO 2×], "only young plants seen up to 9'; leaves gland-dotted; fruits found impaled on Cactus thorns"

Guatemala, Petén, La Cumbre, on Pusila road, 5 km, [16°8' N, 89°20' W], on hilltop in zapotal, (yfr), 18 Aug. 1976, **C.L. Lundell & E. Contreras 20214** [CAS, LL, MO, NY, RSA], "shrub 20 ft., 3. in. diam.; fruit green"; – on La Cumbre, ca. 500 m E of km 143 of the Petén - Izabal road, [16°5' N, 89°21' W], in zapotal, on tophill, (fr), 18 Mar. 1975, **C.L. Lundell & E. Contreras 19120** [LL], "shrub 15 ft., 3 in. diam.; fruit greenish"; – La Cumbre, E of km 142/143 of the road, [16°5' N, 89°21' W], in zapotal on top of hill, (flbuds female), 11 May 1975, **C.L. Lundell & E. Contreras 19282** [DUKE, LL, US], "shrub 12 ft. high, 2 in. diam.; flowers whitish"; – La Cumbre, west of km 142/143, 500 m from the road, [16°5' N, 89°21' W], in zapotal on top of hill, (fr), 9 Sep. 1975, **C.L. Lundell & E. Contreras 19818** [LL, NY 2×, MO, S], "small tree 30 ft. high, 4 in. diam.; fruit green"; – La Cumbre, W of km 142/143, from the road, 500 m, [16°5' N, 89°21' W], in zapotal on top of hill, (yfr), 9 Sep. 1975, **C.L. Lundell & E. Contreras 19825** [CAS 2×, LL, MO, NY], "tree 30 ft., 4 in. diam.; young fruit green"; – La Cumbre, km 142 of Cadenas road, on Las Cañas road, 700 m, [16°4' N, 89°21' W], in low forest on top of hill, (yfr), 31 Jul. 1969, **E. Contreras 8812** [DUKE, LL, MO, RSA, S], "tree 45 ft. high, 8 in. diam."; – La Cumbre, on Las Cañas, on km 142 E of the Petén - Izabal road, [16°4' N, 89°21' W], in zapotal, tophill, (fr), 6 Mar. 1975, **C.L. Lundell & E. Contreras 19059** [LL], "shrub 15 ft., 2 in. diam.; fruit green" – **Alta Verapaz**, Rubelsanto, Balasterra, ca. 2–3 km S.E.E., [300 m], [15°58' N, 90°27' W], in high forest, zapotal on top of hill, (yfr), 23 Jul. 1975, **C.L. Lundell & E. Contreras 19553** [DUKE, LL, MO, S], "tree 45 ft. high, 5 in. diam.; young fruit green"

Belize, Corozal, Cerros Maya Ruins, Lowry's Bight, [18°20' N, 88°20' W], coastal area; in secondary growth, (st), 10 Apr. 1983, **C.J. Crane 536** [LL], "small tree; occasional"; – same locality: coastal area; growing along the shoreline, (flbuds male), 6 May 1983, **C.J. Crane 689** [LL], "tree ca. 20 ft."; – ca. 4 km SE of Sarteneja, 1 m, ca. 18°21' N, 88°7' W [18°20' N, 88°9' W], *Spartina-Distichilis* salt marsh with tree-shrub islands, adjoining lagoon, tree island, (fr), 18 Mar. 1987, **G. Davide & A.E. Brant 32665** [BM, FHO, MO], "treelet 4 m; fruit yellowish green"; – without data [LUNDELL (1937): Corozal District: Corozal], [ca. 18°23' N, 88°23' W], (fr), 1931–1932, **P.H. Gentle 292** [F n.s. (dig. photo), MICH 2× (photo at LL), US], "7 ft. high, 1 in. diam."

Jamaica, **Hanover**, Lucea, [18°27' N, 78°10' W], (fr), s.d. and 14 Jan. 1891, **A.S. Hitchcock s.n.** [F, MO].

St. James, Montego Bay, [18°28' N, 77°55' W], rocky hills, (fr), 22 Mar. 1908, **N.L. Britton & A. Hollick 2353** [FHO (fragm.), NY], "tree 7 m"; – Irwin, near Montego Bay, [18°27' N, 77°53' W], (fr), Feb. 1924, **C. Norman 106** [BM, MO, NY], "slender tree about 10 ft; leaves very dark green" – **Trelawny**, Beach hammock at Good Hope Beach, near Falmouth, [ca. 18°30' N, 77°39' W], (yfr), 23 Jul. 1952, **E. West & L. Arnold 851** [DUKE, GH]; – Sherwood Content, 700–900 ft., [18°23' N, 77°38' W], wooded limestone hilltop, (fr), 23 Oct. 1955, **G.R. Proctor 11059** [BM, NY, US], "shrub; fresh fruits green"; – 0.6–1 mile north of Spring Garden, 1750–2000 ft., [18°18' N, 77°34' W], wooded rocky limestone hilltop, (fr), 1 Nov. 1975, **G.R. Proctor 35419** [MO], "arborescent shrub; fruits green"; – Island View Hill, Wilson Valley district, 1.5 miles N of Warsop, 2000–2200 ft., [18°17' N, 77°35' W], wooded limestone hillside, (fr), 30 Dec. 1962, **G.R. Proctor 23082** [BM, LL], "small slender tree; fruit olive-green"; – Ramgoat Cave district, Cockpit Country, ca. 1500 ft., [ca. 18°16' N, 77°39' W], dry rocky hillside, (fl female), 4 Jul. 1955, **R.A. Howard & G.R. Proctor 14387** [A, BM], "tree of 15', dbh 3"; flowers flesh to tan with silvery pubescence" – **St. Ann**, along the Queen's highway about 2 miles E of Rio Bueno, 15 ft., [18°28' N, 77°26' W], dry coastal limestone woodland, (fr), 15 Jan. 1956, **W.T. Stearn 139** [A n.s., BM], "small tree"; – 1 mile W of Discovery Bay, 100', [18°28' N, 77°24' W], low woodland on coral limestone, (fr), 28 Dec. 1961, **C.D. Adams 10210** [M], "small tree"; – Discovery Bay, [18°28' N, 77°24' W], light woodland scrub on eroded limestone, (yfr), 12 Sep. 1976, **C. Whitefoord 1447** [A n.s., BM, F], "small tree, about 8 ft.; open habit; ripe fruits brownish"; – vicinity of Green Grotto Caves, 2.5 miles west of Runaway Bay, 5–50 ft., [18°28' N, 77°23' W], rocky limestone woodland, (yfr), 3 Nov. 1976, **G.R. Proctor 36497** [BM, MO], "slender tree 6 m tall"; – Knutsford estate, 3 miles due S of Browns Town, ca. 2000 ft., [18°21' N, 77°22' W], wooded limestone hill, (fr), 28 Oct. 1962, **G.R. Proctor 22834** [BM, DAV, MICH, U], "slender tree 10 m tall"; – 1 mile S of St. Ann's Bay, [18°26' N, 77°12' W], roadbank, (fl female, yfr), 21 Sep. 1954, **R.A. Howard & G.R. Proctor 14004** [A, NY, US 2×], "tree of 15'; fruit green; flowers tawny with silvery pubescence"; – along the bucket line from the Reynolds mine area to the sea, [ca. 18°24' N, 77°7' W], dry coastal thorn forest, (fr), 20–31 Dec. 1953, **R.A. Howard & G.R. Proctor 13581** [A], "tree 20' tall, 8" dbh; fruit green" – **Portland**, Blue Mts., Robertsfield [not located], (fl male), 15 Jun. 1916, **J.R. Perkins 1209** [GH 2×, K, WU], "8–10 ft.; flowers white". – **St. Elizabeth**, Mt. Charles estate, 1 mile due SSW of Giddy Hall P.O., 750–1000 ft., [18°6' N, 77°53' W], dry wooded limestone hillside, (fr), 21 Dec. 1975, **G.R. Proctor 35541** [U], "slender tree 10 m tall"; – Slipe district, 2–4 miles SW of Lacovia, [18°5' N, 77°45' W], (fl female, yfr), 7 Jul. 1955, **R.A. Howard & G.R. Proctor 14518** [A], "shrub 8'; leaves dull both sides, lighter below; young fruit brownish with silky pubescence"; – Malvern to mountain side, 1200 ft., [17°58' N, 77°42' W], (fl female), 12 Sep. 1907, **W. Harris 9922** [BM, F, K, NY, US], "shrub or small trees 10 ft. high"; – Retirement district near Malvern, [17°58' N, 77°42' W], dry hillside, (fr), 12 Sep. 1954, **R.A. Howard & G.R. Proctor 13726** [A], "shrub to 12'; fruit green"; – Kaiser mine area south of Gutters, [17°59' N, 77°36' W], forested limestone outcrop near pit #101, (fr), 20 Jan. 1956, **R.A. Howard, G.R. Proctor & W.T. Stearn 14721** [U], "tree of 30', 6" dbh; fruit green"; – Lovers Leap, 1500 ft, [17°52' N, 77°39' W], scrub woodland on limestone escarpment, (fl male, fr), 6 Jun. 1976, **R.F. Thorne & G.R. Proctor 48019** [GH, MICH, MO, NA n.s., NY, RSA], "large shrubs; flowers on male; female in fruit"; – 1 mile NE of Bull Savannah School, [17°53' N, 77°36' W], limestone outcrop on dry hillside, (fl male, fl female), 16 Sep. 1954, **R.A. Howard & G.R. Proctor 13917** [A, FHO (fragm.), NY, US], "shrub of 7'; flowers slightly lavender in color, silky pubescent"; – St. Elizabeth, 1.5 miles N of Shooters Hill [not located], (fl buds male), 25 Sep. 1954, **R.A. Howard & G.R. Proctor 14102** [A], "tree 20', 3" dbh; flowers greenish-brown; fruit green"; – Stanmore Hill (added in pencil: St. Elizabeth) [not located], 2200 feet, (fl female, yfr, st), 11 Sep. 1907, **W. Harris 9775** [BM, F, K, NY, US], "a slender erect tree 25 feet high". – **Manchester**, Mile Gully to Wear, 1600', [18°8' N, 77°33' W], at margin of woodland, (fl male), 12 May 1963, **C.D. Adams 12505** [M], "tree 15'; flowers dull pink"; – vicinity of Walderston, 2400–2700 ft., [18°7' N, 77°29' W], wooded limestone hillside, (fr), 9 Jan. 1963, **G.R. Proctor 23106** [BM], "small tree"; – Mandeville and vicinity, Spur Tree Hill, 600 m, [18°1' N, 77°34' W], (fr), 2 Sep. 1907, **N.L. Britton 1059** [NY], "tree 6 m"; – on rocky western slope of Don Figuerero Mountains, near Spur Tree, ca. 2500 ft., [18°1' N, 77°34' W], (yfr), 23 Jan. 1958, **T.G. Yuncker 18053** [BM, F, G, MICH, NY, S], "tree about 12 ft. high"; – Lititz Savanna, 300–900 ft, [17°55' N, 77°34' W], on limestone, (fl male), 7 Jul. 1914, **W. Harris 11733** [BM, F, K, MO, NY, US], "small tree up to 15 ft."; – Round Hill to Gut River, 10 ft., [17°52' N, 77°26' W], in dry mangrove; salina margin on limestone rocks, (fr), 21 Feb. 1960, **C.D. Adams 6316** [BM], "shrub 6–8 ft." – **Clarendon**, top of N side of Round Hill near Milk River, [17°51' N, 77°23' W], in mature dry limestone forest, (fr), 8 Nov. 1980, **V. Kapos 1597** [FHO],

MO, W], "slender tree to 10 m with green-orange fruits"; – west end of Round Hill, 25–250 ft., [17°51' N, 77°23' W], dry coastal woodland, (fr), 21 Nov. 1954, **G.R. Proctor 9472** [BM, NY 2×, US], "shrub 3 m tall; fruits greenish"; – Kemps Hill, 300–500 ft., [17°51' N, 77°17' W], dry woodland over limestone, (fl male), 23 Jun. 1963, **G.R. Proctor 23701** [BM, DAV, MICH, RSA, U], "slender tree 8 m tall; flowers dull buff (male)"; – 1 mile ESE of Jackson Bay Gun Club, sea-level, [17°44' N, 77°14' W], dry woodland near the sea, (yfr), 14 Dec. 1974, **G.R. Proctor 34468** [BM], "arborescent shrub; fruits green"; – Portland ridge, along road before fishing village on uphill slope near three large Manchines, [17°44' N, 77°11' W], (fr), 27 Feb. 1967, **R.W. Read 1819** [GH, US], "fruit dull brick red" – **St. Catherine**, Alumina Jamaica mud-lake dam area, 1 mile N of Mt. Rosser, 1400–1600 ft., [18°12' N, 77°5' W], (fr), 16 Jan. 1958, **R.A. Howard & G.R. Proctor 15063** [A, BM], "common shrub 12 ft. tall; fruit olive-green"; – Great Goat Island, Old Harbour Bay, [17°52' N, 77°3' W], rocky woods, (fr), 4 Mar. 1908, **N.L. Britton & A. Hollick 1864** [NY], "tree 7 m"; – Great Goat Island, 50–100 ft., [17°52' N, 77°3' W], dry rocky woodland, (fr), 27 Feb. 1958, **G.R. Proctor 17442** [BM], "shrub 2 m tall"; – vicinity of Spanish Town, Healths [? barely legible] Five Hills near Salt Island, [ca. 17°54' N, 76°59' W], limestone rocks, (yfr), 30 Aug. - 3 Sep. 1908, **N.L. Britton 3063** [NY], "tree 6 m"; – Hellshire Hills, 50', [17°54' N, 76°57' W], in thicket, (fr), 8 Mar. 1962, **C.D. Adams 10780** [MO], "small tree"; – Hellshire Hills, central portion, due S of Spanish Town on Windsor road, then 3 hrs hike from end of one side road, ca. 140–200 m, 17°52' N, 76°58' W, dry forest and thorn scrub on dogtooth limestone, hilly terrain, discontinuous canopy; emergents to 15 m, (fr), 12 Jan. 1993, **D.C. Daly 7601** [MO, NY], "shrub or low-branching tree 2.5 m; fruits immature, globose"; – Port Henderson, 150 ft., [17°57' N, 76°53' W], (fl male), 17 Oct. 1961, **C.D. Adams 9774** [BM, DUKE], "shrub 6–8 ft.; buds pointed; corolla of male flowers pink; sweet-scented"; – upper slopes of Port Henderson Hill, 400–700 ft., [17°56' N, 76°53' W], wooded rocky limestone hillside, (fr), 2 Jan. 1972, **G.R. Proctor 32772** [BM], "shrub 2.5 m tall"; – Rodney's Lookout near Port Henderson, [17°56' N, 76°53' W], cactus scrub, (fr), 4 Jan. 1972, **R.P. Wunderlin 5066** [F 2×], "tree to 20 ft.; fruits green" – **St. Andrew**, Red Hills, on way to Cooper's Hill, 0.75 mile ESE of summit, [18°4' N, 76°51' W], on rocky slope, (fr), 1 Jan. 1956, **W.T. Stearn 58** [A, BM], "small tree, to 14 ft. high; fruits green"; – Liguanea Hills, [18°2' N, 76°45' W], (fr), 20 Feb. 1910, **A. Prior 582** [K]; – Hope, 200 m, [ca. 18°1' N, 76°45' W], (fl male), 22 Jun. 1896, **E.J.F. Campbell 6424** [F, NY]; – Mona, 1000 ft., [18°1' N, 76°45' W], (fr), 14 Mar. 1900, **W. Harris 7891** [F, NY], "bush 12 ft."; – road to Wareka [= Waireka], Long mountain, south side, 900 ft., [17°59' N, 76°45' W], (fr), 19 Nov. 1907, **W. Harris 10011** [BM 2×, F, K, NY, P, US], "small tree 18 ft. high"; – Long Mountain, west, near Kingston, 700 ft., [17°59' N, 76°45' W], (fr), 7 Feb. 1904, **W. Harris 8863** [BM, F, NY, US], "small tree 15 ft high"; – road to Wareka [= Waireka], E of Kingston, 150–250 m, [17°59' N, 76°45' W], dry rock-slopes, (yfr), 30 Jul. 1926, **W.R. Maxon 10532** [BM, GH, NY, US], "small tree 6–8 m high"; – Long Mountain, west side, by road to Wareka [= Waireka], 450 ft., [17°59' N, 76°45' W], limestone slope, (fr), 3 Jan. 1956, **W.T. Stearn 68** [A n.s., BM 2×, S], "small tree; fruit bronzed green"; – Kingston, on road to Wareka, 300–700 ft., [17°59' N, 76°45' W], scrub-covered limestone hillsides, (fl male), 5 Jul. 1965, **G.L. Webster 13660** [BM, DAV, DUKE, GH], "small tree 4 m high; flowers whitish"; – Long mountain, back of Kingston, 700–1300 ft., [17°59' N, 76°45' W], dry scrubby forest on limestone near top, (fl male), 21 Jun. 1954, **G.L. Webster & K.A. Wilson 4856** [A, BM, MICH, US], "common profusely flowering shrub; flower-buds greenish-pink"; – northern slope of Long Mountain, ca. 1000 ft., [17°59' N, 76°45' W], in thicket, (yfr), 9 Nov. 1957, **T.G. Yuncker 17322** [BM, F, MICH, NY, S], "small tree about 10 ft. high"; – forest on northern slope of Long Mountain, ca. 900 ft., [17°59' N, 76°45' W], (yfr), 5 Dec. 1957, **T.G. Yuncker 17657** [BM, F, G, MICH, MO, NY, S], "tree about 15 ft. high"; – Guava Ridge, 2000', [18°1' N, 76°41' W], (fr), 29 Jan. 1888, **H.F.A. Eggers 3694** [L, WU], "arbor 8' alt."; – St. Andrews, (fl male, fr), Oct. 1843, **W. Purdie s.n.** [K 2×]. – without further data or not located: "in montibus Jamaicae", (fl male), s.d. [Apr. - Jul. 1821], **C.L.G. Bertero s.n.** [B? (destroyed), G-DC n.s. (dig. photo), MO, TO n.s.]; – ad Flamstead [which one?], 2000', (fr), 22 Jan. 1888, **H.F.A. Eggers 3506** [BREM n.s. (dig. photo), L, US], "arbor 30'; semina rubra"; – (fl female), 13 Dec. 1895 or 1896, **W. Harris 6172** [F, NY], "bush 12 ft."; – (fl male), s.d., **J.H. Hart "1071"** [US]; – (fr), 1858, **W.T. March 1190** [K]; – (fl female), s.d., **W.T. March 1426** [GOET]; – (fl male, fr), s.d., **W.T. March 1682** [GOET]; – (fr), 1858, **W.T. March 1953** [LE]; – (fl male, fl female, fr), s.d., **W.T. March s.n.** [GH, NY]; – (fl male, yfr), s.d. or 1843, **"Hooker" [W.T. March?] s.n.** [K, P, U 2×]; – (fr), 1807, **F.R. de Tussac s.n.** [P]; – barely legible + "S. Mary" + 3/46 [= March 1846?]; – (fl male, fl female, st female), s.d., **s.coll. s.n.** [GOET, S, W].

Colombia, San Andrés y Providencia: Providencia isla [E of Nicaragua!], al noroeste del sector Smooth water, 125 m, 13°20'29" N, 81°22'7" W, (st female), 13 Jan. 2002, **J. Ruiz & M.C. Fandiño 23** [FMB n.s.

(dig. photos)]; – "Depto. San Andrés y Providencia", without further data but most probably also from the Isla de Providencia, (yfr), 23 Aug. 1977, **Freesman P#86 B** [FMB n.s. (dig. photos)].

Diospyros texana SCHEELE, *Linnaea* 22: 145–146 (June 1849); [fig. 6–9].

Brayodendron texanum (SCHEELE) SMALL, *Bull. Torrey Bot. Club* 28 (6): 356 (1901).
Protologue: "auf felsigem Boden bei Neubraunfels: Lindheimer. März bis April" (syntypes lost; for further details see WALLNÖFER 2010a).

Typus: U.S.A., Texas, gesammelt bei Braunfels, [ca. 29°42' N, 98°7' W], in schattigen Uferwäldern auf fruchtbarem, leichtem Humus, (fl male), Apr. 1846, **F.J. Lindheimer 451** [neotype: MO (designated by WALLNÖFER 2010a: fig. 10–11), isoneotypes: BM, CAN n.s., G, K 3×, NA n.s., P, US n.s., W 2×]; – for further details see WALLNÖFER (2010a).

= *Diospyros cuneifolia* HIERN, *Trans. Cambridge Philos. Soc.* 12 (1): 268–269 (1873).
Protologue: "Mexico, Pavon in Hb. Delessert!"

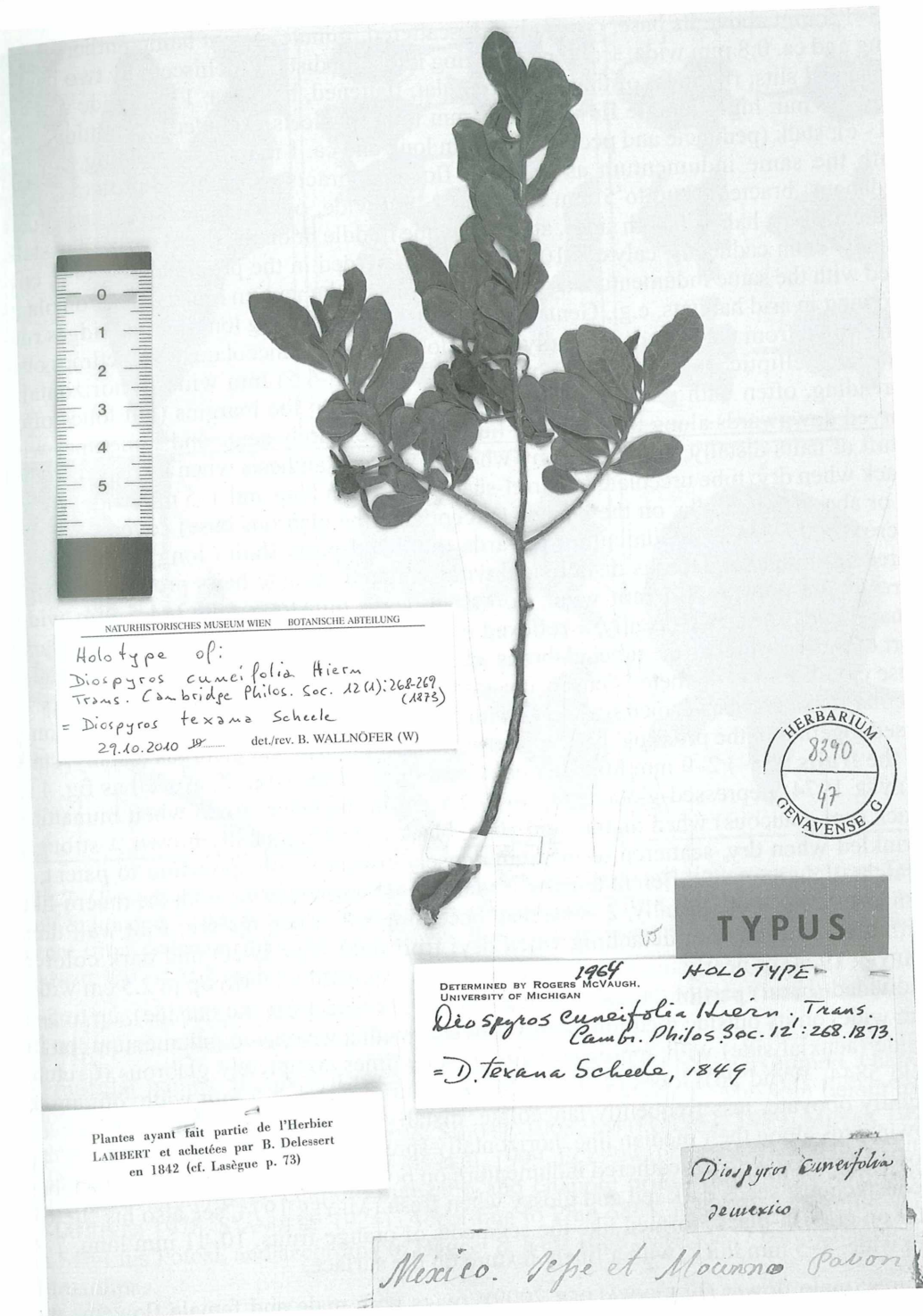
Typus: "*Diospyros cuneifolia* de Mexico" on the upper label and "Mexico. Sesse et Mocinno Pavon" on the lower label [holotype: G-DEL (fig. 6)].

Note: The persons in question are: Martín Sessé y Lacasta (1751–1808), José Mariano Mocino (1757–1820) and José Antonio Pavon (1754–1844). It is unknown to me who wrote the two old labels (both are in different handwritings). The specimen seems to have been extracted by Pavon from the herbarium in Madrid and distributed (MCVAUGH 1990: 197). Considering the distribution range of the species, it seems doubtful that the specimen really may have been collected during the Sessé and Mocino expeditions (compare MCVAUGH 1969, 1977, 1990). The sheet bears an annotation label of R. McVaugh from 1964 (with the correct identification) but no annotation from W. P. Hiern. It is quite astonishing that the latter, when preparing his monograph (HIERN 1873), did not recognize the real identity of the specimen!

Densely and intricately branched, usually many-stemmed (rarely single-stemmed), slow growing shrub or tree usually up to ca. 4 m, less frequently up to 8–10 m and only rarely up to 15 m tall, already flowering when ca. 1 m tall, tardily deciduous or occasionally subdeciduous (apparently evergreen when young); trunk usually up to 10 cm, rarely up to 60 cm in diameter; bark resembling that of *Lagerstroemia indica*, smooth, light reddish gray or reddish brown, the outer layers exfoliating in irregular, papery sheets, exposing the smooth, gray or whitish, inner bark (SPONGBERG 1977, 1979; MEYER 1974); branches and twigs often spreading in an angle of up to 90° from the main axis; scales of **buds** ± ovate, densely hairy (hairs partially collapsed and twisted); young twigs (see fig. 23 in MEYER 1974) green when alive, ± terete, ± densely covered with patent or less frequently ± spreading, straight or slightly flexuose, light hairs of different lengths and with some glands; bark of older twigs with the epidermis detaching in gray stripes and scales and then glabrous, ± smooth, often with scattered, lenticels, later on shallowly longitudinally fissured; **leaves** (fig. 7a) alternate, with brochidodrome venation (see fig. 23 and 29 in MEYER 1974); petioles 1–1.5 mm long, 0.8 mm thick, medium densely covered on both sides with patent hairs, on adaxial side flat or with a faint longitudinal groove; leaf lamina obovate, rarely lanceolate or elliptic, (0.5–) 1.5–3 (–5.3) cm long, (0.4–) 0.7–1.7 (–2.8) cm wide, (1.4–) 1.8–2.4 (–3.2) times longer than wide, char-

taceous, adaxially dark green and abaxially lighter green when alive and mature, dull on both sides when dry; adaxial side of leaves (including the venation) with scattered (well spaced), patent, straight, stiff, light, at the base often thickened hairs of different lengths, and sometimes \pm verrucose; indumentum (see fig. 30 in MEYER 1974) on abaxial leaf surfaces \pm similar (rarely \pm missing), but sometimes denser and composed of much longer \pm appressed, spreading or patent, straight or \pm flexuose hairs and sometimes also of glands; leaf apex rounded, less frequently acute or retuse; base of the lamina narrowly cuneate; leaf margin entire, revolute when alive and when dry (strongly revolute on plants from arid habitats, e.g., Gentry & Engard 23099 from Durango); flachnectaria (fig. 7a) 0–10 usually on abaxial leaf surfaces (rarely a few ones also on adaxial surfaces, e.g., of Carranza et al. 1535, Chiang et al. 7549 and on the holotype of *D. cuneifolia*), missing near base and apex of leaves, round; midvein flat or slightly raised adaxially, prominent and sometimes (especially when young) with a dense indumentum abaxially; secondary veins 5–6 per side, slightly raised adaxially, more prominent abaxially; intersecondary veins not conspicuous; tertiary and quaternary veins flat on both sides, less frequently slightly raised; **inflorescences** and flowers appearing in spring with the expanding new leaves; male cymes 1 (–2)-flowered (fig. 7b), solitary in the axil of bracts, arranged up to 4 (–11) together near the base of always new long or short shoots (the latter are often very short and leafless; see also chapter "Habit and biology"); female cymes 1-flowered (fig. 7d), solitary in the axil of bracts, arranged up to 2 (–3) together near the base of new long shoots; **flowers** (4–) 5 (–7)-merous (see fig. 2–3 in MEYER 1974), fragrant; male flowers 5–7 mm long (pedicels excluded), pendulous (fig. 7b - c); stalk (peduncle and pedicel) 3–9 (–17) mm long and ca. 0.5 mm thick, nodding, medium densely to densely covered with patent hairs of different lengths (same sort of indumentum as on young twigs); bracts ca. 1 mm long and wide, ovate or elliptic, covered with a \pm dense, appressed indumentum abaxially, glabrous adaxially, usually soon caducous; bracteoles 1 (–6) mm long and up to 0.5 (–2) mm wide, \pm linear or lanceolate (the larger ones leaf-like: Sperry T441), \pm folded, attached on the lower half of the stalk, covered with the same indumentum as the bracts, glabrous adaxially, soon caducous; calyx 3–3.5 mm long, undivided in the proximal 1–2 mm, covered on both sides with scattered, straight and stiff, patent (on proximal parts \pm appressed) hairs and adaxially also with some glands, or on some specimens at least partially \pm glabrous; calyx lobes narrowly triangular, oblong, lanceolate or rarely \pm ovate, (1.5–) 2–3 mm long and 1–1.5 mm wide, erect or reflexed distally, obtuse or rounded, less frequently acute and usually with a dense tuft of brownish hairs distally; corolla greenish white or pale yellow-green when immature, creamy white or white at anthesis when alive, black when dry; tube 4–5 mm long, \pm urceolate, widest in the distal half and there 3.5–4 mm wide, on the outside (except near the glabrous base) medium to densely covered with \pm spreading, straight or slightly flexuose, light hairs of different lengths, on the inside glabrous (but with scattered, minute hairs near the insertion of filaments); aperture of the corolla 2–3 mm wide; corolla lobes 2–2.5 (–3) mm long and ca. 2.5 mm wide, \pm semiorbicular, retuse or \pm emarginate distally, \pm reflexed or revolute, abaxially very densely covered with the same sort of indumentum as on the tube (but hairs somewhat longer), adaxially glabrous; stamens usually 16 (20 in a 6-merous flower of Correll 27018), in two rows, 4–5 mm long (the shorter in the inner row); filaments 1–2 mm long (free part 0.3 mm on the longer and 0.8 mm on the shorter stamens) and ca. 0.3 mm wide, adnate to the corolla tube

WALLNÖFER: A revision of neotropical *Diospyros* (Ebenaceae): part 4



NATURHISTORISCHES MUSEUM WIEN BOTANISCHE ABTEILUNG

Holotype of:
Diospyros cuneifolia Hiern
 Trans. Cambridge Philos. Soc. 12 (1): 268-269 (1873)
 = *Diospyros texana* Scheele
 29.10.2010 det./rev. B. WALLNÖFER (W)

HERBARIUM
 8390
 47
 GENAVENSE G

TYPUS

1964
 DETERMINED BY ROGERS McVAUGH,
 UNIVERSITY OF MICHIGAN

Diospyros cuneifolia Hiern. Trans.
 Camb. Philos. Soc. 12: 268. 1873.
 = *D. texana* Scheele, 1849

Plantes ayant fait partie de l'Herbier
 LAMBERT et achetées par B. Delessert
 en 1842 (cf. Lasègue p. 73)

Diospyros cuneifolia
 de Mexico

Mexico. Depto de Moctezuma Pavon

Fig. 6: Holotype of *Diospyros cuneifolia* HIERN [G-DEL].

0.5–1.5 mm above its base, covered with scattered, minute, patent hairs; anthers 3 mm long and ca. 0.8 mm wide, ± oblong, tapering into a tip distally, dehiscent by two lateral, subapical slits; rudiment of the ovary irregular, flattened, hairy, ca. 1 mm wide and less than 0.5 mm high; **female flowers** ca. 7 mm long (pedicels excluded), pendulous (fig. 7d - e); stalk (peduncle and pedicel) 1–5 mm long and ca. 1 mm thick, nodding, covered with the same indumentum as on male flowers; bracts as on male flowers, soon caducous; bracteoles up to 5 mm long and 1 mm wide, ovate-lanceolate or triangular, acute distally, hairy on both sides, attached in the middle or on the distal part of the stalk, usually soon caducous; calyx 7–10 mm high, undivided in the proximal 1–2 mm, covered with the same indumentum as on male flowers (indumentum much denser on plants growing in arid habitats, e.g., Gentry & Engard 23099), lacking longitudinal ridges running down from the sinuses abaxially; calyx lobes oblong, lanceolate or sometimes obovate or ± elliptic, (4–) 7–9 (–12) mm long and 3–5 (–6.5) mm wide, ± horizontally spreading, often with raised longitudinal veins, ± flat on the margins (but lobes often curved downwards along their median line), obtuse or rarely acute and sometimes with a tuft of hairs distally; corolla creamy white or white at anthesis when alive, brownish-black when dry; tube urceolate to barrel-shaped, 5–6 mm long and 4–5 mm wide, widest in or above the middle, on the outside (except near the glabrous base) covered with an increasingly denser indumentum towards the distal parts (hairs long, ± straight, ± spreading), inside glabrous distally and with scattered, minute hairs proximally; aperture of the corolla 3–4 mm wide; corolla lobes 4 mm long and 3–4.5 mm wide, emarginate or truncate distally, ± reflexed or revolute, abaxially covered with the same sort of indumentum as the tube, glabrous adaxially; staminodia missing; ovary semiglobose ca. 2.5 mm in diameter, densely covered with spreading, ± straight hairs, usually 8-locular (6-locular in a 6-merous flower with 3 stylodia); stylodia (3–) 4, 2.5–3 mm long, fused together in the proximal half, ± scattered hairy, bilobed and glabrous distally; stalk of the **fruits** (1.5–) 2–9 mm long and ca. 1 mm thick; fruits (fig. 7f, as well as fig. 4 in MEYER 1974) depressed-globose, up to 2–2.5 cm in diameter, green when immature, black (not glaucous) when mature and alive, black or less frequently brown, ± strongly wrinkled when dry, scattered to medium densely covered with spreading to patent, ± straight, light hairs of different lengths, ± glabrescent when mature, with the mucro-like remnant of the style distally, 2–8-seeded, becoming soft when mature; fruit wall thin, with the epidermis not detaching when dry; fruit pulp very sweet and dark colored (MEYER 1974) or nearly black; calyx (including the spreading lobes) up to 2.5 cm wide; undivided (basal) part of the calyx saucer-shaped (as seen from the outside), up to 5–6 mm wide, on its outside medium densely covered with a weathered indumentum, on its inside (adaxial side) with appressed hairs or sometimes completely glabrous (Crutchfield 5844, Wynd 96); lobes (4–) 12 mm long and (3.5–) 4–5.5 mm wide, oblong to slightly obovate, less frequently lanceolate, distally acute, obtuse or rounded, curved downwards along their median line, horizontally spreading or ± reflexed (MEYER 1974), loosely covered with a weathered indumentum on both sides; sinuses between the lobes inconspicuous; seeds dark red and glossy when fresh (MEYER 1974, see also his fig. 6), later on grayish-black, formed like the segments of orange-fruits, 10–11 mm long, 7–8 mm wide, 3–5 mm thick, with a finely texture on the surface.

Figures: male flower (ECKENWALDER 2009); twigs with male and female flowers, and with fruits (DIGGS et al. 1999, VINES 1960, 1984); habitat, habit, morphology and

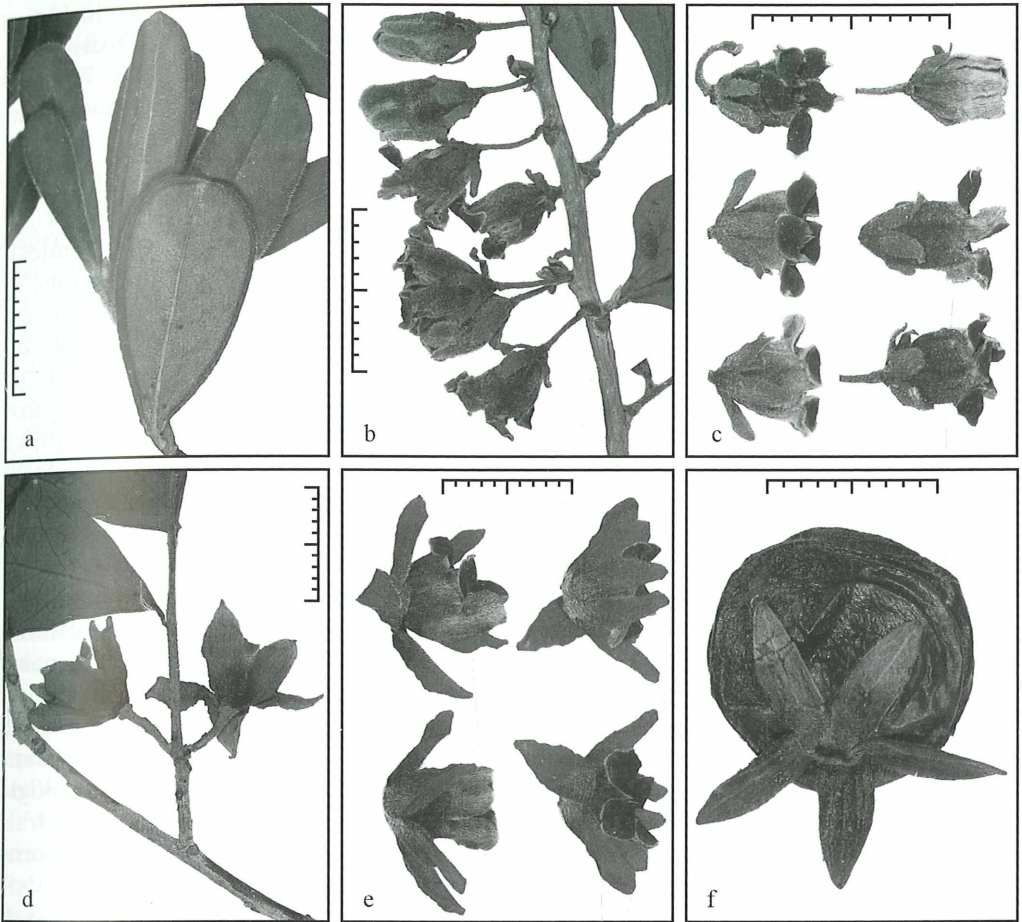


Fig. 7: *Diospyros texana*: **a**: leaves (from Puig 6866 [MEXU]); **b**: male inflorescence (from Lundell & Lundell 10300 [US]); **c**: male flowers (from Correll 27018 [MO]); **d**: female inflorescence (from Solomon 2691 [MO]); **e**: female flowers (from Mearns 1408 [US]); **f**: fruit (from Stewart 1303 [GH]); scale = 1 cm.

anatomy of all parts of the plant (MEYER 1974: 124 photos); pollen (JONES et al. 1995). Plenty of color photos are available in the Internet.

Vernacular names: In Texas it is called: Texas persimmon, black persimmon, chapote (sometimes also written: "sapote" or "zapote"), chapote prieto, Mexican persimmon (GRAY 1886, SMALL 1903, BRITTON & SHAFER 1908, LITTLE 1953, 1979, MEYER 1974, VINES 1960, 1984, CAREY 1994, DIGGS et al. 1999, ECKENWALDER 2009), and in Mexico: chapote (Tamaulipas), chapote manzano and chapote prieto (both in Nuevo León) (MARTÍNEZ 1978, STANDLEY 1924). According to Puig 6866, it is called zapotillo verde in San Luis Potosí, and according to Hageet & Kerr 1088, catelane [? barely legible!] in Tamaulipas.

Distribution: This species is known from the southern half of Texas (USA), as well as from the states Chihuahua (one locality near the eastern border), Coahuila, Durango

(only collected once in the NE), Nuevo León, San Luis Potosí (with only two localities in the central part), and from Tamaulipas in northeastern Mexico (fig. 9). Distribution maps have been published by LITTLE (1976: map 65), THOMPSON et al. (2001: 74), and for Texas only by MEYER (1974) and TURNER et al. (2003). It grows from sea level up to an elevation of ca. 2000 meters.

Habitat and ecology: According to numerous herbarium-labels, it was collected in deciduous or evergreen, open to closed, often low forests, in oak-forests (encinares), in dense undergrowth, in brush vegetation, in thickets, in scrubs (matorrales, chaparrales), in cactus- and thorn-scrub, in dry, scrubby, semidesert areas, on slopes of canyons, in dry rocky bottoms, on slopes, hilltops and ridges, in rocky prairies, in clearings, in overgrazed pastures, frequently also along creeks, streams (arroyos) and rivers. It grows on both, limestone and basaltic rocks, and was often reported to be locally common. – ECKENWALDER (2009) reports it from "open woodlands of bottomlands, prairie margins, rocky hillsides", SPONGBERG (1979) from "rich moist soils of bottomlands" as well as from "dry rocky mesas and isolated canyons", and BRITTON & SHAFER (1908) from "moist, rich soil of river valleys" In Coahuila it is a major component of the vegetation types "Piedmont Shrub" and "Tamaulipan Thorn Shrub" (MULLER 1947). According to VAN AUKEN & BUSH (1992), it is a "poor competitor in low nutrient soils" VAN AUKEN et al. (1981) pointed out that it had the second highest density in evergreen and the fourth highest density in deciduous forests in the cedar brakes region of the Edwards Plateau of central Texas. In two Texan riparian forests it was observed to reach population densities of 356 and 491 plants per hectare (WOOD & WOOD 1989). Similar densities were also reported by AUKEN et al. (1980). MEYER (1974) wrote: "Seldom, however, does Texas persimmon occur either as the most abundant or the height-dominant species, except where other woody plants have been removed previously" The ecological and climatic requirements of *D. texana* are indicated in detail by THOMPSON et al. (2001). CAREY (1994) compiled a summary from literature on habitat types, plant communities, site characteristics, and ecological requirements (e.g., from BUSH & VAN AUKEN 1984; MCLENDON 1991; VAN AUKEN et al. 1979; VORA 1990; WOOD & WOOD 1988, 1989; but also see AUKEN et al. 1980 and VILLARREAL QUINTANILLA et al. 2006, 2009). She also noted: "Texas persimmon grows on a variety of soil types including calcareous soils, clays, and fine sandy loams. The climate in southern Texas and northern Mexico is subtropical with warm winters and hot humid summers. Rainfall is bimodal, peaking in the spring and fall"

Habit and biology: According to EVERITT (1984), "it is usually 2 to 3 m tall, but may attain a height in excess of 6 m", and according to MEYER (1974) it is usually 8–12 feet [ca. 2.5–3.7 m] tall. "The largest tree recorded in Texas [near Uvalde] is 26 feet [ca. 8 m] tall with a crown diameter of 31 feet [ca. 9.5 m]", and "other plants are taller, but not as large in diameter" (MEYER 1974). According to the "Texas Big Tree Registry" (ANONYMOUS 2010), the actual national champion tree of *D. texana* grows in Uvalde County and reaches a height of 25 feet (7.6 m), a circumference of the trunk of 71 inches (1.8 m, corresponding to 57 cm in diameter) and a "crown spread" of 36 feet (ca. 11 m). SMALL (1903) [obviously quoted also by BRITTON & SHAFER (1908)] noted: "shrub or tree reaching a height of 16 m, with a trunk diameter of 6 dm", and ECKENWALDER (2009) indicated a height of up to 15 meters. SPONGBERG (1979), however, reported the height with "to 25 m tall" and DIGGS et al. (1999) with "to ca. 30 m tall", but very unfortunately

both did not mention any sources and obviously confused feet with meters! – VAN AUKEN & BUSH (1992) indicate that the diameter of trunks at ground level is usually up to 10 cm, and SMALL (1903) notes that it may reach 60 cm in diameter what seems to be in concordance with fig. 27D in MEYER (1974). – It "readily sprouts from both stems and roots in the field" (see fig. 25–27 in MEYER 1974), and is usually multi-stemmed and tends to form clonal stands called mottes (MEYER 1974, see also his fig. 15). – BRITTON & SHAFER (1908) inform us that "the wood is hard, very compact, nearly black, with a specific gravity of about 0.85", and GRAY (1886) notes: "heavy white wood" The heartwood seems to become black due to the deposition of naphthoquinones and their derivatives as a response to injury and the subsequent infection by fungi (compare WALLNÖFER 2001a). MEYER (1974, see also his fig. 33) noted: "the root is always black or dark brown", and "no dark prominent heartwood is present unless the root is injured" – With respect to the bark, he writes as follows (see also his fig. 18): "the stem exterior is slightly furrowed until 1 to 2 centimeters in diameter as a result of multiple shallow phellogen formation during radial enlargement. Ultimately, however, the stem usually becomes somewhat smooth, because the phellogens form large, continuous layers that kill extensive areas of the outer periderm and phloem, which strip off in sheets in late summer and fall"

Concerning the change of foliage NELSON et al. (2002) stated: "All species initiated leaf production in early- to mid-March and plants had a full complement of leaves by early June. *Diospyros texana*, ..., and ...were leafless for at least one month prior to this spring-time initiation of leaves and were therefore classified as deciduous. However, *D. texana* and ... were winter-deciduous (full leaf drop by February), " And it "may retain significant numbers of leaves in some winters" and it "might be more aptly classified as facultatively evergreen" In fact, some specimens with flowers (e.g., Hernandez & Martinez 1712 and Solomon 2690) show beside young also some old leaves of the previous season. *D. texana* is according to WELTZ et al. (1992) "drought-deciduous" – The leaves of individuals growing in arid habitats (e.g., Gentry & Engard 23099 from Durango, Puig 6866 from San Luis Potosi, see fig. 7a) are smaller and strongly revolute and appear therefore much narrower. Additionally, the indumentum on abaxial leaf surfaces is denser and composed of much longer hairs.

Male flowers are always arranged near the base of new long or short shoots of the current season. The latter are produced on more proximal parts of the twigs and are often very short and leafless; sometimes their axes do not exceed even the bud-scales! In that case it appears at first sight that the flowers are coming out in clusters directly from the older, naked parts of the twigs. SPONGBERG'S note (1979) is therefore, imprecise and may be somewhat misleading. – MEYER (1974) observed that "the fruit turns from entirely green to splotchy green and black before turning completely black at maturity. The fruit is firm when green, and soft when black and mature. The fleshy mesocarp turns darker orange rapidly after being exposed to the air" BRITTON & SHAFER (1908) noted: "The fruit is very astringent unless fully ripe, but stains everything [according to FACCIOLOA 1990: also the tongue] it comes in contact with by its black juice"

MEYER (1974) analyzed in detail and documented with plenty of photos the anatomy and morphology of all parts of the plant (including the wood, bark, seed, seedling, root system, and root sucker). The anatomy of the leaves was also studied and described by PAR-

MENTIER (1892). – According to JONES et al. (1995), pollen is tricolporate with psilate ornamentation. – The number of chromosomes is $2n = 30$ (BALDWIN & CULP 1942, ECKENWALDER 2009).

Phenology: *D. texana* has been collected in flower from the end of February till May (a few specimens with flower buds were also collected in January, June and August), and in fruit from April to December. According to MEYER (1974), "most flowers appear from March to May; however, a few open later in the growing season after periods of abundant rainfall" on newly grown twigs, and "the fruit ripens from August through October" ECKENWALDER (2009) indicates it to be in flower from February to March and in fruit in August.

Pollination: According to MEYER (1974), "the flowers of Texas persimmon produce nectar, and when open, are visited by numerous insects" (see table 1 with a list of 18 families belonging to seven orders), and "the most numerous insects visiting the flowers were the honey bee and the two halictid bees. However, a number of other insects were present which probably are important for pollination" (appertaining to 11 of the families). The flowers are utilized by adults of *Pepsis grossa* FABRICIUS (Hymenoptera: Pompilidae) as a source of nectar (PUNZO 2006).

Seed dispersal: by unspecified birds (VINES 1960, 1984, MEYER 1974) and by mammals, such as: ringtail (*Bassariscus astutus*) (TAYLOR 1954, TOWEILL & TEER 1977, CHAVEZ-RAMIREZ & SLACK 1993, ACKERSON & HARVESON 2006), raccoon (*Procyon lotor*) (MEYER 1974, CHAVEZ-RAMIREZ & SLACK 1993), foxes (*Vulpes fulva* and *Urocyon cinereoargenteus*) (CHAVEZ-RAMIREZ & SLACK 1993), Texas armadillo (*Dasypus novemcinctus*) (HAMILTON 1946), coyote (*Canis latrans*) (EVERITT 1984, ANDELT et al. 1987), and probably also by cattle (MEYER 1974). Compare also EVERITT & ALANIZ (1981).

Germination and development of the seedling: According to own experiments carried out with fresh seeds collected by J.R. Abbott in western Texas, germination takes 4–6 weeks after planting. After development of the taproot, the elongating, initially arched hypocotyl pulls the seed body to the soil-surface. The testa does not split except for a narrow slit and the whitish cotyledons do not emerge from the seed, apart from their proximal parts. After abscission, the bases of the cotyledons bend outwards setting the naked plumule free (fig. 8). Soon the hypocotyl straightens out to a vertical position and turns green. During the next few days the first, tiny, alternate, epicotyledonary leaves appear. However, the plumules of some seedlings cannot be set free and stay trapped in the seed coat till the seedling dies! In such cases the seed body may be exposed at the top of the erect hypocotyl until death. – According to NG (1976, 1991), this kind of germination is called the "durian type" (= crypto-epigeal sensu DUKE & POLHILL 1981) and is characterized by a developing hypocotyl and hidden (enclosed) cotyledons which are soon shed together with the seed body. – MEYER (1974) described the germination as well as the development and growth rate of seedlings in detail. He noted: "the hypocotyl straightens out the fifth or sixth week, pulling the cotyledons covered with the empty seed coat from the soil. The hypocotyl ceases elongation at 19 to 35 millimeters. Most cotyledons abscise from the stem the fourth through the sixth week" In his fig. 9, the third and fourth seedling from the right side (eight and ten weeks old, respectively) show, in fact, fully exposed cotyledons (= phanerocotylar sensu DUKE 1965)! Unfortunately,

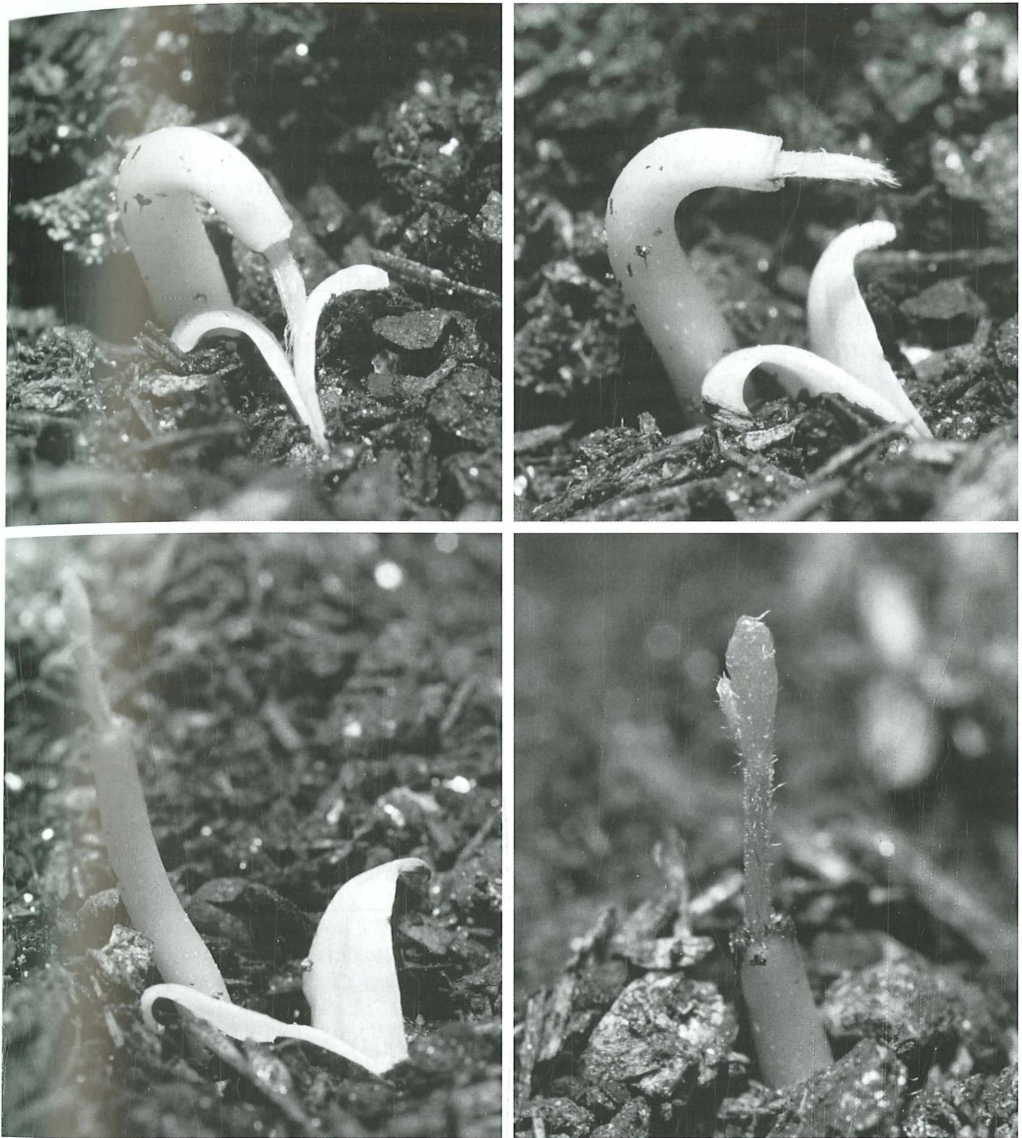


Fig. 8: Germination of *Diospyros texana*.

he did not mention the color of the cotyledons. Further studies with respect to the germination of *D. texana* are necessary to confirm these results. – The physiological and ecological requirements of seedlings are dealt with in BASKIN & BASKIN (1998), VAN AUKEN & BUSH (1992), EVERITT (1984), PLOWMAN & MUNSON (1983), VORA (1989). No seed dormancy mechanisms were observed and the seedlings are shade-tolerant (EVERITT 1984, VAN AUKEN & BUSH 1992).

Physiology and synecology: Various studies dealing with these topics have been carried out: e.g., ANDERSON et al. (2001); GONZALEZ RODRIGUEZ et al. (2004); NÁVAR (1993);

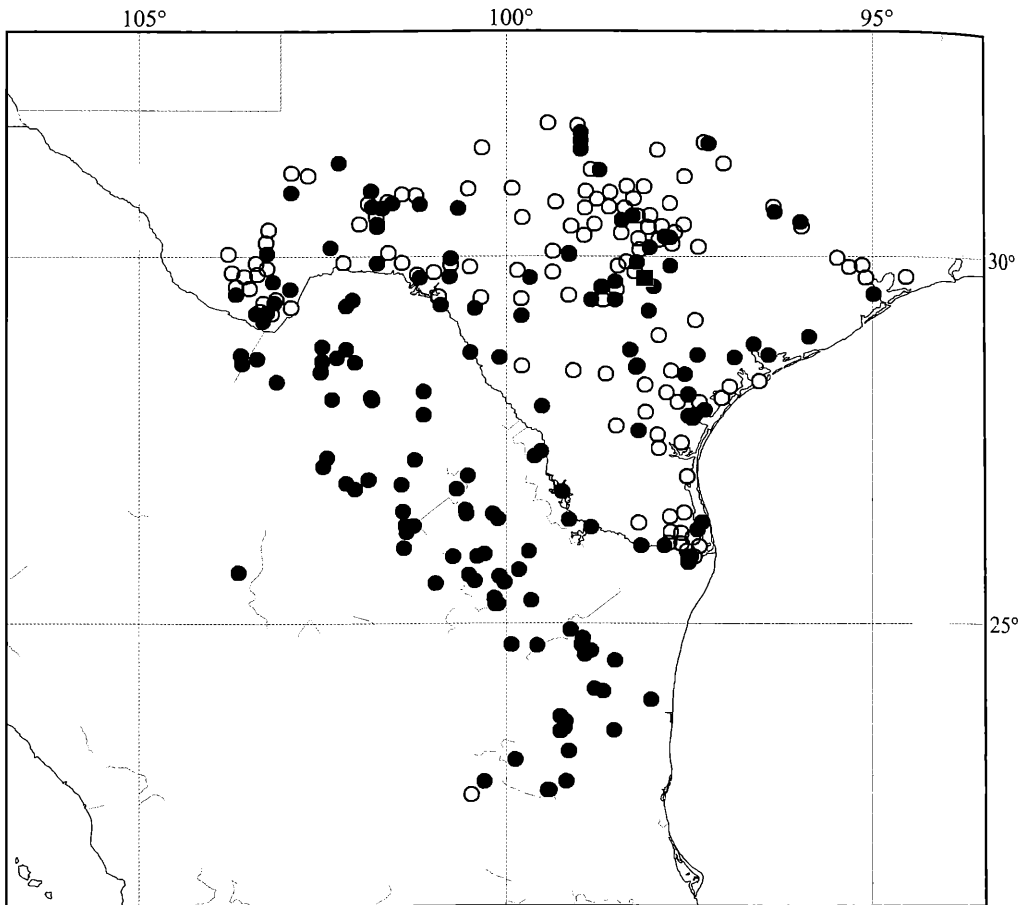


Fig. 9: Distribution of *Diospyros texana* (●; type locality: ■; data from literature: ○; for Texas: TURNER et al. 2003; for San Luis Potosí, Mexico: VILLARREAL QUINTANILLA et al. 2009).

NÁVAR & BRYAN (1990); NÁVAR et al. (2001, 2002, 2004); NORTHUP et al. (2005); RAMÍREZ et al. (2006); RUTHVEN et al. (2003); VAN AUKEN & BUSH (1987); WELTZ et al. (1992). The larvae of *Resciphia servia* CRAMER and occasionally also those of *Hypocala andremona* CRAMER (both: Lepidoptera: Noctuidae) feed on *D. texana* (KENDALL 1976, HALLMAN & KNIGHT 1993). The fungus *Pseudocercospora kaki* has been observed on *D. texana* (DAVID 2000).

Use: The Comanche natives used the fruits as food (MOERMAN 1998). FACCIOLA (1990) and ECKENWALDER (2009) also inform us that the fruits can be eaten fresh or dried. "The black juice of the fruits was used during frontier days to dye buckskin or leather black" (CROSSWHITE cited in DIGGS et al. 1999). According to STANDLEY (1924) and SPONGBERG (1979), it was employed locally for dyeing sheep and goat skins. STANDLEY (1924) noted that "the wood is susceptible of a high polish" and that "in England it is said to have been used as a substitute for boxwood, in making engravings"; BRITTON & SHAFER (1908) mentioned that it was used for tool handles and other turned ware, and VINES

(1960, 1984) informed us that "it was also used in a craft now little practiced - that of ornamenting wooden objects by burning designs into them with an iron" *D. texana* is used in Mexico as fire wood and as fodder (PANDO-MORENO & VILLALÓN-MENDOZA 2001).

Agriculture and farming: According to MEYER (1974), *D. texana* is "an important, largely undesirable woody species which has invaded about 6 million acres of Texas, mostly on the Edwards Plateau, Central Basin and South Texas Plains" In Tamaulipas (Mexico) it was reported to reach population densities of 660 individuals per hectare on cultivated land (JIMÉNEZ-PÉREZ et al. 2009). And EVERITT (1984) states: "Although usually considered a minor component of range vegetation, Texas persimmon may become one of the primary problems following use of mechanical brush control methods such as chaining and root plowing (SCIFRES 1975, 1980). Moreover, it is a hard-to-kill species that is essentially resistant to conventional herbicides applied as broadcast sprays" (BOVEY et al. 1981, KITCHEN et al. 1980, SCIFRES et al. 1981). Aeration enhances the growth and spreading of the species (RUTHVEN & KRAKAUER 2004). This is mainly due to the tenacity as well as the strong capacity of the plant to develop stem and especially root suckers after suffering damages (MEYER 1974). With time passing it may form large clonal groves (called "mottes" by MEYER 1974: see fig. 15; TISSERAT 1995) with a remarkable tendency to spread over pastures. The latter author proposed, therefore, the use of the fungus *Nalanthamala diospyri* (CRAND.) SCHROERS & M.J. WINGF. (= *Acremonium diospyri*) to control the spreading of persimmon trees. – In contrast to adult cattle, "calves get the scours [diarrhoea] after eating large numbers of fruit" (MEYER 1974).

Specimens examined: **U.S.A.**, Texas, Upton County, King Mountain, P. O. [= Post Office] McCamey, 3000 ft., [31°17' N, 102°16' W], rocky areas, (fr), 3 Aug. 1973, **D. Demaree 67205** [MO], "6 ft. tall"; – [Pecos County], W of Fort Stockton, [30°53' N, 102°55' W], (yfr), 18 Apr. 1931, **M.E. Jones 28252** [BM]; – Crockett County, 2.45 miles E of the Pecos River on U.S. 190, ca. 3.5 miles E of Iraan, 30°54'3" N, 101°50'29" W, at small roadcut (through arid limestone plateaus) on north side of road, (fr), 10 Aug. 2001, **J.R. Abbott 14560** [SEL n.s., W], "shrubby tree ca. 2 m tall; fruits black"; – [Pecos County], Sheffield, [30°41' N, 101°49' W], (flbuds male), 20 Apr. 1931, **M.E. Jones 28251** [BM, MO]; – Crockett County, W of Ozona, S of I-10 (at Exit 343) on TX 290, ca. 0.3 mile N of County Road 411, in foothills E of (over-looking) Fort Lancaster Historic Site (State Park?), a few miles E of the Pecos River, 30°39'55" N, 101°41'5" W, rocky south-facing slope around gully, (fr), 8 Aug. 2001, **J.R. Abbott 14534** [SEL n.s., W], "shrubby tree 2–4 m tall; fruits black"; – Crockett County, several miles W of Ozona on I-10, ca. 0.5 miles E of Exit 343 overpass (TX 290), 30°43'37" N, 101°32'51" W, rocky ledge on north side of road; extremely arid site, (st), 8 Aug. 2001, **J.R. Abbott 14530** [SEL n.s., W], "shrub 1 m tall; low compact growth (leaves small for species)"; – Crockett County, just NE of Ozona, 13.1 miles W of Sutton County line, 1.3 miles E on I-10 from westbound Exit 365 off-ramp (TX 163), 0.1 mile W of eastbound Exit 368 off-ramp (Loop 466 to Ozona), north side of ramp on top of roadside highwall, 30°42'37" N, 101°10'20" W, (fr), 8 Aug. 2001, **J.R. Abbott 14524** [SEL n.s., W], "shrub ca. 1.5 m tall; fruits blackish"; – Sutton County, 6 miles N of Sonora on U.S. route 277, 620 m, 30°30' N, 100°43' W [correct seems to be: 30°40' N, 100°39' W], (yfr), 21 May 1991, **J.S. Miller 6306** [MO], "shrub 2.5 m; young fruits green"; – Terrell County, Independence Creek near Pecos River, Dryden, 1800 ft., [30°27' N, 101°45' W], dry rocky bottoms, (fr), 13 Jul. 1963, **D. Demaree 48412** [BM], "8 ft. tall" and: 1900 ft., dry ridges, (fr), 14 Jul. 1963, **48430A** [WIS], "8 ft. tall" and: 1900 ft., dry rocky bottoms and ridges, (fr), 17 Jul. 1963, **48489** [BM], "7 ft. tall, common"; – Terrell County, banks of Pecos River, Joe Chandler Dude Ranch, P. O. [= Post Office] Dryden, 1700 ft., [ca. 30°25' N, 101°45' W], (fr), 4 Aug. 1973, **D. Demaree 67230** [MO], "12 ft. tall, common"; – Brewster County, Ridge Spring, about 12 miles S of Marathon, [30°3' N, 103°15' W], (fl male), 26 Mar. 1938, **O.E. Sperry T441** [US]; – Terrell County, Sanderson, [30°8' N, 102°23' W], along low limestone bluffs of creek, (yfr), 23 Apr. 1928, **E.J. Palmer 33439** [MO]; – Shuler's Canyon 60 miles S of Alpine, [ca. 29°30' N, 103°40' W], (fl male, fl female), Apr. 1925, **R.A. Studhalter 1017** [US]; – Brewster County, Big Bend National

Park, Persimmon Gap, [29°40' N, 103°10' W], (fl female), 6 Apr. 1942, **A. Nelson & R.A. Nelson 5135** [MO]; – same locality: (fr), Sep. 1933, **T.L. Steiger 156** [NHA]; – same locality: (fr), 7 Oct. 1935, **O.E. Sperry 489** [US]; – Brewster County, Black Gap Wildlife Management Area, rocky limestone slopes along Stillwell Creek, [29°34' N, 102°56' W], (fl male), 9 Apr. 1967, **F.R. Waller Jr. 1278** [WIS]; – Brewster County, Big Bend National Park, 5 miles N of Panther Junction on U.S. 385, then ca. 0.2–0.4 mile E of road, 29°22'31" N, 103°9'6" W, in wash below low hills, (fr), 8 Aug. 2001, **J.R. Abbott 14538** [SEL n.s., W], "shrubby tree ca. 4 m tall; fruits black"; – Brewster County, Chisos Mountains, gravelly flat between Burro Mesa and Chisos Mts., 1150 m, [29°14' N, 103°24' W], (yfr), 6 Jul. 1931, **J.A. Moore & J.A. Steyermark 3400** [MO], "tree 8 ft."; – Big Bend National Park, [29°15' N, 103°15' W], desert, (fl male), 3 Apr. 1942, **A. Nelson & R.A. Nelson 5075** [US], "small tree with white bark"; – Brewster County, Chisos Mountains, near upper Juniper Spring, not reaching a higher altitude 4800 ft., [ca. 29°10' N, 103°18' W], (fr), 15–18 Jul. 1921, **R.S. Ferris & C.D. Duncan 2854** [MO]; – Brewster Co., 14 miles E of Castolon, S edge Chisos Mts., [29°8' N, 103°18' W], frequent in draws, (yfr), 2 May 1937, **H.C. Cutler 1019** [MO]; – Val Verde County, at Pumpville turn-off, 2450 [ft.], [29°55' N, 101°45' W], in limestone soil, (fl male), 3 Apr. 1953, **B.H. Warnock 11342** [WIS], "frequent and widespread; – Val Verde County, 45 miles N of the city of Del Rio, along U.S. Highway 277, 23 miles N of the junction of U.S. Highway 377, between U.S. 377 and Texas Highway 55, just SW of the Val Verde - Edward County Line, [29°59' N, 100°45' W], along roadside, (fr), 4 Aug. 1992, **J. Ricketson 4761** [MO], "shrub 4 feet tall; fruits green, turning soft and black with age"; – Val Verde Co., 2 miles N of Comstock on St. Hwy. 163, [29°43' N, 101°10' W], Mesquite-*Acacia* thornland with a dry creek bordered by *Melia* and *Celtis*, (fl female, yfr), 27 Apr. 1974, **W. Hess 3178** [US], "shrub 2–3 m tall; quite bushy; purple-brown flowers or green fruits"; – Val Verde Co., about 13 miles S of Loma Alta, [ca. 29°44' N, 100°46' W], rocky hills, (fl male), 1 Apr. 1963, **D.S. Correll & E.L. Little Jr. 27147-A** [M], "small tree to 8 ft." and: (fl female), **27147-B** [M]; – [Val Verde County], Del Rio, [29°21' N, 100°53' W], (fr), 21 Apr. 1930, **M.E. Jones 26292** [BM]; – Kinney Co., Fort Clark, [29°18' N, 100°25' W], (fl female), 3 Apr. 1893, **E.A. Mearns 1408** [US]; – Brackett [= Brackettville], [29°18' N, 100°25' W], (fl buds male), 21 Mar. 1900, **Trelease 48** [MO]; – Maverick Co., Eagle Pass, [28°42' N, 100°29' W], (yfr), May 1913, **C.R. Orcutt 5989** [MO]; – same area: river bottoms, (fr), 2 Aug. 1931, **O.M. Clark 4019** [G]; – Dimmit Co., 25 miles from Eagle Pass on Carrizo Springs Rd., [28°38' N, 100°5' W], (yfr), 29 Jul. 1921, **R.S. Ferris & C.D. Duncan 3032** [MO]; – Brown County, near Brownwood, [31°42' N, 98°59' W], along dry limestone escarpment, (fr), 30 Oct. 1924, **E.J. Palmer 26764** [MO, P], "arborescent shrubs 4–6 m"; – Brown Co., near headwaters of Indian Creek, [ca. 31°35' N, 98°59' W], (fl male), 11 Aug. 18??, **J. Reverchon 841** [MO]; – Brown County, along the Colorado River, 17 miles S of Brownwood, [31°28' N, 98°59' W], on high ground, in tight red silty clay, (fl male), 9 May 1967, **J.W. Stanford 1073** [WIS]; – McLennan County, Speegleville Park, on SW shore of Lake Waco, [31°33' N, 97°14' W], (st), 19 Apr. 1990, **W.C. Holmes 5032** [WIS], "small tree ca. 3 m tall, uncommon"; – San Saba, [ca. 31°11' N, 98°43' W], light soil, (fl male, fl female, fr), May [MO: "1885" added in pencil], [US-label: F. [? Fazenda] Concho [not traced], rocky bluffs, (fl male), Apr. 1882], **J. Reverchon 592** [MO, US, WU 2x]; – 15 miles N of Johnson City Texas, Chester Kast ranch, south fenceline of ranch, [30°30' N, 98°25' W], rocky hillside; shallow bracket soil, (fl male), 20 May 1963, **H.L. Kast 27** [WIS], "flowers greenish white"; – Burnet Co., Marble Falls, [30°34' N, 98°16' W], (fr), Aug. 1888, **Pammel s.n.** [MO]; – Brazos Co., College Station, Little Brazos River, 370 ft., [ca. 30°37' N, 96°20' W], dry bottoms, (st), 17 Jul. 1964, **D. Demaree 50877** [BM], "7 ft. tall, 2 in. D.B.H."; – Anderson, [ca. 30°29' N, 95°59' W], (fl female), 29 Mar. 1935, **B.C. Tharp s.n.** [MO]; – Travis Co., W of Austin, near Beccaves, [ca. 30°17' N, 97°50' W], in cedar brakes, (fl male), 21 Apr. 1941, **C.L. Lundell & A.A. Lundell 10300** [US], "shrub 6 ft. high, corolla pale yellow-green"; – Travis Co., Hill Country, ca. 2 miles S of the State Capital along Barton Creek, south of the Colorado River in the City of Austin, [ca. 30°16' N, 97°46' W], limestone areas with scrub and along creek, (fl male), 15 Mar. 1976, **J. Henrickson 14868** [IEB n.s. (dig. photo)], "common dioecious trees to 15 ft. tall; bark peeling, flaking off; leaves shinny green above, gray-green beneath; corollas white; flowers sweet aromatic"; – Travis County, limestone hills in Zilker Park S of Austin, [30°16' N, 97°46' W], (fl male), 9 Apr. 1946, **B.C. Tharp 46021a** [K, MO, W, WIS n.s.] and: (fl female, yfr), 8 Apr. 1946, **46021b** [K, MO, NA n.s., W, WIS n.s.]; – Austin, [30°16' N, 97°45' W], (fr), 1881, **S.B. Buckley s.n.** [K]; – same locality: rocky banks, (yfr), 10 May 1972, **E. Hall 393** [BM, G, K, NA n.s.]; – same locality: (st), Aug. 1880, **G.W. Letterman s.n.** [P], "fruit black"; – same area: (fl male), 17 Mar. 1908, **H.H. York 354** [MO]; – Hays County, ca. 24 miles SW of Austin, near Driftwood, 17000 Farm to Market Road (F.M.) 150 West, 0.45 mile N of junction with Ranch Road 1826, ca. 0.1–0.2 mile E of road on private driveway, 30°8'15" N, 98°1'52" W, open juniper-live oak savannah, parts chalk-prairie-like, (fr), 6 Aug. 2001, **J.R. Abbott 14515** [SEL n.s., W], "shrubby

tree ca. 1.8 m tall; fruits blackish"; – Kerr County, Kerrville, [30°3' N, 99°8' W], (fr), Jul. 1889, **T.V. Munson & C.L. Hopkins s.n.** [US]; – bank of Guadalupe R., Kerrville, [30°2' N, 99°8' W], dry, sandy bank, (fr), 18 Sep. 1939, **R.B. Clark 556** [MO]; – Caldwell Co., 3¼ miles W of Lockhart, Lockhart State Park, [29°53' N, 97°45' W], frequent in hilltop woods, (fl male), 3 Apr. 1949, **V.L. Cory 55424** [US], "small tree, about 2.5 m high"; – Real County, Boren Ranch, 5 miles E of Leakey, [29°43' N, 99°40' W], edge of grazing area in canyon, (fr), 17 Jun. 1966, **C. Trapp CT-66-29** [WIS], "shrub"; – Bexar Co., 15 miles N of San Antonio, Loop 1604, [29°40' N, 98°30' W], rocky, clay soil, wooded area just off road, (fl female), 19 Mar. 1977, **D. Novosad 1127** [M], "tree, bark smooth, light gray"; – Comal County, US 35 ca. 1 mile N of New Braunfels, [29°43' N, 98°7' W], (fr), 5 Sep. 1978, **W.G. D'Arcy 11733** [MO], "tree 5 m tall"; – N side of Canyon Lake at 880 Military drive, on Canyon Lake Island, [ca. 29°54' N, 98°13' W], abundant on dry, rocky hill-sides, (fl male), 27 Mar. 1994, **M.B. White 182** ["Bexar Reg. Herb." n.s. (dig. photo)], "small tree to 12 m tall, with trunk to 6 dm thick; bark smooth and gray, outer layers peeling; corolla white, sericeous, 8–12 mm long"; – Guadalupe County, 225 Windwood Circle, NW of Seguin, [29°36' N, 97°59' W], (fr), 17 Jul. 1994, **A.W. Lievens 5703** [MO], "shrub; mature fruits blackish"; – Bexar Co., 18 miles W of San Antonio, [29°25' N, 98°50' W], (fl male), 2 Apr. 1937, **H.C. Cutler 830** [MO]; – 14511 Star Cross Trail, Helotes, [ca. 29°34' N, 98°41' W], west facing hill, near top; soil rocky and stony, but well laced with humus; full sun, (fl male), 30 Mar. 1994, **M. Fox 66** ["Bexar Reg. Herb." n.s. (dig. photo)], "small tree with naked bark; twigs grayish; leaves spatulate, entire, four arising from bud; flowers urn-shaped, 5 mm, greenish-white"; – San Antonio, Oakwell Farms, limestone hill, 80 m S of S Oakwell Farms Pky & 180 m E of Harry Wurzbach drive, [ca. 29°26' N, 98°29' W], small grove, among other small trees on shallow caliche, (fl male), 27 Mar. 1994, **H. Cliffe 556** ["Bexar Reg. Herb." n.s. (dig. photo)], "tree 4 m tall, 8 cm dia., much branched; crown rounded; bark thin, peeling; corolla white, urceolate; petals to 8 mm long, recurving; stamens 15, inserted"; – same area: Oakwell Farms, N side of east-west path & 20 m W of extreme E end, [ca. 29°26' N, 98°29' W], edge of thick stand of *Celtis*, *Ulmus*, *Acacia*, *Prosopis*, *Aloystia* & *Condalia*, (fr), 4 May 1994, **H. Cliffe 579** ["Bexar Reg. Herb." n.s. (dig. photo)], "small tree 4 m tall; bark smooth, thin, gray, outer layers peeling; fruit black, 1.5 cm dia.; seeds 8, flat, orbicular"; – San Antonio, 600 ft., [29°25' N, 98°30' W], (yfr), 17 Apr. 1894, **A.A. Heller 1591** [BM, G 2×, K 2×, MO, P, SI, Z]; – same area: common in woods, (fr), 3 Oct. 1900, **B.F. Bush 1255** [K 2×] and: (flbuds male), 22 Mar. 1902, **1157** [MO]; – same area: (yfr), 1 May 1905, **R. Bebb 2269 (21021)** [WIS], "small tree"; – same area: (fr), 2 Jul. 1921, **G.L. Fisher 109** [US], "tree 9 ft."; – Uvalde, [29°12' N, 99°47' W], (fr), Sep. 1879 - Oct. 1880, **E. Palmer 759** [K] and: (fr), Jul. 1879, **789** [NA n.s., P, US 2×]; – Wilson County, J. Sutherland Springs, 29 miles SE of San Antonio, [29°16' N, 98°3' W], (flbuds), 22–30 Aug. 1879, **E. Palmer 788** [P]; – Atascosa County, Campbelton [= Campbellton], [28°44' N, 98°18' W], sandstone hills, (fl male), 10 Mar. 1917, **E.J. Palmer 11244** [K, MO]; – between the Frio and the Nueces rivers, on the road to Laredo, [ca. 28°30' N, 98°13' W], (flbuds male), 27–28 Jan. 1880, **E. Palmer 788** [K, MO, NA n.s., W, WU]; – Bee Co., 12 miles E of Beeville, [28°24' N, 97°33' W], in sandy open scrub forest, (fl male), 27 Mar. 1963, **D.S. Correll 27018** [MO], "tree to 25 ft. tall, with trunk to 10 in. in diam.; flowers very fragrant, creamy color"; – Goliad County, near Goliad, [28°40' N, 97°23' W], rocky prairies, (fl male, fl female), 8 Apr. 1900, **H. Eggert s.n.** [MO]; – Victoria County, Bloomington, [28°38' N, 96°53' W], sandy ground, (fl male, fl female), 13 Mar. 1916, **E.J. Palmer 9166** [K, MO, NA n.s.] and: (fl male), **9167** [K, MO]; – Jackson County, Vanderbilt, [28°49' N, 96°37' W], woods along river, (fr), 11 May 1916, **E.J. Palmer 9525** ("9525a") [K, MO]; – Calhoun Co., Port Alto, [28°40' N, 96°25' W], (fr), 6 Jun. 1937, **J.A. Drushel 10433** [P]; – Matagorda County, Peytons creek near Bay City, [28°55' N, 95°52' W], low woods, (fr), 12 May 1916, **E.J. Palmer 9735** [K, MO]; – Galveston Bay, [ca. 29°30' N, 94°59' W], (fl), s.d., **T. Drummond s.n.** [K], "Tenaz III in 329" [barely legible]; – San Patricio County, Welder Wildlife Refuge, Pecan Mott, along Aransas River, [28°8' N, 97°30' W], common in open to closed forest, (st), 19 Jan. 1964, **F.R. Fosberg 44662** [US], "sterile shrub, to 3 m tall"; – S of Camphouse at Rob & Bessie Welder Wildlife Foundation, about 7 miles N of Sinton, [28°8' N, 97°30' W], mixed brush community, (st), 26 Apr. 1981, **S.L. Hatch 4374** [WIS] and: (fr), 31 Jul. 1981, **4449** [WIS]; – Webb County, on Rio Grande Plains, 30 miles N of Laredo on US Hwy 83 (10 miles N of intersection with US 81), [27°58' N, 99°30' W], flat, fine soiled, thorny xeromorphic "Mesquite" (*Acacia* sp., *Opuntia* sp.) and desert grass scrub savanna with 1–2 m tall shrubs, (st), 2 Dec. 1972, **H.H. Iltis 27018** [WIS], "tree 4 m, with very smooth bark, much flaked like *Platanus* but patches bigger"; – Nueces County, along Nueces Bay, 0–20 ft., [27°50' N, 97°30' W], (fl male), 12 Mar. 1894, **A.A. Heller 1431** [G, K, MO, Z]; – Neucestown [? = Nueces], [27°48' N, 97°27' W], bluffs, (fr), 27 Apr. 1896, **C.L. Marlatt s.n.** [US]; – Corpus Christi, 20 ft., [27°51' N, 97°25' W], (fl female), 14–21 Mar. 1894, **A.A. Heller 1451** [US]; – San Patricio County, near Gregory, 35 ft., [27°55' N, 97°17' W], (fr), 14 Apr. 1894, **A.A. Heller 1572** [BM, G, P 2×]; – Jim Wells County, La Copita Research

Area, 5 miles S of Alice on Hwy 281 and 7 miles W of Ben Bolt, near SW corner of ranch, [27°38' N, 98°11' W], gray sandy loam range; site in SW pasture; growing with *Chloris*, *Tridens*, *Aristida*, *Eragrostis*, hog plum, shrubby blue sage and brasil, (st), 7 Jun. 1984, **C. Coffey 469** [WIS]; – Zapata Co., 8 miles S of Zapata, [26°48' N, 99°14' W], dry sandy soil, (yfr), 6 May 1933, **E.U. Clover 1920** [MICH n.s., MO]; – Cameron County, Green Island, [26°23' N, 97°19' W], (fr), 23–29 Jun. 1922, **B.C. Tharp 1229** [US]; – Laguna Atascosa National Wildlife Refuge, Unit 2, ca. 200 m NE of sign "Impoundment No. 3", 20 ft., [26°17' N, 97°23' W], dense scrub on ridge ca. 5 m above Laguna; gray silt packed hard; *Zizyphus* sp. - *Leucophyllum* frut. - *Bumelia* sp. complex, (yfr), 24 Apr. 1959, **A. Traverse 1106** [MO], "tree-shrub 2 m, basal diam. 5 cm; crown diam. 2 m; sparingly branched below, ultimately densely branched; branch ends appear tufted; bark gray, smooth underbark; papery outer bark peeling in large flakes; fruit green, tomentose"; – Hidalgo Co., Santa Ana National Wildlife Refuge, [26°4' N, 98°9' W], (fl male), 14 Apr. 1977, **J.C. Solomon 2690** [MO 2×], "small tree 5 m; flowers white, fragrant" and: (fl female), **2691** [MO], "small tree 5 m; flowers white, fragrant"; – Cameron Co., Charpote, Santa Maria, [26°4' N, 97°50' W], (st), 13 May 1889, **J.G. Tucker s.n.** [US]; – Cameron Co., Esperanza Ranch, Brownsville, [ca. 25°55' N, 97°30' W], (fl male), 21 May 1904, **H.S. Barber 29** [US]; – vicinity of Brownsville, Las Palmas Ranch, [ca. 25°55' N, 97°30' W], in dense undergrowth, (fr), 1–5 Aug. 1921, **R.S. Ferris & C.D. Duncan 3172** [MO]; – near Brownsville, [ca. 25°55' N, 97°30' W], (fr), 29 May 1904, **H.S. Barber 36** [US]; – same area: in clearing, (fl female), 17 Mar. 1942, **C.L. Lundell 10782** [IEB n.s. (dig. photo)], "tree 15 feet high, 3 in. diam."; – NE of Brownsville, 10 m, [25°55' N, 97°28' W], chaparral forest; in woodland; soil clay, (fl male), 27 Feb. 1945, **s.coll.** ("**The Runyon Herbarium**") **s.n.** [AAU, M], "a small tree; roots deep seated; bark rough; leaves dark green, smooth; flowers light yellow; odor fragrant"; – westlich vom Colorado [BLANKINSHIP (1907) indicates additionally also "Braunfels"], in Gebüsch der Flußwäldungen, (fr), Aug. 1845, **F.J. Lindheimer 453** ("Flora Texana exsiccata. Fasc. III") [BM, G, K, MO, NA n.s., P, OXF, W 2×], "Frucht schwarz mit schwarzem, süßem Fleisch, so groß wie Kirschen; Strauch oder kleiner Baum (bis 1.5 dick), mit weißlicher, glatter Rinde; Holz weiß, fest, dicht, ohne sichtbare Ringe und Fasern; Frucht reif im August"; – without further data, (fl female), 1846, **F.J. Lindheimer 452** ("Flora Texana exsiccata. Fasc. III") [BM, FHO, K 2×, MO, NA n.s., P 2×, OXF, US, W 2×]; – without further data, (fr), 1845, **F.J. Lindheimer s.n.** [US]; – Comanche Spring, New Braunfels etc., (fl male), Mar. 1851, **F.J. Lindheimer 980a** [BM, G 2×, K, M, MO, P, US, W] and: (fl female), Mar. 1851, **F.J. Lindheimer 980b** [BM, G 2×, K, M, MO, P, US, W]; – entre Laredo y Bejem [not located], (fl male), Feb. 1828, **J.L. Berlandier s.n.** [K]; – Shofford [not located], (fr), 8–9 May 1904, **D. Griffiths 6326** [US]; – Devil's River, (yfr), 22 Apr. 1930, **M.E. Jones 26294** [BM, MO]; – Texquite Creek [not located], (fl male), 23 Mar. 1932, **M.E. Jones 29221** [MO]; – Ft. [Fort] Jugh [? barely legible] [not located], (fr), 1850, **C.C. Parry s.n.** [MO]; – Pecos County, (fr), 9 Jul. 1943, **B.C. Tharp 43-741** [MO]; – "Texas oriental", (fl male), 1848/1849, **C. Wright s.n.** [G]; – "collected in Expedition from Western Texas to El Paso, New Mexico", (fr), May - Oct. 1849, **C. Wright 423** [K 2×, OXF]; – without further data, (fr), s.d., **T. Drummond 201** [K, OXF] and: (fl male), 1835, **T. Drummond 229** ("339") [G, K, OXF, W]; – "Texas occidental", "dans bois sur les et sur les bords des rivieres", "Bosquets de Victoria à " [barely legible], [FHO-label: "dans les bois pres de la Leona"], (fr), Nov. 1849, **Trécul 1249** [FHO, P 2×].

Mexico, Chihuahua. Sierra de Los Hechiceros, Cañon Encampanado, below (E of) Rancho Encampanado and above (W of) jct. with Cañon de Indio Felipe, 1300–1400 m, 28°40'30" N, 103°36' W, canyon-bottom woods with perennial stream; in dry igneous mountains; *Prunus serotina*, locally *Populus* and *Salix*, *Quercus grisea*, *Juglans major*, *Celtis reticulata*, *Prosopis*, (fr), 27 Jul. 1974, **T. Wendt & A. Adamciewicz 429** [MEXU, TEX], "small tree; common; throughout canyon" – Coahuila, ca. 66 air miles W of Cd. Acuna [= Ciudad Acuña], 17 miles W of Rancho Chupadero de Caballo in Canyon de Colorado, 720 m, 29°25' N, 102°05' W, with *Pistacia*, *Rhus*, *Prosopis*, *Berberis*, *Aloysia*, *Juglans*, etc., (fr), 26 Jul. 1973, **J. Henrickson 11357b** [WIS], "tree to 15 ft. tall, frequent"; – 120 km al oeste de Villa Acuña [= Ciudad Acuña], [ca. 29°20' N, 102°10' W], matorrales medianos subinermes con Pastizal y encinos bajos, (fr), 29 Aug. 1985, **F. González Medrano, P. Hiriart, P. Dávila & R. Molczadzki 14766** [MEXU]; – Sierra de Hechiceros, Cañon del Indio Felipe, near Chihuahua boundary, ca. 28°33' N, [ca. 28°33' N, 103°36' W], hillsides and along arroyos; a deep wooded canyon with running water in the igneous Sierra, (fr), 27–29 Sep. 1940, **R. Stewart 132** [BM, GH, NA n.s.], "bush 4 m, common"; – Picachos Colorado, ca. 28°36' N, [28°37' N, 103°23' W], about cliffs and along arroyos, (fr), 11 Aug. 1940, **I.M. Johnston & C.H. Muller 109** [GH, LL, MEXU, MICH], "common bush or tree 6–8 ft. tall"; – Municipio de Ocampo, Sierra del Carmen, Rchos. [= Ranchos] Morteros y San Isidro, ca. 178 km de Múzquiz, por la brecha Múzquiz, Boquillas del Carmen, 1200 m,

28°47' N, 102°30' W, matorral, *Pistacia texana*, *Juglans microcarpa*, *Acacia reomeriana* y *Quercus laceyi*, (fr), 20 Aug. 1994, **M.A. Carranza, J. Encina & J. García Mata 2112** [MO]; – Mpio. de Múzquiz, Recho. Florida, aprox. 100 km al NW de Múzquiz rumbo a Boquillas del Carmen carr. 53, 700 m, 28°45' N, 102°10' W, matorral de *Acacia rigidula*, *Prosopis glandulosa*, *Yucca rostrata* y *Acacia farnesiana*, (fl male), 29 May 1992, **M.A. Carranza, J. Noriega P. & L. García 1535** [MEXU]; – 22 km ESE of La Cuesta del Plomo on the Múzquiz-Boquillas highway, near the intersection of the highway from V Acuña [= Ciudad Acuña], N. side of S. de la Encantada, 1000 m, 28°38'38" N, 102°18'18" W, crasi-rosulifolios espinosas y matorral de esp. var.; veg. primaria; limestone cut fan & some gravel deposits; stony calcareous clay loam; asociada con *Agave lecheguilla*, *Acacia berlandieri*, *A. roemeriana*, *Parthenium incanum*, (fr), 7 Jun. 1972, **F. Chiang, T. Wendt & M.C. Johnston 7549** [F, LL, MEXU, MO, NY]; – western slopes of the Sierra del Carmen [? Sierra de la Encantada], 10 km E of Hacienda de la Encantada, [28°35' N, 102°30' W], open hillsides, (fr), 15 Sep. 1941, **R.M. Stewart 1688** [GH, LL], "shrub 15 dm tall, not common"; – Cañón de Milagro, E side of the Sierra de los Guajes, ca. 12 km W of Hacienda de la Encantada, [28°35' N, 102°30' W], on hillsides; a deep narrow box-canyon in limestone, (fr), 16 Sep. 1941, **R.M. Stewart 1724** [GH, LL], "shrub 15 dm tall, not common"; – Rancho Babia [= La Babia], [28°34' N, 102°3' W], (fr), 18 May 1939, **E.G. Marsh Jr. 1201** [F, GH, TEX]; – Cañón de Madera, western side of Sierra de los Guajes, ca. 4 km E [W?] of Rancho Buena Vista, [ca. 28°26' N, 102°31' W], banks of arroyo, (fr), 7 Sep. 1941, **R.M. Stewart 1497** [GH, LL], "common"; – Cañón de Ybarra [= Ibarra], the principal canyon at the NW end of the calcareous Sierra del Pino, [28°18' N, 103°7' W], bank of arroyo, (fr), 22 Sep. 1941, **R.M. Stewart 1814** [GH, LL], "shrub 2–3 m tall, fairly common"; – 1 km NW of Puerto del Aire, the pass at the southern end of the Sierra de la Encantada, [28°4' N, 102°22' W], dry rocky arroyo, (fr), 1 Sep. 1941, **R.M. Stewart 1303** [GH, LL], "3 m tall, common"; – Mpio. de Múzquiz, Sierra de Santa Rosa, 40 km al NW de Múzquiz, 650–700 m, 28°05' N, 101°50' W, bosque de *Juniperus*, *Celtis*, *Yucca* y *Acacia*, (fr), 5 May 1989, **J.A. Villarreal, R. Vazquez & Alumnos de Postgrado 4897** [MEXU, TEX]; – Hacienda San Rafael, about 10 miles SW of Hacienda Mariposa, along the Sabinas River, [28°3' N, 101°49' W], (fr), 18 Aug. 1937, **F.L. Wynd 709** [A, G, GH, K, MEXU, MO, NA n.s., US]; – road from Piedras Negras S to Monclova, 20 miles S of Allende, [28°10' N, 101°7' W], (fr), 22–24 Aug. 1938, **I.M. Johnston 7037** [GH], "tree 12–20 ft.; fruit black"; – Sabinas, [27°51' N, 101°7' W], chaparral, (fr), 13 Aug. 1948, **L.A. Kenoyer & Crum 2564** [A], "shrub 2–3 ft."; – same area: (fr), 21 May 1902, **E.W. Nelson 6174** (or "6774") [US]; – 3 miles S of Ocampo, 4 miles SW of Hwy 30 towards Rancho Mesquite, in Chihuahuan Desert, 3900 ft., ca. 27°16' N, 102°26' W, on rocky (volcanic) margin of broad arroyo; with *Celtis*, *Randia*, *Rhus*, *Chilopsis*, *Prosopis* etc., (fr), 22 Sep. 1972, **J. Henrickson 7931** [TEX], "large common shrub to 10 ft. tall; bark grey plated; fruits dark blue-black"; – Cañón de la Charretera, Sierra de la Madre, along the road up the open main canyon, 4200–5200 ft., [27°9' N, 102°29' W], lower canyon, (fr), 16 Sep. 1941, **I.M. Johnston 9169** [GH], "frequent bush 3–6 ft; fruit black"; – Hermanas, [27°14' N, 101°14' W], (yfr), 20 Apr. 1939, **E.G. Marsh Jr. 1578** [F, GH, TEX 2×]; – ladera baja de la Sierra de San Marcos, frente a las Dunas de Cuatrociénegas, 950 m, 26°55' N, 102°10' W, matorral rosetofo de *Agave*, *Yucca* y cactaceas, (fr), 24 Jun. 1989, **A. Rodríguez, M. Martínez & J. Manuel Sosa 1122** [MEXU]; – Cuatrociénegas (27 km SW on MX 30 then 14 km SE), slopes of Sierra San Marcos y Pinos, 26°49.87' N, 102°03.50' W, frequent in washes, (fl male), 29 Mar. 1992, **J.L. Neff 92-3-29-3** [MEXU], "large shrub to 3 m; most plants past flowering or in fruit"; – Cañón Espantosa, western slope of Sierra de San Vicente, a large canyon in limestone about 20 km ESE of Cuatro Ciénegas, [26°58' N, 101°52' W], (fl male), 14 Mar. 1941, **A.H. Schroeder 101** [GH] and: (fl, fr), 26 Mar. 1941 and 15 May 1941, **114** [GH 2×] and: (yfr), 24 Apr. 1941, **140** [GH]; – Monclova, 2000 ft., [26°54' N, 101°25' W], dry cliff, (fr), 5–7 Jul. 1939, **S.S. White 1736** [ECON, MICH], "small shrub"; – Mpio. de Candela, Cerros cercanos a Candela, aprox. 3 km al SE, 1900 m, 26°50' N, 101°20' W, [correct is: 26°50' N, 100°40' W], matorral espinoso de *Acacia rigidula*, *Acacia wrightii*, (fr), 26 Jun. 1989, **A. Rodríguez, M. Martínez & J. Manuel Sosa 1108** [MEXU]; – road from Monclova S to Saltillo, Sierra Gavia, 5 miles N of Saucillo, [ca. 26°22' N, 101°24' W], along canyon, (fr), 27–30 Aug. 1938, **I.M. Johnston 7220** [GH, LP], "shrub or tree 10–15 ft."; – Mpio. de Monclova, La Muralla, carr. Saltillo-Piedras Negras, [26°20' N, 101°22' W], lugares áridos y protegidos; sólo en lugares de arroyos y con algo de sombra; algunos cañones, (fl female), 9 Apr. 1980, **S.A. González Razgado s.n.** [MEXU]; – Mun. de Castaños, La Muralla, carr. 57, Saltillo-Monclova, 1000 m, [26°20' N, 101°22' W], matorral de *Acacia rigidula*, *Mimosa biuncifera*, *Leucophyllum*, *Vanuelinia heterodon*; suelo litosol, (fr), 15 May 1987, **A. Rodríguez 1075** [TEX]; – Mpio. de Castaños, Sierra la Gavia, Cañón la Gavia en el Rancho la Gavia, 1500 m, 26°20' N, 101°15' W, bosque de *Juglans* y *Quercus*, (fr), 10 Sep. 1987, **J.A. Villarreal & M.A. Carranza 4044** [MEXU]; – Hwy 57, 70 miles N of Saltillo, [ca. 26°15' N, 101°21' W], cactus-scrub area, (fr), 3 Jun. 1966, **J.S. Wilson 11441** [TEX],

WIS]; – Mun. Ramos Arizpe, Sierra de la Paila, El Cedral, 1300–1600 m, 26°02' N, 101°23' W, bosque esparcido de *Quercus glaucooides*, *Pinus arizonica*, *Juniperus flaccida*, (st), 16 Oct. 1986, **J.A. Villarreal, M.A. Carranza & A. Rodríguez 13564** [BRIT]; – Municipio de Ramos Arizpe, near Rancho San Francisco, [ca. 25°33' N, 100°57' W], in an arroyo bottom in the desert, (fr), 15 Jun. 1936, **F.L. Wynd & C.H. Mueller 96** [A, K, MEXU, MO, US, WIS n.s.]. – **Durango**, Bajada de Sierra Sarnoso [= Sierra del Sarnoso]. SE of Dinamita, ca. 3800 feet, [25°42' N, 103°38' W], desert scrub; limestone; growing along the arroyo. (old flower, fr), 5 Oct. 1972, **H.S. Gentry & R.G. Engard 23099** (added by hand: "6406") [MEXU], "small dense dark green tree" – **Nuevo León**, Lampazos, Rancho Resendez, [ca. 27°1' N, 100°31' W], (fr), 21 Jun. 1937, **M.T. Edwards 293** [F, GH n.s., MO, NA n.s., TEX, UC]; – Mun. Bustamante, Sierra Gomas, Bustamante Canyon, 650–1100 m, 26°33' N, 100°33' W, southern exposure in *Cordia*, *Mimosa*, *Acacia*, *Hechtia*. Candillilla, Lechuguilla-association, (fr), 12 Aug. 1988, **T.F. Patterson 6563** [TEX]; – Grutas de Bustamante, aprox. 5 km al SW de Bustamante, 700–1040 m, [26°30' N, 100°32' W], pendientes de 10% y 40%; veg. de matorral submontano (en la parte superior hay abundancia de encinos, pero sin constituir verdaderos bosques de encino); suelo de grosor variable, sumamente pedregoso; rendzinas, (fr), 1 Jul. 1982, **R. Sánchez Silva 203** [F, MEXU], "arbolito de 2,5 m; fruto verde, redondo"; – Sabinas Hidalgo, [26°30' N, 100°10' W], (fr), 9 Aug. 1940, **L.A. Kenoyer C28** [GH n.s., TEX]; – San Blas, 11 miles S of Sabinas Hidalgo, [26°26' N, 100°6' W], sparsely scattered on desert, (fr), 10 Aug. 1939, **C.H. Mueller 2634** [GH, LL, MICH, NA n.s., UC], "small tree up to 15 ft."; – head of Cañón de las Barretas [? barely legible], W of Icamole, [ca. 25°55' N, 100°43' W], crest of mountain, (st), 3 Feb. 1907, **W.E. Safford 1271** [US], "small tree white smooth stem"; – Monterrey, Chipinque Road, below pine zone on "M" ridge, [25°55' N, 100°23' W], (fr), Sep. 1961, **R.F. Smith M549** [TEX], "small tree with lichen covered bark (smooth)"; – near Salinas [= Salinas Victoria], [25°57' N, 100°17' W], (st female), 14–17 Oct. 1924, **C.R. Orcutt 1387** [DS]; – San Maria near Cerralvo, [ca. 25°59' N, 99°41' W], (fr), 28 May 1847, **A. Wislizenus 346** [MO], "middle-sized tree"; – W of Maria [= Santa Maria] near Monterrey, [25°44' N, 99°49' W], (yfr), 28 May 1847, **J. Gregg 806** [MO], "black, edible pleasant"; – W of Monterrey, [ca. 25°40' N, 100°30' W], (fr), 24 Jun. 1848, **J. Gregg 195** [MO]; – foothills of the Sierra Madre near Monterrey, [ca. 25°35' N, 100°25' W], (fr), 9 Jul. 1888, **C.G. Pringle 1885** [A n.s., BM, BR, E, F, G 4×, GH n.s., K, M, NA n.s., P 2×, PH, UC, UPS, US 2×, VT n.s. (photo: MEXU), W, WU, WU-Keck]; – 6 km E of Villa Juárez on Mexico 40, [25°39' N, 100°5' W], thorn-scrub pasture, on rd to river and gravel pit, (st), 19 Dec. 1990, **D. Seigler, J. Ebinger, H. Clarke & C. Gratton 13186** [MEXU, MO, NY], "shrub 2 m tall"; – gravel road S of Cadereyta, near Monterrey, [25°34' N, 100°1' W], thorn-scrub pasture, (st), 19 Dec. 1990, **D. Seigler, J. Ebinger, H. Clarke & C. Gratton 13182b** [MO, NY], "tree 2 m"; – Mun. Villa de Santiago, near Horsetail Falls [= Cascada Cola de Caballo], 2500 ft., [25°21' N, 100°9' W], (st), 3 Jul. 1941, **W.C. Leavenworth & Leavenworth 820** [F], "shrub 6 ft."; – Mun. Montemorelos, along road from Proterero Redondo [= Rotrero Redonda] to Dos Adjuntas, 1200 m, 25°16' N, 100°08' W, on dry southern exposed slope, on limestone, in chaparral, (fr), 10 Aug. 1988, **T.F. Patterson 6458** [TEX]; – Guajuco Cañón, El Cercado, ca. 30 miles S of Monterrey, [ca. 25°16' N, 100°6' W], sparse on openly wooded hillsides above the oxcart road, (fr), 10 Aug. 1934, **C.H. Mueller & M.T. Mueller 1322** [A, F, MICH, TEX], "flowers cream ivory"; – Guajuco, 27 miles SE of Monterrey, [ca. 25°16' N, 100°6' W], a mountainous section, (fl male, fr), 1–8 Mar. 1880, **E. Palmer 784** [G 2×, GH n.s., K, NA n.s., P, PH, US 2×, W, WU]; – Huajuco Cañón, 35 miles S of Monterrey, 3500 ft., [ca. 25°16' N, 100°6' W], (st), 29 Mar. 1954, **A.F. Wilson M-18** [F], "small tree"; – Mun. Montemorelos, Ojo de Agua, 432 m, [25°19' N, 99°39' W], bosque de galería, prim., (fl male), 2 Mar. 1988, **N. Tirado 128** [MEXU], "arbusto de 3 m, con flor blanca" and: (fl male), 5 Apr. 1988, **N. Tirado 41** [MEXU], "árbol de 3 m, con flor blanca"; – 1 mile above (W of) Iturbide on the Linares-Galeana highway, [24°43' N, 99°55' W], badly overgrazed pasture on calcareous gravel alluvium, (fr), 30 Sep. 1960, **J. Crutchfield & M.C. Johnston 5844** [MICH, TEX], "large shrub, scarce"; – 10 miles S Linares, [24°42' N, 99°34' W], thorn forest, (st), 21 Aug. 1948, **L.A. Kenoyer & Crum 3272** [GH], "shrub"; – "Walnut [barely legible!] Springs" near Monterrey [not located], grows from San Antonio de Bexar here, (st), 7 Feb. 1847, **J. Gregg 173** [MO], "small tree; wood white and fine grain; smooth whitish bark; berry pleasant, smaller but shape of persimon, and black"; – top hill Mirador, north side [not located], (fl male), 31 Mar. 1947, **M.M. Lacás 284** [F]. – **San Luis Potosí**, Mpio. de Guadalcázar, La Joya, Santo Domingo, 1300 m, [ca. 22°51' N, 100°17' W], matorral con Mesquite como dominante, (fr), 10 Jul. 1979, **H. Puig 6866** [MEXU], "arbusto de 1,5 m, escaso"; [cited in VILLARREAL QUINTANILLA et al. (2009): La Trinidad, Ejido Núñez, Guadalcázar, 1950 m, 22°40'06.2" N, 100°28'24.2" W, **O. Mares Arreola 785** [ANSM n.s.]]. **Tamaulipas**, Fracc. America, 8 miles S of N. Laredo [= Nuevo Laredo], [27°21' N, 99°31' W], in sandy silt, (defl female, yfr), 1 Mar. 1964, **E. Villanueva 49** [DUKE]; – 23.7 miles S of Nuevo Laredo on Highway 85,

[27°17' N, 99°36' W], dry scrubby semidesert area, (fr), 1 Jul. 1969, **R.E. Weaver Jr. 2001** [DUKE], "rare shrub 4 ft., fruits green"; – Mpio. Reynosa, 2 kms al E de Cd. Mier, en la carretera a Reynosa Tamps, 40 m, [26°25' N, 99°8' W], matorral espinoso, (st), 8 Feb. 1969, **F. González Medrano 2011** [MEXU], "arbusto 2 m"; – Carmargo [= Camargo], [26°19' N, 98°50' W], (fl female), 30 May 1904, **D. Griffiths 6496** [MO]; Matamoros, [ca. 25°50' N, 97°30' W], (yfr), Apr. 1836, **J.L. Berlandier 1530** [GH] and **3030** [G, GH, MO, P]; – 40 km al NW de San Carlos, camino a Burgos, 400 m, [24°55' N, 99°7' W], matorral alto subinerme: suelo pedregoso, (fr), 22 Aug. 1985, **J. Jimenez 302** [MEXU, MO], "árbol de 3 m con fruto verde y negro"; – Mun. San Carlos, 12 km del ejido El Gavilan hacia Burgos, 600 m, [24°48' N, 98°57' W], matorral alto subinerme, (flbuds), 4 Jun. 1986, **M. Yanez 846** [MO], "arbusto 2 m; fruto negro"; – Mun. San Carlos, Sierra de San Carlos, 18 km al NO de San Carlos camino a San Nicolás, 866 m, 24°43' N, 98°58' W, encinar con *Acacia*; bosque encino, (fr), 9 Aug. 1994, **J. Martínez & G. Martínez 214** [MEXU], "arbusto de 3 m: fruto negro"; – Mpio. San Nicolás, entre San Nicolás y el Rancho El Lantrisco [= El Antrisco], 650 m, [24°38' N, 98°50' W], (flbuds male), 10 Mar. 1970, **V.M. Toledo & F.G. Medrano 2803** [MEXU], "árbol de 3 m"; – Sierra de San Carlos, vicinity of San José, 2000 ft., [24°35' N, 98°55' W], (fr), 7 Jul. 1930, **H.H. Bartlett 10143** [F, GH, MICH, US], "small tree"; – 33 km al N de Jiménez, [24°30' N, 98°30' W], selva baja perennifolia, (st), Nov. 1963, **F. González Medrano 492** [MEXU], "árbol de 15 m"; – 7 miles N of Padilla, 400 yards from river, [ca. 24°7' N, 98°47' W], on upper dry fine sandy soil, (st), 11 Jun. 1951, **B. Hageat & W.P. Kerr 1088** [MICH], "tree ranging from 4–9' in height"; – 11 km después de la desv. al Chapote 16 km antes de la Derivadora de la Presa Vicente Guerrero, 200 m, [ca. 24°5' N, 98°40' W], matorral alto espinoso, alterado por pastoreo, (fr), 27 Jun. 1985, **M. Martínez 679** [CICY], "árbol 5 m; frutos verdes"; – 30 kms al NE de Soto la Marina, [23°58' N, 98°1' W], selva baja perennifolia, (st), Dec. 1964, **F. González Medrano 889** [MEXU], "árbol de 8 m"; – 6 miles W Victoria, [ca. 23°44' N, 99°15' W], oaks, (fr), 28 Aug. 1948, **L.A. Kenoyer & Crum 3363** [A]; – road to Jaumave, 6 miles SW of Ciudad Victoria, [23°40' N, 99°11' W], locally abundant on floor of rocky limestone canyon, (fr), 13 May 1949, **R. McVaugh 10537** [DUKE, K, MEXU, MICH, MO, TEX, US], "small tree; fruit green, globose, 1–1.5 cm diam. (?immature)"; – 20 km al SW de Cd. Victoria en el Ej. Altas Cumbres 4 km rumbo al Ej. Joya Verde, 950 m, [23°35' N, 99°12' W], matorral bajo subinerme; pendiente pronunciada, (fr), 4 Jun. 1985, **J. Jimenez 163** [MEXU, MO], "arbusto de 2,5 m con frutos verdes"; – Balcón del Chihue, 20 km al NE de Jaumave, 950 m, [23°32' N, 99°15' W], ladera a sotavento S.M. O. [?]; bosque bajo de latifoliadas, esclerofilas, (fr), 5 Sep. 1982, **F. González Medrano 12817** [MEXU 2×, TEX], "arbusto de 3 m"; – Mun. Villa de Casas, San Antonio el Grande, 500 m, [23°33' N, 98°31' W], (st), 9 Mar. 1969, **H. Puig 4072** [P]; – Cuesta de Angostura, 32 miles S of Cd. Victoria, [23°16' N, 99°8' W], shrub-grass basaltic mesa, (fr), 10 Aug. 1942, **H.S. Gentry 6702** [GH, RSA]; – Mun. Tula, 2 km W de Salitrillo, [23°9' N, 99°52' W], matorral mediano subinerme (*Larrea* y *Prosopis*), (yfr), 14 Dec. 1976, **F.G. Medrano, A. Castellanos & F. Guevara F. 10267** [UC], "arbusto 1,5 m, escaso; fruto verde"; – Mun. Gomez Farias, Cañón de la Servilleta, 4 km al W de la Charca o 1 km al S del ejido El Riachuelo, Rio La Chaca o Comandante, 22°51' N, 99°10' W, selva baja caducifolia, (fl male), 25 Mar. 1986, **L. Hernández S. & M. Martínez 1712** [TEX], "arbusto 1 m; flores blancas y botones"; – Mun. Gomez Farias, La Servilleta, 4 km al W de la Charca, 150 m, [ca. 22°51' N, 99°10' W], bosque tropical caducifolio, (fl male), 29 Apr. 1985, **M. Martínez 518** [CICY, MO], "árbol 4 m; flor blanca"; – Mpio. Ocampo, 2 km al N de Flores Magon, 420 m, [22°44' N, 99°25' W], bosque tropical caducifolio, en derrame basáltico, (fr), 9 May 1982, **L. Hernández 254** [CICY, MEXU], "árbol de 3 m, escaso"; – Mpio. Ocampo, 3 km NE de R. [= Ricardo] Flores Magon, 450 m, [22°44' N, 99°24' W], selva baja caducifolia, (st), Jan. 1970, **F. González Medrano, P. Torres G., V. Solis W. & M. Terrazas G. 3297** [MEXU, MO], "árbol de 4 m"; – San Jose [not located], (fr), 17 Feb. 1939, **H. LeSueur 342** [TEX]; – Buena Vista Hda [= Hazienda] [not located], (fr), 16 Jun. 1919, **E.O. Wootton s.n.** [US]; – Valley of Rio Grande, below Doñana [not located], (fr), s.d., **C.C. Parry, J.M. Bigelow, C. Wright & A. Schott 704** [US].

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Literature

- ACKERSON B.K. & HARVESON L.A., 2006: Characteristics of a ringtail (*Bassariscus astutus*) population in Trans Pecos, Texas. – *Texas J. Sci.* 58 (2): 169–184.
- ADAMS C.D., 1972: Flowering plants of Jamaica. – Mona, Jamaica: University of the West Indies.
- ANDELT W.F., KIE J.G., KNOWLTON F.F. & CARDWELL K., 1987: Variation in coyote diets associated with season and successional changes in vegetation. – *Journal of Wildlife Management* 51: 273–277.
- ANDERSON L.J., BRUMBAUGH M.S. & JACKSON R.B., 2001: Water and tree-understory interactions: a natural experiment in a savanna with oak wilt. – *Ecology* 82 (1): 33–49.
- ANKLI A., HEINRICH M., BORK P., WOLFRAM L., BAUERFEIND P., BRUN R., SCHMID C., WEISS C., BRUGGISSER R., GERTSCH J., WASESCHA M. & STICHER O., 2002: Yucatec Mayan medicinal plants: evaluation based on indigenous uses. – *Journal of Ethnopharmacology* 79: 43–52.
- ANONYMOUS, 2010: Texas big tree registry. – <http://texasforests-service.tamu.edu/> [consulted: 30 Oct. 2010].
- ASPREY G.F. & ROBBINS R.G., 1953: The vegetation of Jamaica. – *Ecol. Monogr.* 23: 359–412.
- ASPREY G.F. & LOVELESS A.R., 1958: The dry evergreen formations of Jamaica: II. The raised coral beaches of the north coast. – *J. Ecol.* 46: 547–570.
- AUKEN O.W., FORD A.L., STEIN A. & STEIN A.G., 1980: Woody vegetation of upland plant communities in the southern Edwards Plateau. – *Texas J. Sci.* 32: 23–35.
- BALDWIN J.T. & CULP R., 1942: Polyploidy in *Diospyros virginiana* L. – *Amer. J. Bot.* 28: 942–944.
- BARRERA M.A., BARRERA V.A. & LOPEZ F.R.M., 1976: Nomenclatura Etnobotánica Maya. – México, D. F.: Instituto Nacional de Antropología e Historia.
- BASKIN C.C. & BASKIN J.M., 1998: Seeds. Ecology, biogeography, and evolution of dormancy and germination. – San Diego, etc.: Academic Press.
- BLANKINSHIP J.W., 1907: *Plantae Lindheimerianae*. Part III. – *Annual Rep. Missouri Bot. Gard.* 18: 123–223.
- BORHIDI A., 1996: *Phytogeography and vegetation ecology of Cuba*. 2nd ed. – Budapest: Akadémiai Kiadó.
- BOVEY R.W., MEYER R.E. & BAIR J.R., 1981: Potential herbicides for brush control. – *J. Range Managem.* 34: 144–148. [not seen!]
- BRITTON N.L. & SHAFER J.A., 1908: *North American trees*. – New York: Henry Holt and Company.
- BUSH J.K. & VAN AUKEN O.W., 1984: Woody-species composition of the upper San Antonio River gallery forest. – *Texas J. Sci.* 36: 139–148.
- CAREY J.H., 1994: *Diospyros texana*. – In: *Fire effects information system*, (online). U.S. Depart-

- ment of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. – <http://www.fs.fed.us/database/feis/> [consulted: 30 Oct. 2010].
- CHAVEZ-RAMIREZ F. & SLACK R.D., 1993: Carnivore fruit-use and seed dispersal of two selected plant species of the Edwards Plateau, Texas. – *Southw. Naturalist* 38 (2): 141–145.
- D'ARCY W.G., 1970: Jacquin's names, some notes on their typification. – *Taxon* 19: 554–560.
- DAVID J.C., 2000: *Pseudocercospora kaki*. – *IMI Descriptions of Fungi and Bacteria* 144: 1431–1440 ("PS: Sheet No. 1439"). [not seen!]
- DE LOS ANGELES LA TORRE-CUADROS M. & ISLEBE G.A., 2003: Traditional ecological knowledge and use of vegetation in southeastern Mexico: a case study from Solferino, Quintana Roo. – *Biodiv. Cons.* 12 (12): 2455–2476.
- DE LOS ANGELES SÁNCHEZ-DZIB Y., SOSA-NÁJERA S. & DEL SOCORRO LOZANO-GARCÍA M., 2009: Morfología polínica de especies de la selva mediana subperennifolia en la cuenca del Río Candelaria, Campeche. – *Bol. Soc. Bot. México* 84: 83–104.
- DIGGS G.M., Jr., LIPSCOMB B.L. & O'KENNON R.J., 1999: Shinnery & Mahler's illustrated Flora of North Central Texas. – *Sida, Bot. Misc.* 16: 578–579.
- DUANGJAI S., WALLNÖFER B., SAMUEL R., MUNZINGER J. & CHASE M.W., 2006: Generic delimitation and relationships in Ebenaceae sensu lato: evidence from six plastid DNA regions. – *Amer. J. Bot.* 93 (12): 1808–1827.
- DUANGJAI S., SAMUEL R., MUNZINGER J., FOREST F., WALLNÖFER B., BARFUSS M.J.H., FISCHER G. & CHASE M.W., 2009: A multi-locus plastid phylogenetic analysis of the pantropical genus *Diospyros* (Ebenaceae), with an emphasis on the radiation and biogeographic origins of the New Caledonian endemic species. – *Molec. Phylogen. Evol.* 52: 602–620.
- DUKE J.A., 1965: Keys for the identification of seedlings of some prominent woody species in eight forest types in Puerto Rico. – *Ann. Missouri Bot. Gard.* 52: 314–350.
- DUKE J.A. & POLHILL R.M., 1981: Seedlings of Leguminosae. – In: POLHILL R.M. & RAVEN P.H. (eds.): *Advances in legume systematics* 2: 941–949. – Kew: Royal Botanic Gardens.
- ECKENWALDER J.E., 2009: Ebenaceae GÜRKE, Ebony family. – *Flora of North America north of Mexico* 8: 246–250. – New York and Oxford: Oxford University Press.
- ESTRADA J. & WALLNÖFER B., 2007: Ebenaceae. – In: DUNO DE STEFANO R., AYMARD G. & HUBER O. (eds.): *Catálogo anotado e ilustrado de la flora vascular de los Llanos de Venezuela*, p. 460. – Caracas: FUDENA - Fundación Empresas Polar - FIBV
- EVERITT J.H., 1984: Germination of Texas persimmon seed. – *J. Range Managem.* 37 (2): 189–192.
- EVERITT J.H. & ALANIZ M.A., 1981: Nutrient content of cactus and woody plant fruits eaten by birds and mammals in South Texas. – *Southw. Naturalist* 26: 301–306. [not seen!]
- FACCIOLA S., 1990: *Cornucopia. A source book of edible plants.* – Vista: Kampong Publications.
- GAERTNER C.F., 1807 ("1805"): *Supplementum Carpologiae.* – Leipzig: C. F. E. Richter.
- GONZALEZ RODRIGUEZ H., CANTU SILVA I., GOMEZ MEZA M.V. & RAMIREZ LOZANO R.G., 2004: Plant water relations of thornscrub shrub species, north-eastern Mexico. – *J. Arid. Environ.* 58 (4): 483–503. [not seen!]
- GRAY A., 1886: *Synoptical Flora of North America: The Gamopetalae.* 2nd edition – New York: Ivison, Blakeman, Taylor, and Company.
- HALLMAN G.J. & KNIGHT R.J. Jr., 1993: *Hypocala andremona* (Lepidoptera: Noctuidae) development on eight species of *Diospyros* (Ebenaceae). – *Florida Entomologist* 76: 461–465.
- HAMILTON W.J. Jr., 1946: The black persimmon as a summer food of the Texas armadillo. – *Journal of Mammalogy* 27: 175.

- HIERN W.P., 1873: A monograph of Ebenaceae. – Trans. Cambridge Philos. Soc. 12 (1): 27–300 (+ XI plates).
- HOLMGREN P.K. & HOLMGREN N.H., 1998–2010: Index Herbariorum. – New York Botanical Garden. – <http://sciweb.nybg.org/science2/IndexHerbariorum.asp>.
- JACQUIN N.J. von, 1798: Plantarum rariorum horti caesarei schoenbrunnensis: 3: 34 (tab. 312). – Vienna: C.F. Wappler.
- JIMÉNEZ-PÉREZ J., ALANÍS-RODRÍGUEZ E., AGUIRRE-CALDERÓN Ó., PANDO-MORENO M. & GONZÁLEZ-TAGLE M., 2009: Análisis sobre el efecto del uso del suelo en la diversidad estructural del matorral espinoso tamaulipeco. – Madera y bosques 15 (3): 5–20.
- JONES G.D., BRYANT V.M., LIEUX M.H., JONES S.D. & LINGREN P.D., 1995: Pollen of the South-eastern United States: with emphasis on melissopalynology and entomopalynology. – Contr. Ser. Amer. Assoc. Stratigr. Palynologists 30: 1–76 (+104 plates).
- KELLY D.L. & DICKINSON T.A., 1985: Local names for vascular plants in the John Crow mountains, Jamaica. – Economic Botany 39: 346–362.
- KENDALL R.O., 1976: Larval foodplants and life history notes for eight moths from Texas and Mexico. – Journal of the Lepidopterists' Society 30: 264–271.
- KITCHEN L.M., SCIFRES C.J. & MUTZ J.L., 1980: Susceptibility of selected woody plants to pelleted Picloram. – J. Range Managem. 33: 349–353. [not seen!]
- LIOGIER A.H., 1989: Ebenaceae. – La Flora de la Española 5: 278–284. – San Pedro de Macorís: Ediciones de la UCE.
- LITTLE E.L., Jr., 1953: Check List of native and naturalized trees of the United States (including Alaska). – Agric. Handb., U.S.D.A. 41.
- LITTLE E.L., Jr., 1976: Atlas of United States trees. Volume 3. Minor western hardwoods. – Misc. Publ. U.S.D.A. 1314.
- LITTLE E.L., Jr., 1979: Check List of United States trees. – Agric. Handb., U.S.D.A. 541.
- LOVELESS A.R. & ASPREY G.F., 1957: The dry evergreen formations of Jamaica: I. The limestone hills of the south coast. – J. Ecol. 45: 799–822.
- LOWDEN R.M., 1970: William A. Schipp's botanical explorations in the Stann Creek and Toledo Districts, British Honduras (1929–1935). – Taxon 19: 831–861.
- LUNAN J., 1814: Hortus Jamaicensis. – Jamaica: St. Jago de la Vega Gazette.
- LUNDELL C.L., 1937: The vegetation of Petén. – Publ. Carnegie Inst. Wash. 478.
- MARTÍNEZ M., 1978: Catálogo de nombres vulgares y científicos de plantas mexicanas. – México: Fondo de Cultura Económica.
- MCLAREN K.P., McDONALD M.A., HALL J.B. & HEALEY J.R., 2005: Predicting species response to disturbance from size class distributions of adults and saplings in a Jamaican tropical dry forest. – Pl. Ecol. 181: 69–84.
- MCLENDON T., 1991: Preliminary description of the vegetation of south Texas exclusive of coastal saline zones. – Texas J. S. 43: 13–32.
- MCVAUGH R., 1969: El itinerario y las colectas de Sessé y Mociño en México. – Bol. Soc. Bot. México 30: 137–142.
- MCVAUGH R., 1977: Botanical results of the Sessé & Mociño expedition (1787–1803). I. Summary of excursions and travels. – Contr. Univ. Michigan Herb. 11 (3): 97–195.
- MCVAUGH R., 1990: Botanical results of the Sessé & Mociño expedition (1787–1803). IV The library and the herbarium of the expedition. – Contr. Univ. Michigan Herb. 17: 183–214.

- MEYER R.E., 1974: Morphology and anatomy of Texas persimmon (*Diospyros texana* SCHEELE). – Texas Agricultural Experiment Station [Bulletin] B-1147: 1–55.
- MOERMAN D.E., 1998: Native American Ethnobotany: 1–927. – Portland: Timber Press.
- MOSCOSO R.M., 1943: Catalogus Florae Domingensis. – New York: L. & S. Printing Co.
- MULLER C.H., 1947: Vegetation and climate of Coahuila, Mexico. – Madroño 9: 33–57.
- NÁVAR J., 1993: The causes of stemflow variation in three semi-arid growing species of north-eastern Mexico. – Journal of Hydrology 145 (1–2): 175–190.
- NÁVAR J. & BRYAN R., 1990: Interception loss and rainfall redistribution by three semi-arid growing shrubs in northeastern Mexico. – Journal of Hydrology 115: 51–63.
- NÁVAR J., NÁJERA J. & JURADO E., 2001: Preliminary estimates of biomass growth in the Tamaulipan thornscrub in north-eastern Mexico. – J. Arid. Environ. 47 (3): 281–290. [not seen!]
- NÁVAR J., NÁJERA J. & JURADO E., 2002: Biomass estimation equations in the Tamaulipan thornscrub of north-eastern Mexico. – J. Arid. Environ. 52 (2): 167–179. [not seen!]
- NÁVAR J., MÉNDEZ E., NÁJERA A., GRACIANO J., DALE V. & PARRESOL B., 2004: Biomass equations for shrub species of Tamaulipan thornscrub of north-eastern Mexico. – J. Arid. Environ. 59: 657–674.
- NELSON J.A., BARNES P.W. & ARCHER S., 2002: Leaf demography and growth responses to altered resource availability in woody plants of contrasting leaf habit in a subtropical savanna. – Pl. Ecol. 160: 193–205.
- NG F.S.P., 1976: The fruits, seeds and seedlings of Malayan trees XII–XV – Malaysian Forester 39: 110–146.
- NG F.S.P., 1991: Manual of forest fruits, seeds and seedlings, 1: 61–62 and 319–327. – Kuala Lumpur: Forest Research Institute Malaysia. (Malayan Forest Record No. 34).
- NORTHUP B.K., ZITZER S.F., ARCHER S., MCMURTRY C.R. & BOUTTON T.W., 2005: Above-ground biomass and carbon and nitrogen content of woody species in a subtropical thornscrub parkland. – J. Arid. Environ. 62: 23–43.
- PANDO-MORENO M. & VILLALÓN-MENDOZA H., 2001: Potential agroforestry species identified in the Tamaulipan thornscrub of north-eastern Mexico. – Agroforestry Today 13 (1/2): 14–15.
- PARMENTIER P., 1892: Histologie comparée des Ébénacées dans ses rapports avec la morphologie et l'histoire généalogique de ces plantes. – Ann. Univ. Lyon 6 (2): 1–155.
- PLOWMAN R.D. & MUNSON R.H., 1983: Seed dormancy in Texas persimmon (*Diospyros texana* SCHEELE). – Plant Propagator 29 (4): 14–15. [not seen!]
- PORTER-BOLLAND L., 2001: Landscape ecology of apiculture in the Maya area of La Montaña, Campeche, México. – Dissertation at the University of Florida; 196 pp.
- PUNZO F., 2006: Plants whose flowers are utilized by adults of *Pepsis grossa* FABRICIUS (Hymenoptera: Pompilidae) as a source of nectar. – Journal of Hymenoptera Research 15: 171–176.
- RAMÍREZ R.G., GONZÁLEZ-RODRÍGUEZ H., RAMÍREZ-ORDUÑA R., CERRILLO-SOTO M.A. & JUÁREZ-REYES A.S., 2006: Seasonal trends of macro and micro minerals in 10 browse species that grow in northeastern Mexico. – Animal Feed Science and Technology 128 (1–2): 155–164. [not seen!]
- RUIZ J., FANDIÑO M.C. & CHAZDON R.L., 2005: Vegetation structure, composition, and species richness across a 56-year chronosequence of dry tropical forest on Providencia Island, Colombia. – Biotropica 37: 520–530.

- RUTHVEN D.C., III & KRAKAUER K.L., 2004: Vegetation response of a mesquite-mixed brush community to aeration. – *J. Range Managem.* 57 (1): 34–40.
- RUTHVEN D.C., III, BRADEN A.W., KNUTSON H.J., GALLAGHER J.F. & SYNATZSKE D.R., 2003: Woody vegetation response to various burning regimes in South Texas. – *J. Range Managem.* 56: 159–166.
- SANABRIA O.L., 1986: El uso y manejo forestal en la comunidad Xul, en el sur de Yucatán. *Etnoflora Yucatanense, Fascículo 2*: 1–191. – Xalapa: Instituto Nacional de Investigaciones sobre Recursos Bióticos.
- SAUGET J.S. & LIOGIER E.E., 1957: Flora de Cuba: vol. 4. – *Contr. Ocas. Mus. Hist. Nat. Colegio "De La Salle"* 16. – Reprint of 1974 (included in vol. 2): Koenigstein: Otto Koeltz Science Publishers.
- SAUVALLE F.A., 1873: Flora Cubana. Revisio catalogi grisebachiani vel index plantarum cubensium. – Havanae.
- SCIFRES C.J., 1975: Texas persimmon distribution and control with individual plant treatments. – Texas Agricultural Experiment Station [Bulletin] B-1157: 1–12. [not seen!]
- SCIFRES C.J., 1980: Brush management-principles and practices for Texas and the southwest. – Texas A&M Univ. Press, College Station, Texas. [not seen!]
- SCIFRES C.J., STUTH J.W. & BOVEY R.W., 1981: Control of oaks *Quercus*-spp and associated woody species on rangeland with Tebuthiuron. – *Weed Science* 29 (3): 270–275. [not seen!]
- SMALL J.K., 1903: Flora of the southeastern United States. – New York: Published by the Author.
- SOSA V., FLORES J.S., RICO-GRAY V., LIRA R. & ORTIZ J.J., 1985: Lista florística y sinonimia Maya. *Etnoflora Yucatanense, Fascículo 1*. – Xalapa: Instituto Nacional de Investigaciones sobre Recursos Bióticos.
- SPONGBERG S.A., 1977: Ebenaceae hardy in temperate North America. – *J. Arnold Arbor.* 58: 147–160.
- SPONGBERG S.A., 1979: Notes on persimmons, kakis, date plums, and chapotes. – *Arnoldia (Jamaica Plain)* 39 (5): 290–309.
- STANDLEY P.C., 1924: Diospyraceae. – In: *Trees and shrubs of Mexico*. – *Contr. U. S. Natl. Herb.* 23 (4): 1126–1129.
- STANDLEY P.C. & WILLIAMS L.O., 1966: Flora of Guatemala. – *Fieldiana, Bot.* 24 (8/1–2): 244–251.
- TAYLOR W.P., 1954: Food habits and notes on life history of the ring-tailed cat in Texas. – *Journal of Mammalogy* 35 (1): 55–63.
- THOMPSON R.S., ANDERSON K.H., BARTLEIN P.J. & SMITH S.A., 2001 ("2000"): Atlas of relations between climatic parameters and distributions of important trees and shrubs in North America. Additional Conifers, Hardwoods, and Monocots. – U.S. Geological Survey Professional Paper 1650-C. – Denver: U.S. Geological Survey.
- TISSERAT N.A., 1995: Use of *Acremonium dyospyri* [correct is *diospyri*] to control persimmon trees in pastures. – *Phytopathology* 85 (10): 1178.
- TOWELL D.E. & TEER J.G., 1977: Food habits of ringtails in the Edwards Plateau region of Texas. – *Journal of Mammalogy* 58: 660–663.
- TURNER B.L., NICHOLS H., DENNY G. & DORON O., 2003: Atlas of the vascular plants of Texas. – *Sida, Bot. Misc.* 24: 1–888.
- VAN AUKEN O.W. & BUSH J.K., 1987: Interspecific competition between *Prosopis glandulosa* TORR. (honey mesquite) and *Diospyros texana* SCHEELE (Texas persimmon). – *Amer. Midl. Naturalist* 118: 385–392.

- VAN AUKEN O.W. & BUSH J.K., 1992: *Diospyros texana* SCHEELE (Ebenaceae) seed germination and seedling light requirements. – Texas J. Sci. 44 (2): 167–174.
- VAN AUKEN O.W., FORD A.L. & STEIN A., 1979: A comparison of some woody upland and riparian plant communities of the southern Edwards Plateau. – Southw. Naturalist 24 (1): 165–180. [not seen!]
- VAN AUKEN O.W., FORD A.L. & ALLEN J.L., 1981: An ecological comparison of upland deciduous and evergreen forests of Central Texas. – Amer. J. Bot. 68: 1249–1256.
- VILLARREAL QUINTANILLA J.Á., CARRANZA-P. M.Á., ESTRADA-C. E. & RODRÍGUEZ-G. A., 2006: Flora riparia de los ríos Sabinas y San Rodrigo, Coahuila, México. – Acta Bot. Mex. 75: 1–20.
- VILLARREAL QUINTANILLA J.Á., MARES ARREOLA O., CORNEJO OVIEDO E. & CAPÓ ARTEAGA M.A., 2009: Estudio florístico de los piñonares de *Pinus pinceana* GORDON. – Acta Bot. Mex. 89: 87–124.
- VINES R.A., 1960: Trees, shrubs and woody vines of the southwest. – Austin: University of Texas Press.
- VINES R.A., 1984: Trees of Central Texas. – Austin: University of Texas Press.
- VORA R.S., 1989: Seed germination characteristics of selected native plants of the lower Rio Grande Valley, Texas. – J. Range Managem. 42: 36–40.
- VORA R.S., 1990: Plant communities of the Santa Ana National Wildlife Refuge, Texas. – Texas J. Sci. 42: 115–128.
- WALLNÖFER B., 1999: Neue *Diospyros*-Arten (Ebenaceae) aus Südamerika. – Ann. Naturhist. Mus. Wien, B, 101: 565–592.
- WALLNÖFER B., 2000: Neue *Diospyros*-Arten (Ebenaceae) aus Südamerika - II. – Ann. Naturhist. Mus. Wien, B, 102: 417–433.
- WALLNÖFER B., 2001a: The Biology and Systematics of Ebenaceae: a Review. – Ann. Naturhist. Mus. Wien, B, 103: 485–512.
- WALLNÖFER B., 2001b: Lectotypification of *Diospyros cayennensis* A.DC. (Ebenaceae). – Taxon 50: 887–889 [see Erratum in Taxon 50 (4): 1319].
- WALLNÖFER B., 2003a: A new species of *Diospyros* from southwestern Amazonia. – Ann. Naturhist. Mus. Wien, B, 104: 563–566.
- WALLNÖFER B., (2003b [submitted for publication]): Ebenaceae. – In: CARNEVALI FERNÁNDEZ-CONCHA G. et al. (eds.): Flora ilustrada de la Península de Yucatán. – Mérida (Yucatán).
- WALLNÖFER B., 2004a: A revision of *Lissocarpa* BENTH. (Ebenaceae subfam. Lissocarpoideae (GILG in ENGLER) B.WALLN.). – Ann. Naturhist. Mus. Wien, B, 105: 515–564.
- WALLNÖFER B., 2004b: Ebenaceae. – In: KUBITZKI K. (ed.): The families and genera of vascular plants, 6: 125–130. – Berlin, Heidelberg: Springer Verlag.
- WALLNÖFER B., 2004c: Lissocarpaceae. – In: KUBITZKI K. (ed.): The families and genera of vascular plants, 6: 236–238. – Berlin, Heidelberg: Springer Verlag.
- WALLNÖFER B., 2005: New species of *Diospyros* (Ebenaceae) from the Neotropics and additional information on *D. apeibacarpus*. – Ann. Naturhist. Mus. Wien, B, 106: 237–253.
- WALLNÖFER B., (2006 [submitted for publication]): Ebenaceae. – In: JÖRGENSEN P.M. et al. (eds.): Catalogue of vascular plants of Bolivia.
- WALLNÖFER B., 2007: A revision of neotropical *Diospyros* (Ebenaceae): part 1. – Ann. Naturhist. Mus. Wien, B, 108: 207–247.
- WALLNÖFER B., 2008a: Ebenaceae. – In: HOKCHE O., BERRY P.E. & HUBER O. (eds.): Nuevo

Catálogo de la Flora Vascular de Venezuela, pp. 356–357. – Caracas: Fundación Instituto Botánico de Venezuela Dr. Tobías Lasser.

- WALLNÖFER B., 2008b: Ebenaceae. – In: ZULOAGA F.O., MORRONE O. & BELGRANO M.J. (eds.): Catálogo de las Plantas Vasculares del Cono Sur. – Monogr. Syst. Bot. Missouri Bot. Gard. 107: 1987.
- WALLNÖFER B., 2009a: A revision of neotropical *Diospyros* (Ebenaceae): part 2. – Ann. Naturhist. Mus. Wien, B, 110: 173–211.
- WALLNÖFER B., (2009b [submitted for publication]): Ebenaceae. – In: BERNAL R. (ed.): Catálogo de las plantas de Colombia. – Instituto de Ciencias Naturales, Universidad Nacional de Colombia.
- WALLNÖFER B., 2010a: A revision of neotropical *Diospyros* (Ebenaceae): part 3. – Ann. Naturhist. Mus. Wien, B, 111: 101–133.
- WALLNÖFER B., 2010b: Ebenaceae. – In: FORZZA R.C. et al. (eds.): Catálogo de plantas e fungos do Brasil 2: 931–932. – Rio de Janeiro: Jardim Botânico do Rio de Janeiro.
- WALLNÖFER B., 2010c: Ebenaceae. – In: Lista de espécies da flora do Brasil. – Jardim Botânico do Rio de Janeiro. – <http://floradobrasil.jbrj.gov.br/2010/>.
- WALLNÖFER B. & MORI S.A., 2002: Ebenaceae. – In: MORI S.A., CREMERS G., GRACIE C.A., DE GRANVILLE J.-J., HEALD S.V., HOFF M. & MITCHELL J.D. (eds.): Guide to the vascular plants of central French Guiana. Part 2. Dicotyledons. – Mem. New York Bot. Gard. 76 (2): 254–257, pl. 50–51.
- WELTZ M.A., BLACKBURN W.H. & SIMANTON J.R., 1992: Leaf area ratios for selected rangeland plant species. – Great Basin Naturalist 52: 237–244.
- WHITE D.A. & HOOD C.S., 2004: Vegetation patterns and environmental gradients in tropical dry forests of the northern Yucatan Peninsula. – J. Veg. Sci. 15: 151–160.
- WHITEFOORD C. & KNAPP S., 2009: Ebenaceae. – In: DAVIDSE G. et al. (eds.): Flora Mesoamericana 4 (1): 611–616. – México, D.F.: Universidad Nacional Autónoma de México, etc. – see also: <http://www.mobot.org/mobot/fm/welcome.html>.
- WOOD C.E. & WOOD J.K., 1988: Woody vegetation of the Frio River riparian forest, Texas. – Texas J. Sci. 40: 309–321.
- WOOD C.E. & WOOD J.K., 1989: Riparian forests of the Leona and Sabinal Rivers. – Texas J. Sci. 41: 395–411.
- ZAMORA CRESCENCIO P., GARCÍA GIL G., FLORES GUIDO J.S. & JAVIER ORTIZ J., 2008: Estructura y composición florística de la selva mediana subcaducifolia en el sur del estado de Yucatán, México. – Polibotánica 26: 39–66.
- ZAMORA CRESCENCIO P., FLORES GUIDO J.S. & RUENES MORALES R., 2009: Flora útil y su manejo en el cono sur del Estado de Yucatán, México. – Polibotánica 28: 227–250.

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