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A revision of neotropical *Diospyros* (Ebenaceae): part 9

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Abstract

In the course of a revision of the New World Ebenaceae for "Flora Neotropica" and some regional floras, specimens from ca. 100 herbaria have been studied. The NW-Mexican species *Diospyros californica*, *D. intricata*, *D. sonorae* (synonym: *D. sinaloensis*), *D. sphaerantha* (synonym: *D. rosei*) and the new species *D. reinae* are here described in detail. Lectotypes for *D. californica* and *D. intricata* are selected. Figures, distribution maps, vernacular names, information on habitat and ecology, lists of specimens, and an identification key are included.

Key words: Ebenaceae, *Diospyros californica*, *D. c.* var. *tonsa*, *D. intricata*, *D. reinae*, *D. rosei*, *D. sinaloensis*, *D. sonorae*, *D. sphaerantha*, revision, taxonomy, distribution maps, Flora of Mexico.

Zusammenfassung

Im Rahmen einer Revision der neuweltlichen Ebenaceae für "Flora Neotropica" und einige Regionalfloren konnten Herbarbelege aus ca. 100 Herbarien studiert werden. Die NW-mexikanischen Arten *Diospyros californica*, *D. intricata*, *D. sonorae* (Synonym: *D. sinaloensis*), *D. sphaerantha* (Synonym: *D. rosei*), sowie die neue Art *D. reinae* werden eingehend beschrieben. Lectotypen für *D. californica* und *D. intricata* werden ausgewählt. Abbildungen, Verbreitungskarten, Volksnamen, Angaben zum Habitat und zur Ökologie, Listen der gesehenen Herbarbelege, sowie ein Bestimmungsschlüssel werden präsentiert.

Introduction

In the Americas, the Ebenaceae are represented by the genera *Diospyros*, with about 100–130 species, and *Lissocarpa* with eight species. In the course of an ongoing revision of Ebenaceae (Wallnöfer 2001a, 2001b, 2004a, 2004b, 2004c, 2007–2015, 2008a, 2008b, 2010a, 2010b, 2010c, 2012, 2015a, Wallnöfer & Chávez 2014, Wallnöfer & Mori 2002, Estrada & Wallnöfer 2007; see also Duangjai et al. 2006, 2009) for "Flora Neotropica", "Flora of Ecuador", "Flora of the Guianas", and "Flora de Paraguay" several new species have already been described (Wallnöfer 1999, 2000, 2003, 2005, 2015b).

Note: Additions are given in brackets; coordinates given in brackets were determined during this revision; acronyms of herbaria according to Thiers (2015); 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; s.lat. = sensu lato; s.str. = sensu stricto; 2× = 2 sheets.

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***Diospyros californica* (Brandegee) I.M.Johnst.**, Proc. Calif. Acad. Sc., Ser. 4, 12 (30): 1124 (1924); – [fig. 1–2, 5].

≡ *Diospyros texana* Scheele var. *californica* Brandegee, Zoe 5 (9): 164 (1903).

Typus: Mexico, Baja California Sur: Lower California, Cape Region, (fr), 1890–1893, **T.S. Brandegee s.n.** [lectotype (here designated): UC (photo NY: N.S. 6896 at FHO, NY)]; – syntypes: Lower California, El Taste and Saltillo, [ca. 23°42' N, 109°49' W], (fr), Sep. 1893, **T.S. Brandegee s.n.** [NY, UC]; – San Bernado [= Bernardo], [probably at: 23°38'37" N, 110°16'24" W], (fr), Sep. 1893, **T.S. Brandegee s.n.** [UC] (see below under var. *tonsa*).

Note: Brandegee (1903) indicated his var. *californica* to occur in the "Cape Region of Lower California", but unfortunately he did not cite any specimens. In his herbarium, now kept in UC, there is a single sheet with the three collections cited above (fig. 1). All of them are from the Cape Region and are regarded here as syntypes. The collection placed at the bottom bears on its label the word "Type", written in shaky handwriting, and thus, strongly differing in style compared to the other words. This word was either not written by Brandegee himself or it was added by him a long time (decades) later. Johnston (1924), however, obviously refers to it because he wrote: "Brandegee has indicated a tomentose specimen from the 'cape region' as the type of his *californica*". The leaves of the specimens at the top right side and those at the bottom are medium densely to densely covered with patent hairs on both sides and are thus quite similar. The specimen at the top left side differs in having leaves which are slightly larger and ± completely covered by felted efflorescences of fine crystal needles (probably consisting of naphthoquinones and their derivatives) concealing any indumentum. Very unfortunately, Johnston (1924) selected this specimen as the type of his var. *tonsa*: "The glabrate form, represented by his [Brandegee's] collection from San Bernardo, may be called *Diospyros californica* var. *tonsa*, n. var.". The specimen must have been seen by Johnston, although he did not annotate it. Two fruits and the seeds may have been assigned to the wrong twigs: the single fruit at the top left side seems to belong to one of the other two collections on the sheet, whereas the large fruit and the seeds in the capsule at the top right side may belong to the twig at the top left side (the type of var. *tonsa*). – The specimen from "El Taste and Saltillo" which is kept in NY (see above), consists of a mixture of three twigs which differ in their indumentum. The leaves of the twig on the right side are nearly glabrous and are not covered with a layer of efflorescences (crystal needles).

= *Diospyros californica* (Brandegee) I.M.Johnst. var. *tonsa* I.M.Johnst., Proc. Calif. Acad. Sc., Ser. 4, 12 (30): 1124 (1924); – [fig. 1].

Typus: Mexico, Baja California Sur: Lower California, San Bernado [= Bernardo], [probably at: 23°38'37" N, 110°16'24" W], (fr), Sep. 1893, **T.S. Brandegee s.n.** [holotype: UC (photo NY: N.S. 6896 at FHO)] (see above).

Small tree up to 9 m tall, deciduous (?) or semideciduous (Rebman & Arias 2852 only with young leaves); trunk up to ca. 0.75 m thick, and bark checked (Provance & Dominguez 7008); buds, twig apices and young twigs densely covered with appressed or spreading (on buds), or ± patent (on twigs), straight or flexuose, light or brownish hairs which ± persist on older twigs; **leaves** alternate, with brochidodrome venation; petioles (1–) 3–6 mm long, 1.5 mm thick, canaliculate adaxially, slightly winged laterally, covered with the same dense indumentum as on the young twigs; leaf scars often markedly

Fig. 1: Lectotype and syntypes of *Diospyros californica* (BRANDEGEE) I.M.JOHNST. [UC].

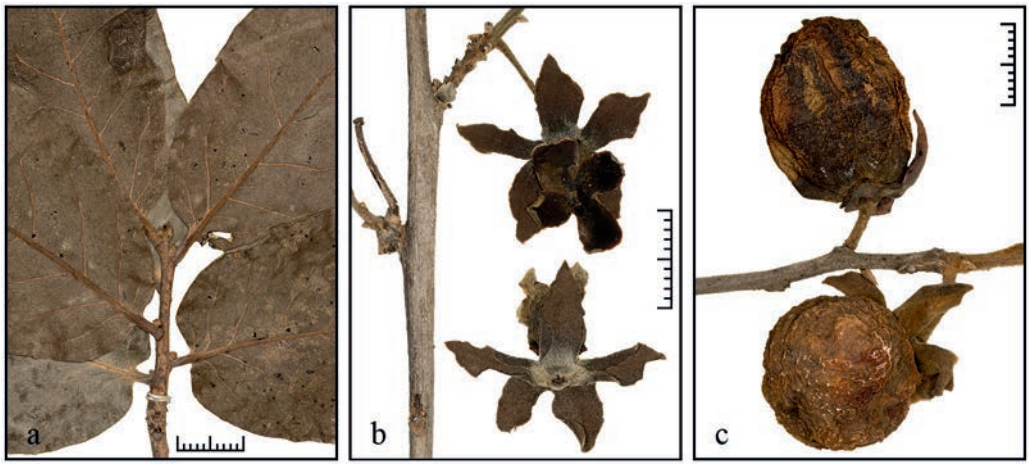

Fig. 2: *Diospyros californica*: a: leaves (from Wiggins et al. 455 [MICH]); – b: female flowers (from Rebman & Arias 2852 [RSA]); – c: fruits (from Brandegee s.n. [UC, lectotype]); – scale = 1 cm.

thickened and protruding; leaf lamina elliptic, less frequently broadly lanceolate, (2–) 3.5–7 (–10) cm long, (1.5–) 2–4 (–6) cm wide, 1.4–1.8 (–2.4) times longer than wide, widest at the middle, firmly chartaceous, scattered to medium densely covered with straight, stiff, patent, ca. 0.5 mm long hairs adaxially, scattered to densely covered with ± patent, straight or ± flexuose, often brownish, slightly longer hairs abaxially, at least partially glabrescent when older, dark green and shiny when alive (Wiggins et al. 455), dull on both sides when dry; leaf apex broadly rounded or obtuse, sometimes retuse; base of the lamina cordate or ± truncate, less frequently abruptly cuneate or broadly rounded (all this shapes often present on the same twig); leaf margins entire, ± revolute when dry; flachnectaria few, small, placed near the base on abaxial leaf surface, but missing on most leaves; midvein ± flat or slightly sunken adaxially, markedly prominent abaxially; secondary veins ca. 8 per side, usually slightly raised on both sides; tertiary and quaternary veins ± flat or slightly raised on both sides, often only hardly visible; **inflorescences**: female cymes (fig. 2b) 1-flowered, in the axil of caducous bracts, 1–2 arranged near the base of new long-shoots or apparently less frequently on short-shoots; stalk up to 1–15 mm long, 1 mm (distally 1.5 mm) thick, covered with the same dense indumentum as on young twigs; bracteoles up to 3 mm long, ca. 0.8 mm wide, densely hairy abaxially, soon caducous; flowers (4–) 5 (–6)-merous; male flowers not available; **female flowers** (Rebman & Arias 2852: with 5 calyx lobes and 4 petals; fig. 2b), ca. 7 mm long at anthesis (pedicels excluded and when sepals spreading); calyx up to ca. 20 mm wide (when lobes spreading), undivided in the proximal 2 mm and there densely covered with appressed or spreading, slightly flexuose hairs on the outside, ± glabrous inside; calyx lobes 10 mm long, 5 mm wide (at the base somewhat narrower), ± lanceolate, widest ± at the middle, acute, ± medium densely covered with appressed or spreading hairs abaxially and with patent, straight or slightly flexuose hairs adaxially, with a tuft of curled, light brown hairs at the apex; margins of lobes ± revolute when dry; corolla ca. 7 mm long at anthesis; tube 6 mm long, ca. 7 mm in diameter, widest below the middle, medium densely covered with short, light, spreading to patent hairs

on the outside, on the inside glabrous; throat widely open, ca. 4 mm wide; corolla lobes 5–6 mm long, 4–5 mm wide, broadly rounded (or truncate?) distally, on abaxial side densely covered with spreading to patent, longer hairs, glabrous adaxially; staminodia missing (only one corolla of Rebman & Arias 2852 examined); ovary 4-carpellate and 8-locular (but 5-carpellate ovaries could occur more frequently), 8 mm long (including stylodia), 4 mm wide, ± conical, densely covered with spreading, ± straight hairs; stylodia 4, exserted, 3 mm long, fused together in the proximal ⅓, medium densely hairy up to the middle, scattered hairy on abaxial side distally; stigmata widened; stalk of the **fruits** up to 15 mm long, 2 (distally 3) mm thick, densely covered with indumentum; fruits (fig. 2c) up to 10-seeded, ± globose, (according to Provance & Dominguez 7008: "often elongated, longitudinal constricted"), up to ca. 3 cm in diameter, green when unripe, becoming soft and brownish-black when ripe (Wiggins et al. 455), black, smooth and with tightly adhering epidermis when dry, medium densely covered with spreading to ± patent hairs when young, glabrescent except at the apex and base when mature, detaching with the calyx; fruit wall thin; pulp black and sweet (Wiggins et al. 455); calyx on fruits not increasing much, as a whole ca. 3 cm wide and 1.5 cm long; lobes usually flexed downwards, ca. 12 mm long, 5–7 mm wide (at the base somewhat narrower), their shape and indumentum as on female flowers, partially glabrescent abaxially when old, with longitudinal, slightly raised veins abaxially; seeds bean-shaped, 10–12 mm long, 7.5–9 mm wide, 4–5 mm thick, brownish-black when dry, subepidermally striate, encircled longitudinally by a slightly sunken, straight vascular strand.

Figures: twig with fruit of var. *tonsa* (WIGGINS 1980); several photos can be seen at http://bajaflora.org/. – The photo shown in ROBERTS (1989: 171) displays erroneously either *Randia armata* or *R. megacarpa* (Rubiaceae).

Distribution, habitat, and phenology: This species is endemic to the Sierra de la Laguna in the Cape Region of Baja California Sur (fig. 5), where it was reported from elevations up to 640 meters. It was collected in flower in August, and in fruit in February, March, August, September, November and December.

According to SHREVE & WIGGINS (1964), it grows along arroyos (streams), in rocky canyons, and on outwash slopes. It is a component of tropical dry forests and riparian communities, and has (with only one individual per hectare) a low population density (BRECEDA et al. 1997). BRANDEGEE (1894) noted: it is "not uncommon along the base of the mountains". ARRIAGA & LEÓN (1989) and LEÓN DE LA LUZ et al. (2012) did not list it among the dominant species in the area.

Mitchell C. Provance reported it from a "canyon, biennially flooded with white sandy-silty soils and riparian subtropical deciduous woodland of small trees, shrubs and some occasional oaks" (Provance & Dominguez 7008); a "densely vegetated steep hillside with subtropical semi-deciduous forest leading down a canyon with an ephemeral creek running through a sandy wash". He saw it repeatedly along arroyos (streams) and in canyons covered with subtropical deciduous (or semi-deciduous) woodland composed of small trees and shrubs, and he reported it once also from an "arroyo with sandy wash … with coastal scrub" (data partly quoted from http://swbiodiversity.org/seinet/collections/).

Habit and biology: ROBERTS (1989) noted: "these plants are often large trees in areas of sufficient rainfall or runoff; otherwise they may be shrubs". BRANDEGEE stated in 1894:

"The leaves are two or three inches long and vary on different trees from glabrous to tomentose; the fruit about an inch in diameter is black when ripe and very pleasant to the taste" and in 1903: "A small tree 4–6 m high; leaves 6–7 cm long, glabrous or pubescent, rounded or cuneate at base, sometimes retuse at apex; fruit 2–3 cm in diameter. The leaves are very variable in shape and pubescence". JOHNSTON (1924) gave the following information: "The peninsular material consists of a glabrate form and one that is brownish with a dense villous indumentum".

According to Mitchell C. Provance (data quoted from http://swbiodiversity.org/seinet/collections/), the trees have the capability to develop root sprouts and new shoots at the base of the trunk. He noted on his collection 8059-C [specimen not seen in the course of this revision]: "Many individuals [are] reproducing vegetatively from the base of the trunk or perhaps more commonly from underground roots or roots exposed by erosion of covering soils. These plants [are] sometimes coming up 5–10 meters away from what is suspected to be the source tree" [= the "mother tree"]. According to him, the main trunk and branches are (at least sometimes) dark gray to nearly black, and the bark is tessellate to smooth. The bark of branches and root sprouts is light to dark gray, and smooth. The corolla is cream to white, dark purple-brown inside, and the calyx is green. The fruits are globose, and at first "lime green and astringent, later cinnamon brown slightly softer and both sweet and astringent, and finally, very dark brown, soft, sweet, and depending on the tree, either with or completely without any remnant astringency. The flavor of the better fruits [is] reminiscent of honey and date". According to him, some fruits display 12 locules and develop sometimes only 2–3 seeds. Opossums are said to be very fond of the fruits. – According to PROVANCE (2006), pollinators are probably nocturnal moths.

Vernacular names and use: it is called guayparín (BRANDEGEE 1894, ROBERTS 1989, BRECEDA et al. 1997, RODRÍGUEZ-RODRÍGUEZ 2003, Carter & Chisaki 3467, Martínez 22 and s.n.). The fruits are edible (ROBERTS 1989, Martínez s.n.). The wood is of good quality (Martínez s.n.), and is used for posts and as fuel (BRECEDA et al. 1997).

The ancient tribes inhabiting the area may have taken the species in cultivation and may have selected and bred varieties with larger, less hairy leaves, and with larger fruits containing abundant fruit pulp. This seems to apply to what was called var. *tonsa*. It cannot be excluded that the ancient tribes may have crossed it with *D. sonorae* (see below) for better fruits.

This species was also included in a genetic analysis carried out by PROVANCE et al. (2013) and in a panbiogeographic analysis made by GARCÍA DÍAZ et al. (2015).

Specimens examined: **Mexico**, Baja California Sur, La Paz, [ca. 24°10' N, 110°20' W], (fr), 4 Feb. 1928, **M.E. Jones 24456** [RSA]; – 17.5 miles SE of La Paz on road to Los Planes, ca. 2100 feet, near 24° N, 110° W [24°2' N, 110°7' W], broad arroyo near crest of hills; associated plants: *Acacia farnesiana*, *Fouquieria peninsularis*, *Franseria ambrosioides*, *Jatropha cinerea*, *Lysiloma microphylla*, *Pachycereus pecten-aboriginum*, (fr), 10 Dec. 1959, **I.L. Wiggins et al. 455** [DS, MEXU, MICH, UC], "tree 3–4 m tall; crown rounded; foliage dark green, shiny; ripe fruits, brownish-black; pulp black and sweet; seeds in three fruits 3, 8, and 10"; – Sierra de La Laguna, 8 miles from Mex. Rte. 1 on the road to San Antonio de la Sierra, 1.2 miles S of Rancho Las Termopilas, 23°41' N, 109°58' W, with *Quercus*, *Ambrosia ambrosioides*, *Pachycereus pecten-aboriginum*, *Opuntia tapona*, *O.* aff. *pumila*, *Croton* and *Cnidoscolus*, (fl female), 8 Aug. 1994, **J.P. Rebman & S. Arias 2852** [ASU n.s. (dig. photo), RSA], "small tree"; – Mpio. La Paz, foothills of the Sierra Lagunita, West Cape, W [correct is probably: SSE] of Santa Gertrudis, ca. 22 km NE of Todos Santos, 503 m, 23°31' N, 110°5' W [?], canyon, biennially flooded with white sandy-silty soils and riparian subtropical deciduous woodland of small trees, shrubs and some occasional oaks; associated with

Sideroxylon occidentale, *Gouania rosei*, *Celosia floribunda*, *Quercus brandegeei* and *Q. tuberculata*, (fr), 18 Dec. 2002, **M.C. Provance & C. Dominguez Gonzales 7008** [UCR n.s., W], "tree ca. 30 ft. tall; trunk ca. 0.75 m, checked; fruits often elongated, longitudinal constricted; calyces curved distally"; – Laguna Mts., [ca. 23°30' N, 109°59' W], (fr), 2 Mar. 1928, **M.E. Jones 24455** [NA n.s., NY]; – Infiernito 30 km E of Todos Santos, [23°27' N, 110°1' W], (fr), 17 Aug. 1944, **M. Martínez 22** [F]; – El Infiernito, Estribaciones de la Sierra de La Laguna (sheet 2: Estribaciones occidentales de la Sierra de La Laguna), [ca. 23°30' N, 110°5' W], (fr), 18 Aug. 1944, **M. Martínez s.n.** [MEXU 2×], "arbolillo de 6 m"; – west side of Cape Region mountains, vicinity of Rancho San Vicente, ca. 630 m, 23°11' N, 110°1' W, foothills, (fr), 7 Nov. 1955, **A. Carter & F. Chisaki 3467** [BM, MEXU, MICH, UC], "tree ca. 8 m tall".

***Diospyros intricata* (A.GRAY) STANDL.**, Publ. Carnegie Inst. Wash. 461 (4): 80 (1935); – [fig. 3–5].

≡ *Macreightia intricata* A.GRAY, Proc. Amer. Acad. Arts 5: 163–164 (1862) [concerning the date of publication compare STAFLEU & COWAN (1976: entry 2123)].

≡ *Maba intricata* (A.GRAY) HIERN, Trans. Cambridge Philos. Soc. 12 (1): 126 (1873).

Typus: Mexico, Baja California Sur: Lower California, Cape San Lucas and vicinity, [22°52' N, 109°54' W], (fr), Aug. 1859–Jan. 1860, **L.J. Xanthus 68** [lectotype: US (here designated; see also GRAY 1862: 153), isolectotypes: GH (photo at DS), K, NY, P].

Shrub or rarely a small tree up to 5.5 m tall, semideciduous (Carter & Dempster 5852) or possibly tardily deciduous (Moran 4160), often divaricately branched (with angles of 60–90°), developing long- and short-shoots; bark gray or whitish, smooth (according to SHREVE & WIGGINS 1964: pale gray, or reddish brown on young twigs); buds, twig apices and young leaves densely covered with indumentum; young twigs with longitudinal ridges, often brown or reddish-brown when young and dry, scattered to medium densely covered with appressed to spreading, straight or slightly flexuose hairs of different length; older twigs often gray, with shallow, longitudinal, brown fissures; **leaves** alternate, with brochidodrome venation; petioles 1 mm long, 0.8 mm thick, covered with the same indumentum as that on the young twigs; leaf lamina obovate, (0.3–) 1–2.5 (–4.1) cm long, (0.3–) 0.5–1.5 (–2.3) cm wide (the larger leaves on long-shoots), (1–) 1.5–2.9 (–3.5) times longer than wide, widest above the middle, firmly chartaceous or coriaceous, sometimes uneven due to subepidermal stone cell granules, scattered to medium densely covered with hairs of different length on both sides when mature (hairs on adaxial side straight or slightly flexuose, appressed or spreading, sometimes ± patent, on abaxial side appressed and ± straight), partially glabrescent (especially adaxially) when very old, dull and often ± gray on both sides, often with irregular reddish-brown patches adaxially when dry; leaf apex broadly rounded or ± slightly retuse; base of the lamina cuneate; leaf margins entire, ± thickened, ± flat or revolute when dry; flachnectaria minute, few (1–3), displayed abaxially in the central part of the lamina, but missing on many leaves; midvein on adaxial side slightly raised proximally, ± flat distally, on abaxial side markedly prominent; secondary veins ca. 5 per side (the proximal veins often slightly arcuate and much longer than the distal, more arcuate ones), flat or slightly raised, often hardly visible on both sides; tertiary and quaternary veins hardly visible; **inflorescences**: male cymes 1 (–4)-flowered, placed in the axil of caducous bracts or of leaves, up to 10 well-spaced along the proximal part of new shoots (e.g., Dominguez 476), stalks (peduncles and pedicels) 4 (–6) mm long and ca. 0.5 mm thick, covered with the same indumentum as that on young twigs; pedicels of the lateral flowers up to 2 mm long; female cymes 1-flowered (fig. 4c–d), ± clustered at the base of new, quite

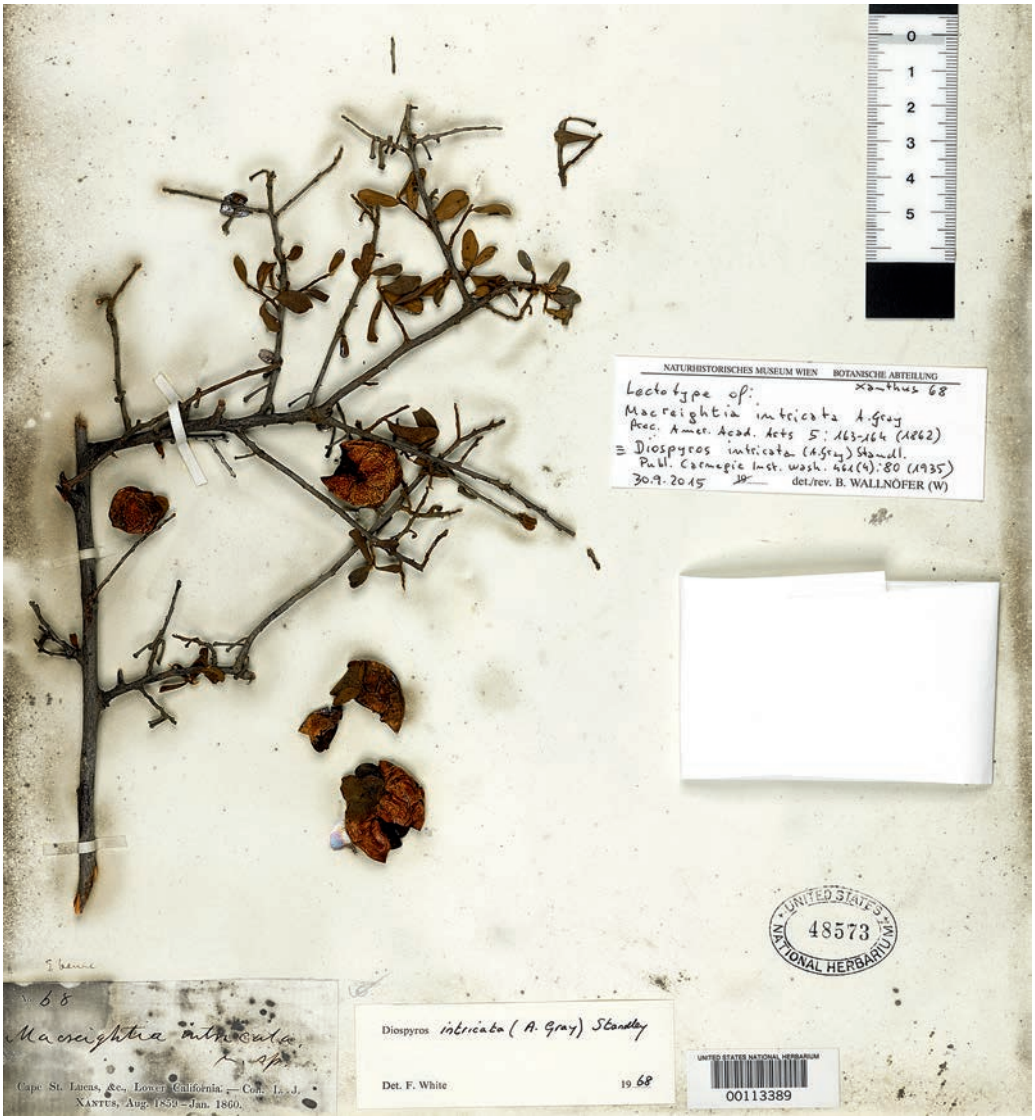

Fig. 3: Lectotype of *Diospyros intricata* (A.GRAY) STANDL. [US].

short shoots; stalks up to 8 (–12) mm long and 0.8–1.5 mm thick (enlarged distally), with the same indumentum as above; bracteoles of male and female flowers 1.8 (–3) mm long, 0.5–1.5 mm wide, obtuse, densely hairy abaxially, glabrous or scattered hairy especially along the margins adaxially, soon caducous; **flowers** 3 (–4)-merous, cream or creamy-yellow, fragrant (Carter & Dempster 5852); male flowers (Moran 4150, Johnston 4054, fig. 4b) 5–7 mm long at anthesis (pedicels excluded); calyx 3.5–4 mm long and 3.5–5 mm wide, undivided in the proximal 2 mm, ± densely covered with appressed to slightly spreading, slightly flexuose hairs on the outside, glabrous near the base inside; calyx lobes 1.2–2 mm long, 1.5–2.5 mm wide, ± triangular, acute or obtuse, with flat

or slightly revolute margins, densely covered with spreading, flexuose hairs adaxially; corolla cream-colored when alive (Moran 4150), 5–6 mm long, densely covered with spreading, thick, straight or slightly flexuose, long hairs and with much smaller, thin hairs (often concealed by the longer ones) on the outside, glabrous inside; tube 4–5 mm long, slightly constricted at the base and apex, widest ± at or a little above the middle and there 2–2.5 mm in diameter; throat 1 mm wide; corolla lobes 2–3 mm long and 1.5–2.5 mm wide, elliptic or ± semicircular, acute, obtuse or broadly rounded, abaxially covered with the same indumentum as that on the tube, but hairs towards the margins shorter and thinner, glabrous adaxially; stamens 6, or 8 (two flowers of Johnston 4054), or 9 (two flowers of Moran 4150), ± of the same size, 4–4.5 mm long, usually glabrous (rarely with few, straight, appressed, long hairs on the connective abaxially); filaments 1.5–2 mm long and ca. 0.2 mm wide, adnate to the corolla tube 0.5–1 mm above its base; anthers 2–2.3 mm long and 0.8 mm wide, widest proximally, tapering into a 0.3 mm long conical connective appendage distally; rudiment of the ovary subglobose, 1.5 mm long, 1 mm in diameter, with three longitudinal grooves (impressions of the filaments), densely hairy, lacking stylodia; **female flowers** (Carter & Dempster 5852, Moran 4160; fig. 4c–d) 7–9 mm long at anthesis (pedicels excluded); calyx 6 mm long and ca. 7 mm wide (when lobes ± spreading), undivided in the proximal 2.5–3 mm, medium densely covered with appressed or slightly spreading, ± straight hairs of different length on the outside (less densely hairy on the margins of lobes); calyx lobes 2.5–3 mm long, 4–5 mm wide, widest at the base, adaxially ± densely covered with spreading, ± flexuose hairs; apices ± broadly rounded and sometimes abruptly narrowed into a small tip bearing a dense tuft of hairs; margins ± revolute; corolla 5.5–8 mm long at anthesis (when lobes erect), densely covered with the same indumentum as that on the outside of the male flowers, glabrous inside; tube 3–5 mm long, 2.5–3 mm in diameter, widest at or below the middle; throat slightly constricted, 1–1,5 mm wide; corolla lobes 2–3 mm long, 1.8–2 mm wide, widest below the middle, obtuse to acute distally, densely hairy abaxially, glabrous adaxially; staminodia 3 (only two anthetic flower dissected: Moran 4160 and 7318; the first with larger and the second with smaller flowers), episepalous, 3.8–5 mm long, glabrous; filaments 2–3 mm long, adnate up to their apex (Moran 7318) or only in the lower ⅔ (Moran 4160) to the corolla tube; antherodes 1.8–2 mm long, 0.6–0.8 mm wide, free, lanceolate, narrowed into a long tip distally; ovary 3-carpellate, 6-locular, 4–5 mm long (including stylodia), ca. 2.5 mm in diameter, gradually narrowed into the stylodia, densely covered with appressed, long hairs; stylodia 3, exserted, fused together in the proximal half, 2 mm long, ± densely covered with shorter hairs; stigmata widened; stalk of the **fruits** 2–7 (–11) mm long, 1–1.5 (–2) mm thick, ± densely hairy; fruits (fig. 4e–f) up to 6-seeded, globose or depressed globose, up to 1.5–2 cm in diameter, changing color from green to greenish yellow when immature, yellowish-brown (amber) and sweet (according to M.C. Provance) or orange (STANDLEY 1924) when mature and alive, light or darker brown when dry, smooth and with tightly adhering epidermis when dry, medium densely covered with appressed or spreading hairs when young, glabrescent except at the apex and base when mature, detaching with the calyx; fruit wall thin but firm; calyx on fruits dish-shaped, up to 14 mm in diameter and 4 mm high, undivided in the proximal 4 mm, abaxially with a ring-like elevated structure at the base, medium densely covered with appressed or slightly spreading, slightly flexuose hairs of different length on the outside and on both sides of the lobes, inside densely covered with appressed, centrifugally orientated, ± straight, long hairs near the base; lobes up

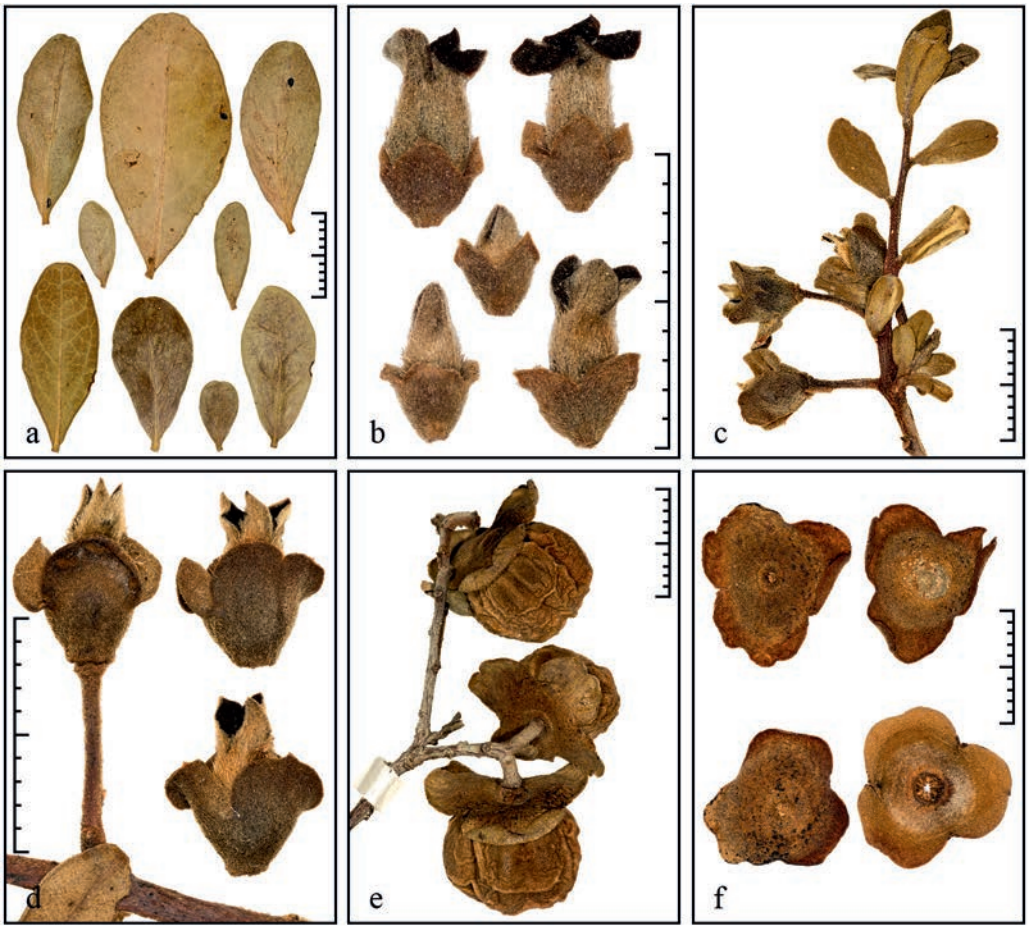

Fig. 4: *Diospyros intricata*: a: leaves, – b: male flowers, – c: female flowers (a–c from Carter & Dempster 5852 [UC]); – d: female flowers (from Moran 4160 [UC]); – e: fruits (from Moran 19051 [MICH]); – f: calyces of fruits (bottom right side: adaxial side of a calyx; from Brandegee 356 [GH]); – scale = 1 cm.

to 4–7 mm long, 8–9 mm wide, spreading or ± flexed downwards, broadly rounded, truncate or retuse, rarely obtuse, with ± revolute margins; seeds ± bean-shaped, usually flattened on the adaxial side (± ellipsoidal when only few seeds per fruit), 7–9 mm long, 5–6.5 mm wide, 4–5 mm thick, red when alive, dark brownish when dry, slightly foveolate.

Figures: twigs with fruits (Wiggins 1980); several photos can be seen at http://bajaflora.org/.

Distribution, habitat, habit, and phenology: This species is endemic to the coastal area in the Cape Region (including the adjacent island of Cerralvo) of Baja California Sur (fig. 5), where it grows from sea level up to elevations of 300 meters. It was collected in flower in May and June (once also in September), and in fruit from August to April (with a mean peak in December).

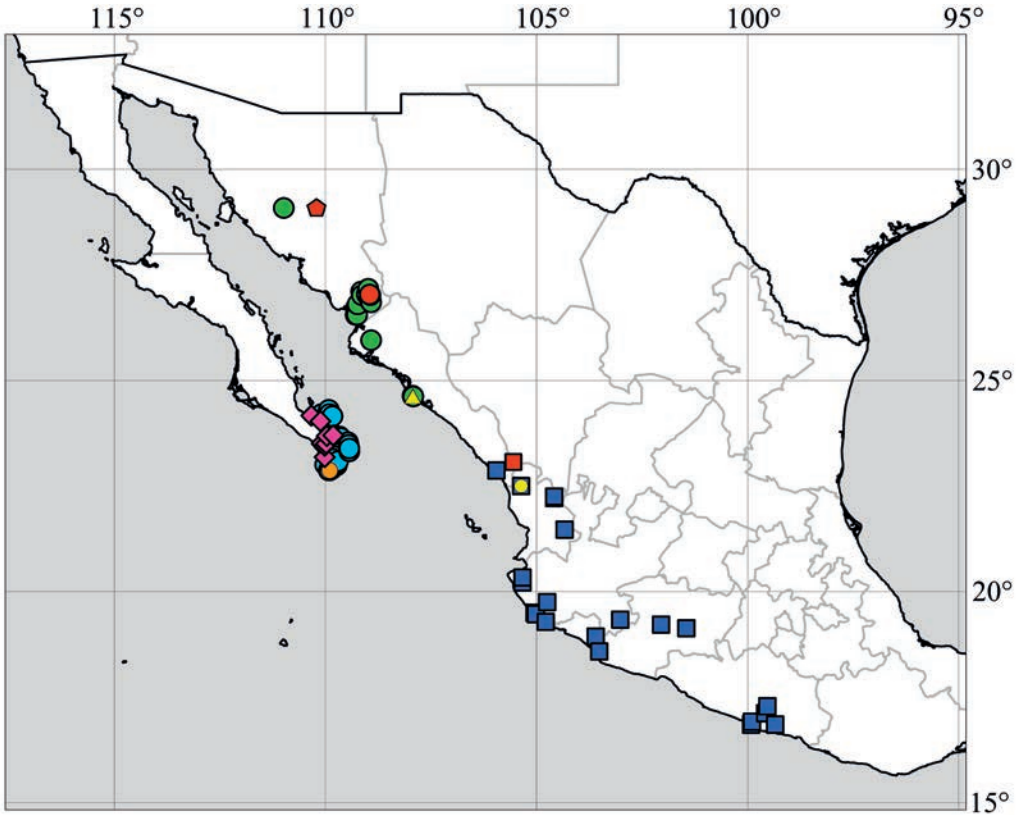

Fig. 5: Distribution of *Diospyros californica* (◆), *D. intricata* (●; type locality: ●), *D. reinae* (⬟), *D. sonorae* (●; type locality: ●; type locality of *D. sinaloensis*: △), *D. sphaerantha* (■; type locality: ■; type locality of *D. rosei*: ●).

According to SHREVE & WIGGINS (1964), it grows on rocky slopes, cliffs, and canyon walls. Collectors found it in the following places: "granite sand beach", "on dunes at base of granitic cliffs", on "sandy flats with dense thorny scrub 10–15 ft. high with *Bursera*, *Jatropha*, *Pachycereus*, *Macherocereus*, etc.", on "sandy soil in dense thickets of *Acacia*, *Bursera*, *Jatropha* & *Krawinskia* with cacti", on slopes covered with "matorral xerofilo", in "thorn forest, associated with: *Cercidium peninsulare*, *Cyrtocarpa edulis*, *Jatropha cinerea*, *Olneya tessota*", on a "wall of canyon near ocean", in "matorrales costeros", and within "desert scrub on white gravelly soil".

JOHNSTON (1924) noted the following: "On Ceralbo Island [= Isla Cerralvo] this plant is the prevailing and characteristic shrub along the cliffs and on the steep slopes near or facing the shore. While most abundant along the shore it is not confined there, for at El Mastrador [= El Mostrador] it extends inland along a steep canyon wall for a half kilometer. The plant is a dense, pale-barked shrub 3–25 dm high and 1–2 m broad. When growing in exposed situations it assumes a flat-topped, hedge-like habit, but when sheltered it forms a comparatively loose growth and has a rounded crown. The ground

beneath the plant is deeply covered with old leaves. The fruit seems to be a rich reddish brown and is glabrous when mature; it appears to be relished by rodents." – According to Shreve & Wiggins (1964), it is a "dense, rounded or flat-topped shrub 1–3 m tall and often nearly as broad".

This species was also included in the panbiogeographic analysis of García Díaz et al. (2015).

Vernacular names and use: it is called guayparín (Martínez 1979, Roberts 1989, Rodríguez-Rodríguez 2003), sapotilla (Peters 205, 220), or zapotillo (Standley 1924, Martínez 1979, Roberts 1989).

According to information gathered by Mitchell C. Provance (see for this http://swbiodiversity.org/seinet/collections/), the fruits are good to eat when ripe, but the wood is too soft to be useful. Many different animals are eating the fruits, especially bobcats, coyotes, foxes and several species of birds. The birds tear the fruit open without removing them from the bush, thus leaving the fruit skins hanging on the twigs.

Specimens examined: **Mexico**, Baja California Sur, Gulf of California, Isla Cerralvo, Arroyo Aguaje, 20 m, 24°18' N, 100°55' W, (defl female), 15 Apr. 1962, **R. Moran 9490** [MICH], "shrub 2 m"; – same island: El Mastrador [= Mostrador], [24°14' N, 109°56' W], on wall of canyon near ocean, (fl male, fr), 8 Jun. 1921, **I.M. Johnston 4054** [A, CAS, DS 2×, F, GH, K, MO, NY, UC, US, W], "common shrub 3–8 ft. high, stems several pallid, top close and rounded"; – same island: Ruffo's Ranch, [24°12' N, 109°54' W], on cliffs and steep slopes facing sea, (flbuds male + female, fr), 7 Jun. 1921, **I.M. Johnston 4048** [A, CAS, F, GH, K, MO, NY, UC], "prevailing shrub forming hedge-like growths 1–6 ft. high"; –Ruffo's Ranch, ca. 24°12' N, 109°54' W, growing on edge of arroyo under a Palo Blanco, (fr), 24 Oct.–9 Nov. 1961, **M. Soule 17** [DS], "8' shrub"; – arroyo 0.25 miles N of Ruffo Ranch, W side of Isla Cerralvo, [24°12' N, 109°54' W], (defl male), 16 Apr. 1962, **I.L. Wiggins 17735** [DS], "shrub 1–1.5 m"; – arroyo leading eastward from old Ruffo Ranch, ca. 24° N, 110° W [24°12' N, 109°54' W], (fr), 16 Apr. 1962, **I.L. Wiggins 17751** [DS]; – S end of Cerralvo Island, 24°09' N, 109°50' W, (defl male), 3 Apr. 1952, **R. Moran 3604** [DS, UC], "dense shrub to 2.5 m; no odor"; – beach at Las Cruces, 37 km SE [NE!] of La Paz, [24°12' N, 110°5' W], granite sand beach, (fr), 12 Dec. 1947, **A. Carter et al. 2156** [DS, F, FHO (fragm.), GH, K (+ carp.), LL, UC, US], "shrub up to 1.8 m tall and as broad, densely divaricately branched"; – margin of landing strip in arroyo at Las Cruces, 200 m from Gulf, [24°12' N, 110°5' W], (fr), 17 Dec. 1958, **I.L. Wiggins 14388** [CAS, DS, K, UC], "dense, stiff shrub about 2.4 m tall, with some slender, straggly branches"; – ca. a San Juan de Los Planes, Bes. [?], 300 m, [23°58' N, 109°56' W], matorral xerófilo; ladera, (fl male), 26 Jun. 1987, **R. Domínguez 476** [UC], "árbol; abundancia baja"; – Mun. San Antonio, 4.1 miles SE of Puente El Saltillo, 4.3 miles NW of turnoff to Los Barriles on Hwy 1, 200 m, [23°41' N, 109°45' W], growing in road cut; desert scrub with *Bursera*, *Parkinsonia*, *Indigofera*, *Mimosa*, *Cnidoscolus*; white gravelly soil, (fr), 3 Sep. 1985, **M. Luckow et al. 2860** [TEX], "small shrub 0.5 m; locally common"; – Cape District, Distr. of Buena Vista, Arroyo La Cienaga, 350', [ca. 23°40' N, 109°40' W], associated with *Lysiloma candida*, *Karwinskia humboldtiana*, *Esenbeckia flava*, *Adelia virgata*, *Colubrina glabra*, and *Bursera microphylla*, (fr), 21 Apr. 1948, **R.E.K. Peters 205** [NY, UC], "densely spreading shrub ca. 9 ft. tall"; – 3 miles (by road) NW of La Ribera, 75 ft., [23°38' N, 109°38' W], thorn forest; assoc.: *Cercidium peninsulare*, *Cyrtocarpa edulis*, *Jatropha cinerea*, *Olneya tesota*, (fr), 12 Oct. 1964, **J.R. Hastings & R.M. Turner 64-266** [DS]; – Rincon, 8.7 km (by road) SE of La Ribera, between Punta Arena and Cabo Pulmo, 5–150 ft., ca. 23°30' N, 109°25' W [correct seems to be: 23°32' N, 109°28' W], sandy flats behind the beach with dense thorny scrub 10–15 ft. high with *Bursera*, *Jatropha*, *Pachycereus*, *Machaerocereus*, and etc., (fr), 13 Dec. 1982, **A.C. Sanders et al. 3344** [ASU n.s. (dig. photo), TEX], "common shrub 5–6 ft. high"; – Gulf coast at Las Barracas, [23°28' N, 109°27' W], sandy soil in dense thickets of *Acacia*, *Bursera*, *Jatropha* & *Karwinskia* with cacti, (fr), 21 Feb. 1947, **L. Constance 3178** [DS, F, GH, K, LL, MICH, MO, NY, UC, US], "small white-barked shrub 2–5 ft. high; fruit green, globose"; – beach area at Cabo Los Frailes, 23°23' N, 109°26' W, (fl male), 13 May 1992, **J.P. Rebman et al. 1370** [ASU n.s. (dig. photo), DES n.s. (dig. photo)], "flower cream"; – Distr. of Los Frailes, El Salado Arroyo, 30' alt., [ca. 23°19' N, 109°26' W], associated with *Bursera microphylla*, *Forchhammeria*

watsonii and *Esenbeckia flava*, (defl male), 30 Apr. 1948, **R.E.K. Peters 220** [UC], "small tree ca. 18 ft. high"; – San Lázaro Cañón, 100 m, near 23°8' N, 109°48' W, north facing cliff at canon mouth, (fl female), 2 May 1959, **R.V. Moran 7318** [CAS, DS, GH n.s., MEXU], "shrub 2 m tall; flowers cream"; – San José del Cabo, [23°5' N, 109°42' W], (fl female, fr), 2 Sep. 1890, **T.S. Brandegee 356** [UC]; – same locality: (fr), 15 Sep. 1899, **T.S. Brandegee s.n.** [NY, UC]; – same locality: (fr), Jan.–Mar. 1902, **C.A. Purpus 247** [MO]; – same locality: (fr), 19 Jan. 1928, **M.E. Jones 24401** [RSA 2×]; – same locality: (st), 25 Mar. 1911, **J.N. Rose 16472** [NY, US]; – hillside along western side of landing strip at La Palmilla, 23°00' N, 109°44' W [23°2' N, 109°44' W], (fr), 27 Sep. 1959, **I.L. Wiggins 15028** [DS, MEXU], "shrubs to 3 m tall"; – arroyo 11 km SW San José del Cabo, [22°59' N, 109°44' W], *Lysiloma*, *Bursera* and *Pachycereus* association, (fr), 18 Dec. 1947, **A. Carter et al. 2283** [DS, GH, K, MO, UC], "rounded shrub or tree 2.4–3 m tall; bark smooth, gray"; – El Tule near Cape San Lucas, [22°58' N, 109°48' W], (fr), 28 Oct. 1941, **F.F. Gander 9735** [CAS]; – 13 km al NE de Cabo de San Lucas, sobre la carretera a San José del Cabo, 50 m, [22°56' N, 109°49' W], matorrales costeros, (fr), 5 Nov. 1978, **J.R. Rzedowski 35995** [MEXU], "arbusto 1,5 m"; – Cabeza Ballena [ca. 22°54' N, 109°51' W], (defl male), 3 Mar. 1937, **P.J. Rempel 55** [RSA]; – N side La Vigia, Cape San Lucas, 22°52' N, 109°54' W, (fl female), 20 May 1952, **R. Moran 4160** [DS, UC], "shrub 1 m"; – S of La Vigia, 22°52' N, 109°54' W, (fl male), 19 May 1952, **R. Moran 4150** [BM, DS, RSA, UC 2×, US], "shrub 2 m high, dense; sepals 3, thick; petals 3, united 1/2, cream-colored; stamens about 9"; – Cabo San Lucas, ca. 5 m, 22°52' N, 109°54' W, on dunes at base of granitic cliffs south of cannery, (fl male + female), 31 May 1974, **A. Carter & L. Dempster 5852** [BM, MICH, NY, RSA, UC], "shrub 0.75 m tall, 2 m across; flowers creamy-yellow, fragrant"; – Cabo San Lucas, 22°52' N, 109°55' W, sandy roadside above the beach, (fr), 9 Nov. 1971, **R. Moran 19051** [MICH (+ carp.), RSA], "shrub 3/4 m"; – same locality: (fr), 18 Mar. 1892, **T.S. Brandegee 356** [F, GH 2×, PH]; – same locality: (defl male and/or fr), 6 Aug. 1932, **J.T. Howell 10608** [A n.s., CAS, DS, F, NY, UC, US]; – from El Saccaton [correct is: El Sacatón, see GOLDMAN 1951: 32, 49] to Cape San Lucas, 20–500 ft., [ca. 23°0' N, 110°0' W], (fr), 29 Dec. 1905, **E.W. Nelson & E.A. Goldman 7371** [US]; – Cape Region, (fl male), 1901, **C. Grabendorffer s.n.** [UC].

Diospyros reinae **B.WALLN.**, Stapfia 103: 111–112 (2015); – [fig. 5–9].

Typus: Mexico, Sonora, Sierra Huérfana (= Mazatán), Municipio de Ures, Tinaja la Piedra Gacha, Cañada el Yuguito, 2.1 km WNW of Rancho el Bachán, 10.1 km NNW of Mazatán, 1223 m, 29°6'17" N, 110°12'39" W, oak woodland/foothills thornscrub transition; in rocky granitic canyon bottom, (fl male), 28 Jul. 2014, **A.L. Reina-G., S. Jacobs & R.A. Villa 2014-284** [holotype: W, isotypes: ARIZ n.s., USON n.s., in total 5 duplicates], "shrub 2–4 m".

Shrub 2–4 m, apparently evergreen (judging from photos taken by Sky Jacobs); bark of the younger trunks gray, smooth, that of the older ones scaly; buds and young twigs densely covered with spreading or ± patent, slightly flexuose, light hairs which persist on older twigs; **leaves** alternate, with brochidodrome venation; petioles 1–1.5 (–2) mm long, 0.8–1 mm thick, canaliculate adaxially, covered with the same dense indumentum as on the young twigs; leaf lamina obovate or elliptic, (1–) 1.5–3.5 (–5.2) cm long, (0.8–) 1–2.2 cm wide, 1.3–2.4 (–3.25) times longer than wide, widest above or at the middle, firmly chartaceous, with scattered, patent, stiff hairs on both sides, ± concolorous, slightly shiny adaxially when mature and dull abaxially when dry; leaf apex obtuse or rounded, sometimes retuse, rarely emarginate; base of the lamina abruptly cuneate; leaf margins entire or slightly revolute; flachnectaria 1–2 (–4) on abaxial leaf surface, but missing on many leaves; midvein on adaxial side ± flat or slightly sunken proximally, slightly raised distally, on abaxial side markedly prominent, medium densely covered with patent hairs on both sides; secondary veins ca. 6 per side, raised on both sides; tertiary and quaternary veins raised adaxially but less strongly abaxially; **inflorescences**: male

Fig. 6: Holotype of *Diospyros reinae* B.WALLN. [W].

cymes (fig. 7b, 9) 1-flowered, placed in the axil of caducous bracts, up to five clustered on new, much reduced, leafless short-shoots or at the base of new, leafy long-shoots; stalk (peduncle and pedicel) up to 12 mm long, 0.8 mm thick, covered with the same dense indumentum as on the twigs; bracteoles ca. 1 mm long and 0.3 mm wide, densely hairy, soon caducous; male **flowers** (Reina et al. 2014-284; fig. 7b–c, 9) 5 (–6)-merous,

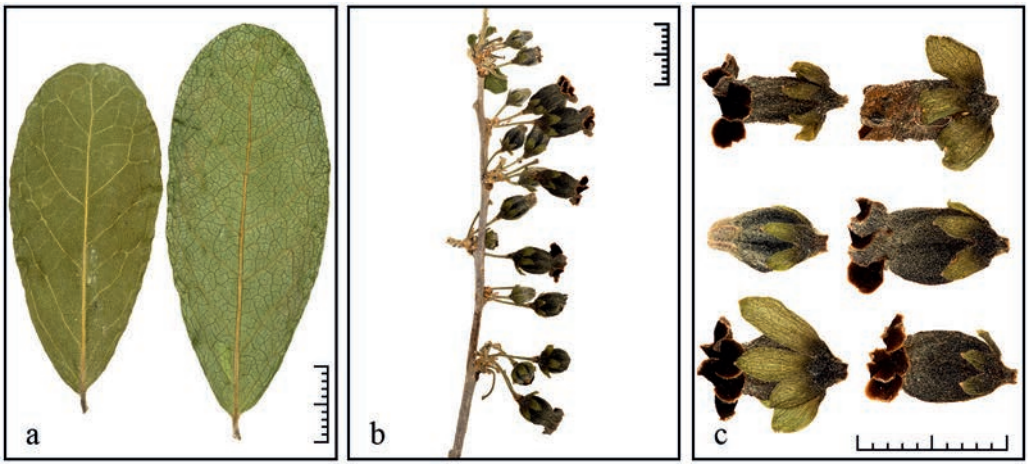

Fig. 7: *Diospyros reinae*: a: leaves (adaxial surface right side, abaxial surface left side), – b: male inflorescences, – c: male flowers (all from Reina-G. et al. 2014-284 [W, holotype]); – scale = 1 cm.

8–9 mm long at anthesis (pedicels excluded and with lobes flexed downwards), hanging when alive; calyx 5 (–7) mm long and 5 (–10) mm wide, undivided in the proximal 1–1.5 mm, scattered to medium densely covered with spreading or ± patent hairs on the outside, only with very few hairs inside; calyx lobes 2–4 (–6.5) mm long, 1.5–2.5 (–3.5) mm wide, often irregular in size and shape on the same flower, widest usually at the base, but sometimes also at or above the middle, obtuse or acute, less frequently rounded, always with a light brown tuft of entangled hairs at the apex, with flat margins; corolla ca. 8 mm long; tube 7–8 mm long, widest below the middle and there ca. 4 mm in diameter, greenish-yellow at anthesis when alive, medium densely covered with straight to flexuose, appressed to spreading, short, light hairs on the outside, inside in the proximal half scattered to medium densely covered with tiny, ± patent hairs, glabrous distally; throat slightly constricted, ca. 2 mm wide; corolla lobes 3 mm long and wide, yellowish-white (shortly before abscission becoming at least partially orange) and strongly flexed out- and downward at anthesis when alive, broadly rounded and retuse or often longitudinally split at the apex, ± densely covered with longer hairs abaxially, glabrous adaxially; stamens 20, usually in pairs, strongly differing in length: the inner 3, the outer up to 5 mm long; filaments 2–2.5 mm long, adnate to the corolla tube except for the distal ca. 0.5 mm, medium densely covered with patent, tiny hairs; anthers 2–2.8 mm long and 0.8 mm wide proximally, tapering distally, glabrous but markedly papillose; rudiment of the ovary consisting of an irregular, densely hairy lump of tissue lacking stylodia; **female flowers** and **fruits** not available.

Note: *Diospyros reinae* is closely related to *D. californica*. There is a gap of ca. 550 km (including the Gulf of California) between the distribution ranges of both species. As female flowers and fruits are unknown, further examination and comparison is necessary.

Distribution, habitat and phenology: This species is endemic to the Sierra Huérfana (= Sierra de Mazatán) which is located in the central part of the Sonoran federal state (fig. 5).

Fig. 8: *Diospyros reinae* B.WALLN.: top: habitat (tree on left side is *D. reinae*), bottom: male flowers; – photos: courtesy of Sky Jacobs (Tucson, USA).

Fig. 9: *Diospyros reinae* B.WALLN.: male flowers and leaves; – photos: courtesy of Sky Jacobs (Tucson, USA).

According to Tom Van Devender (Tucson, USA; information sent by email on 29th April 2015), the Sierra Huerfana is an isolated "sky island mountain range" immediately east of the Sonoran Desert. It is covered by isolated oak woodlands and at lower elevations by widespread foothills thornscrub. *D. reinae* grows there at 1223–1280 m elevation in areas with only ca. 350 mm rainfall per year. It was collected in flower at the end of April and the end of July.

Etymology: The translation of the Spanish name "reina" is queen. Tom Van Devender (Tucson, USA) who sent me the two duplicates, stated via email on 29th April 2015: "All of the people were on the July trip, but only Ana Lilia Reina-Guerrero (my wife), Sky Jacobs, and Robert A. Villa hiked down into the canyon that day. We knew it was there because we have seen it sterile several times in the past".

Specimens examined: **Mexico**, Sonora, Sierra Huérfana (= Mazatán), Municipio de Ures, Cañada el Yuguito, 1.3 km WNW of Rancho El Bachán, 12.5 km NW of Mazatán, 1280 m, 29°6'1" N, 110°12'9" W, rocky granitic canyon bottom oak woodland; in arroyo bottom, (fl male), 29 Apr. 2014, **T.R. Van Devender et al. 2014-258** [ARIZ n.s., USON n.s., W], "solitary shrub 2.0 m".

The following specimens seem also to belong here: Sierra de Mazatán, Municipio de Ures, Rancho El Flauta, Cañada El Flauta, 1260 m, 29°6' N, 110°12'50" W, open oak woodland; Catalina gneiss, 9 Oct. 2004, **A.L. Reina-G. et al. 2004-1313** [ARIZ n.s.], "uncommon shrub 2 m"; – same area: 1260 m, on gneiss; in canyon bottom; open oak woodland, 9 Apr. 2004, **L. Hahn & A. Flesch 4-100** [NMC n.s.], "shrub 1.5 m"; – for both see: http://swbiodiversity.org/seinet/collections.

Diospyros sonorae **Standl.**, Contr. U. S. Natl. Herb. 18 (3): 120 (1916); – [fig. 5, 10–12].

Typus: Mexico, Sonora, Alamos, [27°2' N, 108°57' W], (fr), 27 Dec. 1898, **E.A. Goldman 276** [holotype: US (photo NY: N.S. 6897 at FHO, NY), isotype: GH].

= *Diospyros sinaloensis* Blake, Contr. Gray Herb. 52: 77–78 (1917).

Typus: Mexico, Sinaloa, Altata, [24°38' N, 107°56' W], (fl male), 15 Jun. 1897, **J.N. Rose 1339** [holotype: US (photo NY: N.S. 6898 at FHO, NY), isotypes: GH, NY], "shrub 10 ft. high; seven stems; trunk 6 in. in diameter".

Treelet or tree up to 15 (–20) m tall (already flowering when 3.3 m tall), straight-boled (Yetman et al. 2000), with dense, usually rounded crowns (Felger et al. 2001) or with a spreading habit (Yetman et al. 2000), semideciduous (completely deciduous only in very dry years); dbh of the trunk up to 0.7 m (Felger et al. 2001: trunk ca. 1 m in diameter); bark black (Rose et al. 12842) or dark brown and checkered (Felger et al. 90-655); twig apices and buds medium densely covered with ± appressed or slightly spreading hairs; young twigs subterete, bearing sometimes also minute, translucent, patent hairs (e.g., Gentry et al. 19345), soon glabrescent; **leaves** alternate, with brochidodrome venation, sometimes partially covered with a ± dense layer (efflorescences) of fine crystal needles; petioles (1.5–) 2–3 (–4) mm long, 1.5–1.8 mm thick, ± flat adaxially, slightly winged distally, covered with scattered ± appressed, short hairs, ± glabrescent on mature leaves; leaf scars often markedly thickened and protruding; leaf lamina obovate, less frequently elliptic, rarely broadly lanceolate or ± oblong, (1–) 4–12 (–13) cm long, (0.9–) 1.5–5 (–6.5) cm wide, (1–) 2–2.5 (–4.2) times longer than wide, widest above the middle, rarely at the middle, firmly chartaceous, with scattered, appressed hairs on both sides when young, soon glabrescent, dark green (Gentry et al. 19345) or glossy green (Felger et al. 2001) adaxially, dull abaxially when alive, often characteristically greenish-gray and with lighter venation when mature and dry, dull on both sides; leaf apex obtuse or rounded, rarely retuse; base of the lamina rounded, abruptly cuneate, sometimes truncate or slightly cordate; leaf margins entire, ± flat; flachnectaria few, rarely up to ca. 10 on abaxial leaf surface, usually arranged near the base but some scattered in the proximal 2/3 of the lamina; midvein on adaxial side slightly sunken or sometimes ± flat proximally, ± flat distally, on abaxial side markedly prominent; secondary veins 6–8 per side, raised adaxially, strongly raised abaxially; tertiary and quaternary veins raised on both sides; **inflorescences**: male cymes (fig. 12b) 1-flowered, placed in the axil of caducous bracts, up to 7 clustered on new, usually much reduced, leafless short-shoots; stalk (peduncle and pedicel) 4–7 (–12) mm long, 0.5 mm thick, medium to densely hairy; female cymes (fig. 12c–d) 1 (–2)-flowered, up to 4 arranged near the base of new long-shoots in the axil of leaves or less frequently in the axil of caducous bracts; stalk up to 9 (–13) mm long, 1 mm thick (enlarged distally), ± medium densely hairy; bracteoles of male and female flowers 1–2 (–3) mm long, ca. 0.5 mm wide, hairy abaxially, glabrous adaxially, soon caducous; **flowers** (4–) 5-merous; male flowers (Rose 1339, the type of *D. sinaloensis*, fig. 12b) 8–9 mm long at anthesis (pedicels excluded and with lobes flexed downwards), hanging (Blake 1917); calyx (3–) 4–5 mm long and ca. 5 mm wide, undivided in the proximal 1–1.5 mm and there scattered to medium densely hairy on the outside; calyx lobes 1–4 mm long and 1–2.5 mm wide, ± triangular, less frequently semielliptic, often irregular in size and shape on the same flower, widest at the base, rarely at the middle, acute or obtuse, with a tuft of hairs at the apex, with flat or sometimes slightly revolute

Fig. 10: Holotype of *Diospyros sonorae* STANDL. [US].

Fig. 11: Holotype of *Diospyros sinaloensis* BLAKE [US].

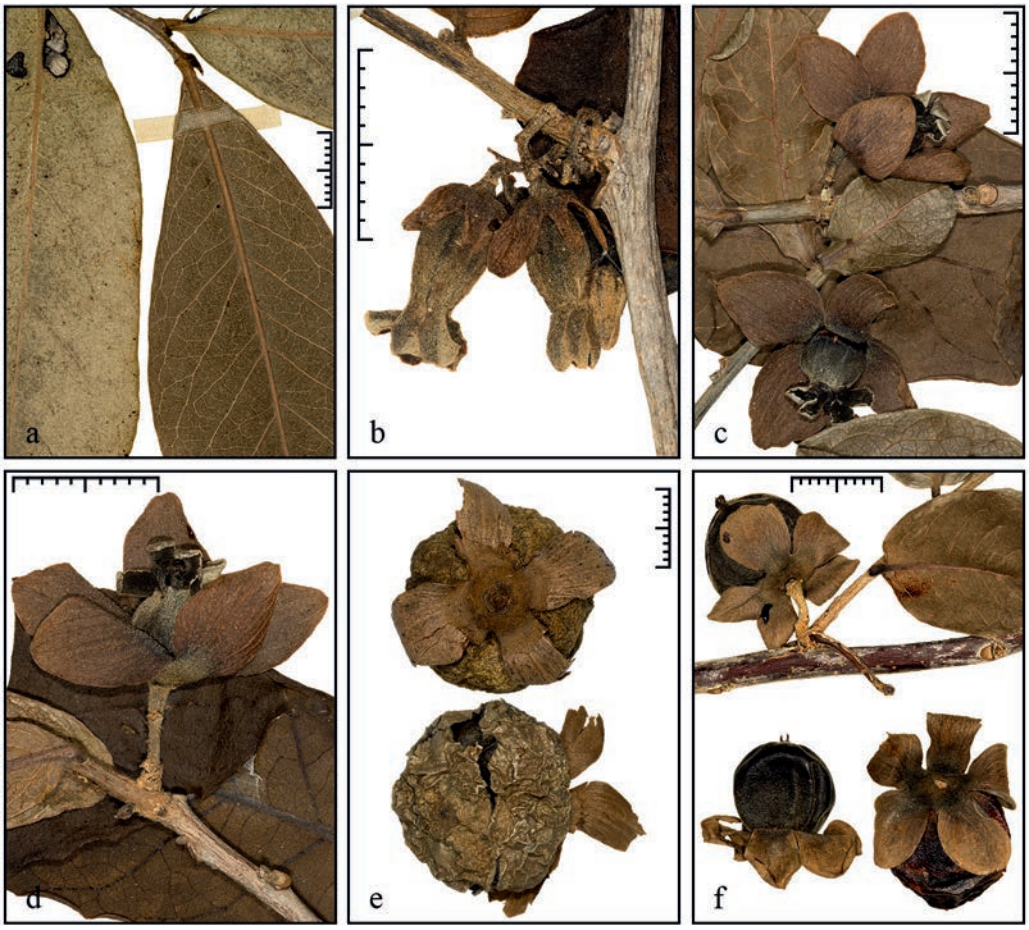

Fig. 12: *Diospyros sonorae*: a: leaves (adaxial surface left side, abaxial surface right side; from Goldman 276 [GH, isotype]); – b: male flowers (from Rose 1339 [US, holotype of *D. sinaloensis*)]; – c–d: female flowers (from Henrickson 1582 [c: E, d: RSA]); – e: fruits (from Goldman 276 [US, holotype]); – f: fruits (from Gentry 2263 [A]); – scale = 1 cm.

margins, scattered hairy on both sides; corolla white (Gonzalez Ortega 5480) or cream (MARTIN et al. 1998) when alive, ca. 7 mm long; tube 6 mm long, widest at or below the middle and there 2.5–3 mm in diameter, ± densely covered with ± spreading, short hairs of different length on the outside (glabrous near base), inside in the proximal half scattered to medium densely covered with tiny, ± patent hairs, glabrous distally; throat slightly constricted, ca. 2 mm wide; corolla lobes 3 mm long and ca. 2–3 mm wide, broadly rounded distally, densely, appressed hairy abaxially, glabrous adaxially; stamens 19 (20, according to BLAKE 1917), usually in pairs, strongly differing in length: the inner 4, the outer up to 7.5 mm long; filaments 2–4.5 mm long, adnate to the corolla tube except for the distal 0.3–0.8 mm, scattered covered with patent, tiny hairs; anthers 2.5–3 mm long and 1 mm wide proximally, tapering distally, glabrous and ± smooth; rudiment of the ovary consisting of an irregular, densely hairy lump of tissue lacking

stylodia; **female flowers** (fig. 12c–d) 7–10 mm long at anthesis (pedicels excluded and when sepals spreading); calyx up to ca. 26 mm wide (when lobes spreading), undivided in the proximal 2–3 mm and there scattered to medium densely covered with appressed or spreading hairs on the outside; calyx lobes (6–) 8–14 mm long, 4–7.5 (–10) mm wide (at the base only half as wide), ± lanceolate, widest below or at the middle, obtuse or rounded, less frequently acute, with ± conspicuous, longitudinal veins abaxially, with scattered, appressed, spreading or patent hairs on both sides, without or sometimes with a small tuft of hairs distally; margins of lobes flat (± involute when dry); corolla white (Gonzalez Ortega 5469, Felger et al. 2001) or cream (Martin et al. 1998) when alive, 6–9 mm long and broadly urceolate at anthesis; tube 5–6.5 mm long, ca. 5 mm in diameter, widest below the middle, medium densely (distally more densely) covered with short, light, spreading to patent hairs on the outside, on the inside glabrous except for some longitudinal areas covered with tiny hairs; throat slightly constricted, ca. 2 mm wide; corolla lobes 3–4 mm long, 2–3 mm wide, broadly rounded distally, on abaxial side densely covered with spreading hairs, glabrous adaxially; staminodia missing (Henrickson 1582) or only one (Gonzalez Ortega 5469), 3 mm long, free except at base, adnate ca. 1 mm above the base of the corolla tube, glabrous; antherode flat, 1 mm long and 0.6 mm wide, ± triangular; ovary (4–) 5-carpellate, (8–) 10-locular (mostly 8-locular according to Standley 1916 and as repeated by Shreve & Wiggins 1964), 5–7 mm long (including stylodia), 3–3.5 mm wide, ± conical, densely covered with ± patent, straight hairs; stylodia 5, ± completely free, 2–3 mm long, exserted, medium densely hairy up to the middle, scattered hairy on abaxial side distally; stigmata widened; stalk of the **fruits** ca. 9 (–13) mm long, ca. 2 mm thick, glabrescent; fruits (fig. 12e–f) depressed globose, up to ca. 3.5 cm in diameter, green when immature, turning yellow to orange to black when ripe and fresh (also shiny: Felger et al. 2001), brown to blackish, smooth and with tightly adhering epidermis when dry, medium densely covered with spreading to ± patent, white hairs when young, glabrescent except at the apex and base when mature, detaching with the calyx; fruit wall thin, consisting of a stone cell layer; pulp soft, blackish brown (Felger et al. 2001); calyx on fruits not increasing much, as a whole ca. 3 cm wide, ± glabrescent; lobes spreading or flexed downwards; seeds bean-shaped, 9–15 mm long, 9–11 mm wide, 3.5–6 mm thick, yellow-brown when fresh (according to S.A. Meyer), dark brown when dry, subepidermally striate.

Notes: As can be seen on Gonzalez Ortega 5469 (especially on the duplicate kept in MEXU), the shape and thickness of the calyx lobes change during their development. The lobes are at first thin and narrowly triangular. Later on they become much thicker and expand in their middle much more than at their base which is finally narrower. – The petioles of leaves on long-shoots are sometimes longer than usual (up to 4 mm long; e.g. Gonzalez Ortega 5469, Rose 1339, Rose et al. 12543). The leaf-lamina on these shoots is usually also larger, a fact which was noted on the label of Gentry et al. 19345: "leaves of two sizes". – The female flowers of Mason et al. 2905 are ± anomalous (especially the calyx): stalks of female cymes up to 28 mm long; bracteoles 9 mm long, 3 mm wide, lanceolate, ± persistent; calyx-lobes narrowly lanceolate and up to 22 mm long.

Figures: leaves (Felger et al. 2001).

Distribution: It is known from the states Sonora and Sinaloa in northwestern Mexico (fig. 5) and was collected from sea level up to elevations of 600–700 meters. Lebgue

KELENG (2001) and LEBGUE et al. (2005) indicated it also from the nearby southwestern part of Chihuahua, but the identification of the corresponding specimens needs to be confirmed. These plants could, however, belong to *D. sphaerantha*.

As the species was often cultivated and planted for its fruits in the past, it is difficult now to establish its natural distribution range. STANDLEY (1924) noted: "The tree is cultivated, but is probably also native in the region". VAN DEVENDER et al. (2000) stated: "closely associated with human settlements", and FELGER et al. (2001) wrote: "The distribution in Sonora suggests naturalization from purposeful introduction". Stephanie A. Meyer (from Alamos) noted via email on 15th October 2015: "There are many of these trees throughout town and on well-established ranches in the area. I have never seen these trees outside of an inhabited area". Gentry noted to the contrary on the label of his specimen 4777 (collected in 1939): "grows uncultivated through the region". – At least some of the collected specimens (see below) may also represent primitive cultivars. But this needs further investigation.

Habitat: According to MARTIN et al. (1998), it grows in deep canyons, near arroyos, roadsides, fields, and is "usually found near human habitation". FELGER et al. (2001) indicated it from the following habitats: "arroyo and valley bottoms, canyons and coastal plains, mostly localized near habitation, sometimes common in hedgerows; tropical deciduous forest and thornscrub", and SHREVE & WIGGINS (1964) from "sandy valley floors and adjacent slopes" in the "Lower Sonoran and Arid Tropical Zones". According to Tom Van Devender (Tucson, USA; information sent by email on 29th April 2015), the species grows near Alamos in coastal thornscrub and tropical deciduous forests with 900–1000 mm rainfall per year. PEINADO et al. (2011) listed *D. sinaloensis* (= *D. sonorae*) in their table 2 under "Tropical Dry. Zonobiome II. Tropical deciduous forest".

Collectors reported it from the following habitats: "coastal thornscrub in arroyos" (streams), "on sand dunes", "canyon with riparian tropical deciduous forest", "sandy soil in valley slopes and bottoms", "sandy soil in rocky arroyo", "sandy soil on the bank of the river", "disturbed area near the ranch and tropical deciduous forest on slopes", "gravelly riparian zone adjacent to dry forest transitional to thorn scrub and cultivated fields", "moist drainage".

Phenology: It was found in flower in April, June and July, and in fruit in January, March, April, (June), August, September and December. According to MARTIN et al. (1998), it flowers from May to June and fruits from June to January. FELGER et al. (2001) indicate the flowering time from May to June and the fruiting time from December to January.

Biology: According to STANDLEY (1916) and SHREVE & WIGGINS (1964), the leaves are persistent. FELGER et al. (2001) noted: "leaves essentially evergreen". Some herbarium specimens (e.g. Rose et al. 14827 or Rose 1339, the type of *D. sinaloensis*) display, however, several twigs with only young and some twigs with a few old leaves, a fact which seems to indicate that the trees are semideciduous. Several trees of *D. sonorae* are growing in Stephanie A. Meyer's garden in Alamos (southern Sonora). On 8th April 2015 she sent me the following information via email: "The trees are in their time of exchanging leaves; these trees do not go deciduous except in the driest of times." According to her,

the trees loose most of their old leaves when the new ones are sprouting. The trees are in "full leaf" in June, and are "very prolific, with seedlings coming up frequently." Trees which were cut down resprout easily and profusely.

According to Mitchell C. Provance (data quoted from http://swbiodiversity.org/seinet/collections/), the trees are spreading by root sprouts. The trunks reach sometimes one meter in diameter and their bark is dark gray and tessellate ("but variously patchy or smooth"). The color of stems is said to sometimes approach black. As he counted "up to 11 seeds per fruit", they seem sometimes to be 6-carpellate and 12-locular (requiring thus 6-merous flowers). He reported to have seen also one tree (Provance & Ross-Ibarra 9601) with mostly male but also with a few perfect flowers, which was thus andropolygamous (concerning this topic see Wallnöfer 2001a). He found one rotting fruit beneath that tree. Further research is needed to ascertain how frequent this situation is and how often fruits are developed.

According to Hallman & Knight (1993), the leaves are damaged by *Hypocala andremona* (Lepidoptera: Noctuidae).

Dispersal: According to Felger et al. (2001), "the fruits are relished by frugivorous bats". Yetman et al. (2000) state: "Many bird species flock to the trees to consume the ripe fruits". Stephanie A. Meyer observed, beside many birds, also many bats in times when the fruits were very ripe. Opossums are probably also dispersing the seeds.

Vernacular names: guayparín (sometimes written guaiparime, guaiparin, guayaparín or wyparin), caguorara [a Mayo name], Sonoran persimmon (these three names are indicated by Martin et al. 1998, Van Devender et al. 2000, Yetman et al. 2000, Felger et al. 2001, and also by several collectors; compare also Standley 1924, Martínez 1979), camyua (Friedman & Davis 29-94, Friedman & Zittere 21-95), zapote (Villaseñor 2006).

Use: The fruits become black when fully ripe, and were "eaten eagerly by natives" (Gentry 4777, collected in 1939). According to Gentry 2263 (collected in 1936), the fruit was eaten raw, or cooked with "panoche" [= "penuche": a coarse grade of sugar made in Mexico]. Martin et al. (1998) give the following information: "The fruits are boiled in milk and the seeds are toasted into an atole" [a traditional beverage], and "the fruit is eaten raw or cooked with panocha", and the "Mayos [name of the natives] grind the seeds and eat them as tortillas or as atole". According to Felger et al. (2001), the slightly sweet and astringent fruits are eaten fresh or cooked, and "the seeds, parched and ground, are made into atole". The same use is mentioned also by Yetman et al. (2000), who additionally noted: "Locations of the trees are well known among Mayos, …". Felger et al. (90-655, collected in 1990) reported on the label: "fruits eaten cooked, they are so sweet you do not have to add sugar". According to Stephanie A. Meyer, the fruits are recently also used to make jam. Standley (1916) noted: "The fruit is edible, but the black pulp is unattractive in appearance and insipid to the taste."

Notes: Standley (1924) accepted *D. sonorae*, *D. sinaloensis*, *D. sphaerantha*, and *D. rosei* as separate entities, but the characters used in his key are not reliable. – *D. sonorae* was included in the panbiogeographic analysis of García Díaz et al. (2015).

Specimens examined: **Mexico**, Sonora, two miles west of Hermosillo, [29°5' N, 110°59' W; according to STANDLEY (1916): cultivated!], (yfr), 8 Mar. 1910, **J.N. Rose, P.C. Standley & P.G. Russell 12543** [paratypes: C, GH, NY, P, US]; – [Rio Mayo Region] Alamos, Rio Fuerte, [ca. 27°10' N, 108°59' W], valley, (yfr), 25 Jun. 1936, **H.S. Gentry 2263** [A, ARIZ n.s., F, K, MO, UC, US], "large sturdy tree of dense foliage, in outline round-oval"; – along road from Alamos to Navajoa at side road to Aduana Mine, km marker 45, [ca. 27°6' N, 109°9' W], (fl female, yfr), 29 Jul. 1969, **C.T. Mason Jr. et al. 2905** [CAS, NY, UC], "large tree"; – Los Promontorios, 12 miles W of Alamos, 2000 ft., [27°1' N, 109°8' W], woods, (fr), 10 Aug. 1930, **P.G. Russell & M.J. Souviron 8** [CAS, US], "low tree"; – Arroyo Aduana, 5–10 miles NW of Alamos, N side of Sonora hwy, 500 m, 27°02' N, 109°00' W, moist drainage, (yfr), 6 Jun. 1989, **E. Joyal et al. 1620** [CAS, RSA], "tree to 20 m"; – Mpio. de Alamos, canyon draining from north side of Sierra de Alamos, ca. 3 km southward (upstream) from La Aduana, ca. 575 m, ca. 27°02' N, 109°01' W, broad riparian canyon with riparian tropical deciduous forest, (fr), 21 Dec. 1990, **R.S. Felger et al. 90-655** [CAS, MEXU], "medium to large trees to 18 m tall; trunk ca. 1 m diameter; the bark checkered, dark brown; the fruits yellow, just starting to ripen (black when ripe)"; – Alamos, cultivated in the edge of town, [27°1' N, 108°56' W], (fr), 10 Mar. 1910, **J.N. Rose et al. 12947** [NY, US]; – Alamos, [27°2' N, 108°57' W], arroyo near town, (defl male), 15 Mar. 1910, **J.N. Rose et al. 12842** [US], "large straggling tree with black bark"; – same area: ca. 1200 ft., sandy soil in rocky arroyo, (st), 21 Oct. 1961, **H.S. Gentry et al. 19345** [US], "small trees with dark green leaves of two sizes"; – same area: 1000–1500', sandy soil in valley slopes and bottoms, (fr), 29 Oct. 1939, **H.S. Gentry 4777** [DS, F, GH, MICH, MO, NA n.s., NY, RSA, UC, US], "symmetrical tree with dense foliage round in outline"; – Mun. Alamos, east side of the Sierra de Alamos, Rancho La Sierrita, 2.1 miles above Rancho Uvalamas (La Cieneguita), and along a trail to about 1 mile W of (above) the ranch, 700 m, 26°58.5' N, 108°57' W, probably originally planted, assoc. with cultivated trees near the ranch; disturbed area near the ranch and tropical deciduous forest on slopes, (fr), 9 Oct. 1992, **A.C. Sanders et al. 12791** [RSA, UCR n.s., WIS], "solitary tree ca. 10 m high, 70 cm dbh, with a broad crown; fruit green"; – Rancho El Negrito S of Alamos, 350–550 m, 26°57.5' N, 108°56' W, (fr), 2 Jan. 1992, **P.S. Martin et al. s.n.** [MO, TEX]; – ca. 18 km S of Alamos, bank of the Rio Cuchujaqui, [26°52' N, 108°56' W], sandy soil of the bank of the river, (fl female), 18 Jun. 1964, **J. Henrickson 1582** [DUKE, E, RSA 2×], "large tree 50 ft. high, 3 ft. dbh"; – Rancheria crossing of the Rio Cuchujaqui, 22.5 km S of Alamos, 200 m, 26°51' N, 108°55' W, beside the road near cultivated fields; gravelly riparian zone adjacent to dry forest transitional to thorn scrub and cultivated fields, (fr), 10 Oct. 1992, **A.C. Sanders et al. 12810** [TEX, UCR n.s.], "one of two 8–10 m high trees with rounded crowns and dense foliage; fruit green"; – Municipio de Navojoa, Arroyo Masiaca, ca. 0.5 km N of Teachive de Masiaca, 75 m, 26°47'45" N, 109°13'50" W, (fr), 10 Dec. 1993, **T.R. Van Devender et al. 93-1487** [ASU n.s. (dig. photo), USON n.s.], "tree 8 m, rare"; – 2.2 km NE from MEX 15 to Jopopaco, 0.2 km E to crossing of Arroyo Masiaca, 25 km (by air) NW Melchor Ocampo, 60 m, 26°44'20" N, 109°16' W, coastal thornscrub on bank of arroyo; associated plants: *Ambrosia ambrosioides*, *Albizia sinaloensis*, *Agonandra racemosa*, *Celtis pallida*, *Henrya insularis*, *Rhynchosia precatoria*, *Citharexylum scabrum*, *Pisonia capitata*, (fr), 4 Aug. 1995, **S.L. Friedman & O. Kiser 240-95** [ASU n.s. (dig. photo), USON n.s.], "tree 6 m, common"; – Municipio de Huatabampo, 1.4 km up Arroyo Camahuiroa from mouth, 500 m N Camahuiroa, 11.2 km (by air) WNW Melchor Ocampo, 5 m, 26°32'55" N, 109°16'45" W, coastal Sinaloan thornscrub; in arroyo; associated plants: *Pisonia capitata*, *Guazuma ulmifolia*, *Lysiloma microphylla*, (fr), 16 Mar. 1994, **S.L. Friedman & C.J. Davis 29-94** [ASU n.s. (dig. photo)], "tree 6 m, uncommon; fruits dried, brown"; – in Arroyo Camahuiroa 3 km upstream from mouth, 2 km NE Camahuiroa, 9.5 km (by air) WNW Melchor Ocampo, 15 m, 26°33'5" N, 109°15'30" W, coastal thornscrub at arroyo margin; associated plants: *Lysiloma microphyllum*, *Guazuma ulmifolia*, *Chiococca alba*, *Capparis flexuosa*, (fr), 17 Jan. 1995, **S. Friedman & J.R. Zittere 21-95** [ASU n.s. (dig. photo), UCR n.s.], "tree 9 m, common; fruit turning orange to black when ripe". – Sinaloa, Mun. El Fuerte, Mochicahui, La Constancia, 20 m, [25°57' N, 108°55' W], terreno húmedo, (fl female, yfr), Jul. 1924, **J. Gonzalez Ortega 5469** [DS, GH, K, M, MEXU, PH, US], "planta 8 m, 60 cm diam.; flor blanca"; – same data: (fl male), **5480** [DS, GH, K, M, PH, US]; – vicinity of Altata, [24°38' N, 107°56' W], sand dunes, (fl male, fl female, fr), 18 Apr. 1910, **J.N. Rose et al. 14827** [C, F, NY, P]; – vicinity of Culiacan, Altata, [24°37' N, 107°55' W], (fr), Sep. 1904, **T.S. Brandegee s.n.** [UC].

Diospyros sphaerantha **Standl.**, Contr. U. S. Natl. Herb. 18 (3): 121 (1916); – [fig. 5, 13–15].

Typus: Mexico, Sinaloa, foothills of the Sierra Madre near Colomas [correct is Colomos = Colonos near Plomosas], [23°4' N, 105°33' W], (fl female), 13–20 Jul. 1897, **J.N. Rose 3194** [holotype: US (photo NY: N.S. 6900 at FHO, NY), isotypes: F (photo F 59334), GH, K, NY].

Note 1: Goldman (1951: 16, 250!) indicated the exact route of Rose's collecting journey: Escuinapa, 14 miles northwesterly, to Rosario [= El Rosario]; – Rosario, 26 miles northeasterly, to Palmarito [not located]; – Palmarito, 20 miles northeasterly, to Colomos, near Plomosas [according to "Google Earth", the latter is located at ca. 23°4' N, 105°30' W]"; – "to a little group of ranches known as Colomos" [according to "NGA GEOnet Names Server (GNS)", located at 23°4' N, 105°33' W].

Note 2: The leaves of the type collection are atypical because they had just expanded and were not yet fully mature (hardened). It is not clear whether the tree had lost all (being deciduous or tardily deciduous) or most of the old leaves (being semideciduous) before flowering.

= *Diospyros rosei* Standl., Contr. U. S. Natl. Herb. 18 (3): 119–120 (1916).

Typus: Mexico, "Territorio de Tepic" [= Nayarit], at Acaponeta, [22°30' N, 105°22' W], (fr), 2–3 Jul. 1897, **J.N. Rose 1522** [holotype: US (photo NY: N.S. 6899 at FHO)].

Note: The fruits of the type (except those in the capsule) are moldy.

Treelet or tree up to 8 m tall (already flowering when 1.5 m tall), probably either deciduous or semideciduous; trunk up to 0.6 m in diameter (Gonzalez Ortega 5877); indumentum consisting of simple, appressed, spreading or ± patent, straight or slightly flexuose, sometimes collapsed and ± twisted, light hairs of varying length; twig apices and buds densely covered with appressed hairs; young twigs subterete, with scattered, appressed to spreading hairs and sometimes (e.g., Rose 3194, the type) also with minute, translucent, patent hairs, soon glabrescent; **leaves** alternate, with brochidodrome venation, sometimes partially covered with a ± dense layer of fine crystal needles (efflorescences); petioles 5–10 mm long, 1–1.8 mm thick, ± flat adaxially, slightly winged distally, covered with the same indumentum as that on the young twigs, ± glabrescent on mature leaves; leaf scars often markedly thickened and protruding; leaf lamina broadly lanceolate or lanceolate-obovate, rarely elliptic, (3–) 6–18 cm long, (2–) 3–8.7 cm wide, (1–) 1.8–2.5 times longer than wide, widest above the middle, rarely at the middle, firmly chartaceous, scattered to medium densely covered with appressed to spreading, long hairs especially abaxially and along veins when very young, soon glabrescent, often characteristically greenish-gray and with lighter venation when mature and dry, dull on both sides; leaf apex obtuse to acute, less frequently rounded; base of the lamina cuneate, rarely rounded or sometimes ± cordate; leaf margins entire, ± flat; flachnectaria few, rarely up to ca. 10 on abaxial leaf surface (completely missing on McVaugh 22913), usually arranged near the base but sometimes also on distal parts of the lamina; midvein on adaxial side ± flat or slightly sunken proximally, slightly raised distally, on abaxial side markedly prominent; secondary veins ca. 8 per side, raised adaxially, strongly raised abaxially; tertiary and quaternary veins raised on both sides when dry; **inflorescences**: cymes of both sexes 1-flowered (fig. 15b–d), placed in the axil of caducous bracts; male cymes up to 5, clustered on new, usually much reduced, leafless short-shoots; female

Fig. 13: Holotype of *Diospyros sphaerantha* STANDL. [US].

Fig. 14: Holotype of *Diospyros rosei* STANDL. [US].

Fig. 15: *Diospyros sphaerantha*: a: leaves (adaxial surface left side, abaxial surface right side; from Gonzalez Ortega 5469 [DS]); – b: male flowers (from Magallanes 4393 [W]); – c–d: female flowers (from Rose 3194 [isotypes, c: NY, d: F, top left side: a detached corolla view from above]); – e: fruits (from Rose 1522 [US, holotype of *D. rosei*]); – f: fruits (from McVaugh 22913 [MICH]); – scale = 1 cm

cymes up to 4, clustered at the base of new, leafy long-shoots; stalks (peduncles and pedicels) of both sexes scattered to ± medium densely hairy (indumentum as on young twigs), 7–9 mm long and 0.3 mm thick on male plants, and up to 12 mm long and 0.8 mm thick (enlarged distally) on female plants; bracteoles ca. 1 mm long, 0.5 mm wide, densely hairy abaxially, soon caducous; **flowers** (4–) 5 (–6)-merous; male flowers (fig. 15b) 9–10 mm long at anthesis (pedicels excluded), sweetly scented (Magallanes 4393); calyx (3–) 4–5 mm long and 4–6 mm wide, undivided in the proximal 1 mm and there scattered to medium densely hairy on the outside, glabrous inside; calyx lobes 2–3 (–5.5) mm long, 1.5–3 mm wide, semielliptic, but often unequal, widest below the middle or near the base, acute, with a tuft of hairs at the apex, with ± flat margins, scattered hairy abaxially, ± glabrous adaxially; corolla white when alive (Magallanes 4393), 8–9 mm long; tube 7–9, widest ± at the middle and there ca. 3 mm in diameter, on the outside

± medium densely covered with appressed, short hairs, on the inside medium densely covered with minute, ± patent hairs in the proximal half, glabrous distally; throat slightly constricted, 2–2.5 mm wide; corolla lobes 3.5 mm long and 2–3 mm wide, semielliptic, rounded distally, on the outside with the same indumentum as that on the tube, glabrous adaxially; stamens 18 (only one flower of Magallanes 4393 dissected), strongly differing in length (the inner 3.5, the outer up to 7 mm long); filaments 1–4.5 mm long and ca. 0.2 mm wide, adnate to the corolla tube except for the distal 0.5–1 mm, medium densely covered with minute, ± patent hairs; anthers 2.5–2.8 mm long and ca. 0.8 mm wide, widest below the middle, slightly tapering distally, glabrous (except for the ca. 0.5 mm long apex with minute, spreading or patent hairs); rudiment of the ovary densely hairy, lacking stylodia; **female flowers** (Rose 3194, the type, fig. 15c–d) 8–9 mm long at anthesis (pedicels excluded and when sepals spreading); calyx up to 30 mm wide (when lobes spreading), undivided in the proximal 2 mm and there medium densely covered with appressed or spreading hairs on both sides; calyx lobes up to 14 mm long, up to 8 mm wide (at the base only half as wide), lanceolate, widest below the middle, with ± conspicuous, longitudinal veins abaxially, with scattered, appressed to spreading hairs or nearly glabrous on both sides; apices acute and with a tuft of hairs; margins flat; corolla ca. 8 mm long at anthesis; tube 4–5 mm long, 5–6 mm in diameter, subglobose (widest at the middle), on the outside medium densely to densely covered with light, appressed to spreading, short hairs, on the inside: some areas glabrous, other areas with minute, patent hairs (Kruse 2505) or hairs only near the base (Rose 3194); throat constricted, ca. 1.5 mm wide; corolla lobes 4–4.5 mm long, 2.5–3 mm wide, widest at the middle, broadly rounded distally, densely covered with slightly longer, ± appressed hairs on the outside, glabrous adaxially; staminodia missing (Kruse 2505) or only one (1 flower of Rose 3194 dissected), strongly reduced, ca. 1.5 mm long, free except at base, adnate 0.5 mm above the base of the corolla tube, distally glabrous, fimbriate-hairy laterally near base; ovary 5-carpellate and 10-locular (Rose 3194) or 4-carpellate and 8-locular (Kruse 2505), 6.5–7 mm long (including stylodia), 3–5 mm in diameter, widest near its base, ± gradually narrowed into the stylodia, densely covered with slightly spreading to patent, short hairs; stylodia exserted, 4 (Kruse 2505: 3.5 mm long, fused together in the proximal 1 mm, the distal 2 mm ± glabrous) or 5 (Rose 3194: ± completely free, 2 mm long, ± densely hairy in the proximal half); stigmata narrow (Kruse 2505) or widened and bilobed (Rose 3194); stalk of the **fruits** up to 15 mm long, 1–1.5 mm thick, covered with remnants of indumentum; fruits (fig. 15e–f) up to 10-seeded, depressed globose (oblate), up to ca. 4 cm in diameter, green, turning yellowish and yellow-orange when still immature (according to collectors), probably black when mature and fresh, ± blackish when dry, smooth and with ± tightly adhering epidermis when dry, medium densely covered with spreading to ± patent hairs when young, glabrescent except at the apex and base when mature, detaching with the calyx; fruit wall thin, consisting of a stone cell layer; immature fruit pulp black (Soto Nuñez et al. 2869); calyx on fruits not increasing much, ± glabrescent; lobes up to 15–20 mm long, 6–8 (–12) mm wide, at first spreading, then strongly flexed downwards and orientated ± parallel to the stalk; seeds ± bean-shaped, 15–17 mm long, 11–12 mm wide, 5–7 mm thick, dark brown when dry, subepidermally striate.

Notes: On the labels of two gatherings it was reported that the young plants seem to perform like climbers (spreading climbers?), but this needs to be confirmed: "arbolito

2–3 m, con las ramas escandentes" (Pérez 430), "shrub 2 m (or vine?)" (Iltis & Vasquez 29150). The northern populations often display shorter petioles than the southern ones. The leaves of some gatherings are medium densely covered with ± patent hairs abaxially (e.g. Tenorio & Flores 16362 from Nayarit, McVaugh 22913 from Jalisco, Hahn 502 and Soto Nuñez 10869 from Michoacán). Quigley 621 (from Jalisco) and Soto Nuñez et al. 2869 (from Michoacán) seem to display atypical, shade-leaves. The ripe fruits of the latter collection show at their base remnants of a patent indumentum.

This species was included under the name *D. rosei* in a genetic analysis carried out by PROVANCE et al. (2013) and in a panbiogeographic analysis made by GARCÍA DÍAZ et al. (2015).

Distribution, habitat and phenology: It is endemic to western Mexico and occurs in southern Sinaloa, Nayarit, Jalisco, Colima, Michoacán, and in Guerrero (fig. 5). It was collected from sea level up to elevations of 1100 m (Magallanes 4393 from Jalisco was collected at 1800 m altitude). – It is a component of low to medium tall deciduous or semideciduous forests ("selva baja caducifolia", "selva mediana subcaducifolia", "bosque tropical subdeciduo") [see: MCVAUGH 1972: 281, RZEDOWSKI & MCVAUGH 1966]. Collectors reported it from the following habitats: oak-forests (encinares), thickets, dry hillsides, canyons (cañadas), ravines, rocky places, along streams (arroyos), stream-sides with gallery forest, on sandy stream-banks, savanna-like pastures, roadsides, secondary vegetation (acahuales). – It was found in flower in May, July and August, and in fruit from July to March.

Vernacular names and use: It is called guayparin in Sinaloa (Gonzalez Ortega 5877), and zapotillo in Michoacán (Soto Nuñez et al. 2869). MARTÍNEZ (1979) gives the following names: guayaparín and jejito (the latter is used around Rosario in southern Sinaloa). The fruits are edible (Kruse 1941).

D. sphaerantha may have been taken into cultivation (at least extensively) and propagated by ancient tribes inhabiting the area. These primitive cultivars may still persist here and there on abandoned land.

Specimens examined: **Mexico**, Sinaloa, Mun. Rosario, Chametla, Coacoyolitos [not traced], 10 m, [ca. 22°52' N, 105°57' W], terreno húmedo, (fr), Nov. 1925, **J. Gonzalez Ortega 5877** [DS, GH n.s., M, PH, US], "planta 8 m, 60 cm diam.; flor blanca", US: "20 m alt.". – Nayarit, Acaponeta, [22°30' N, 105°22' W], (fr), Jul. 1897, **J.N. Rose 3289** [NY]; – same locality: dry hill, (st), 12 Apr. 1910, **J.N. Rose et al. 14473** [NY]; – Mun. Nayar, 16 km al SW de Jesús María, camino a la Mesa del Nayar, 1070 m, 22°15' N, 104°35' W, ecotonia de selva baja caducifolia con bosque de encino, (fr), 1 Aug. 1990, **G. Flores F. & R. Ramirez 2139** [MEXU, MICH], "árbol de 4 m, poco abundante; fruto inmaduro verde"; – cañada del Nogal, 13 km al S de La Mesa del Nayar, camino a Jesús María, 1110 m, 22°13' N, 104°35' W, encinar, en cañada, (fr), 23 Sep. 1989, **P. Tenorio L. & G. Flores F. 16362** [MEXU, MICH], "árbol de 4 m; fruto inmaduro"; – 17,3 km al NW de Jesús María, camino Jesús María-La Mesa del Nayar, en Cañada del Nogal, 1110 m, 22°13' N, 104°35' W, encinar, (fr), 23 Sep. 1989, **G. Flores F. & P. Tenorio L. 1327** [MEXU, MICH], "árbol de 4 m, poco abundante; fruto verde"; – Mun. Santa María del Oro, 6 km al E del Río Santiago, camino Mojarra-Huajimic, 630 m, 21°28' N, 104°20' W, selva mediana subcaducifolia, (fr), 29 Nov. 1989, **G. Flores F.et al. 1807** [MEXU], "arbolito de 3 m; poco abundante; fruto inmaduro". – Jalisco, a 44 km de Tomatlán, rumbo a Puerto Vallarta, 30 m, [ca. 20°20' N, 105°20' W], creciendo entre rocas a la orilla de río, (fr), 14 Dec. 1970, **L.A. Pérez J. 430** [CAS, GH, MEXU, US], "arbolito 2–3 m, con las ramas escandentes; frutos axilares en pares"; – Mun. de Cabo Corrientes, valley of Rio Las Juntas, 10–13 km SE [according to MCVAUGH 1972: 281: S and SW] of El Tuito, 250–330 m, [ca. 20°13' N, 105°20' W], local, on sandy stream-banks; steep rocky valley; decaying granitic soils with forest of *Quercus magnoliifolia* on the ridges, and *Ficus*, *Inga*, *Couepia*, in the valley [MCVAUGH 1972: tropical subdeciduous forest], (fr), 14–16 Dec. 1970, **R. McVaugh 25386** [MICH 2×], "tree 5 m; fruits green, hard, oblate, to 3 cm wide, 1.5 cm high"; – 1–2 km NW Jirosto,

15–17 km WNW Purificación, 400–430 m, 19°45'30" N, 104°45' W, thickets, streamsides with gallery forest, savanna-like pastures, and roadsides, region of Tropical Subdeciduous Forest with canopy to 15 m, (fr), 11 Jan. 1979, **H.H. Iltis & M. Nee 1451** [MICH, TEX, US, WIS], "small tree 5 m tall; fruits green"; – Mpio. La Huerta, Estación de Investigación y Difusión Chamela (UNAM), Arroyo Colorado, ca. 1800 m, [ca. 19°30' N, 105°3' W], veg.: S.M.S.P. [= selva mediana subperennifolia], (fl male), 3 Aug. 1985, **J.A.S. Magallanes 4393** [MEXU n.s., W], "arbusto 3 m; flor blanca, aroma dulce"; – Estación Biológica Chamela, 80–100 m, [ca.] 19°30' N, 105°03' W, densely forested floodplain to more open hillside (selva mediana), (st), 20–27 Apr. 1992, **M.F. Quigley 621** [MEXU]; – same area: Arroyo Colorado atrás del Cerro Colorado, [according to LOTT 1993: ca. 19°28' N, 105°1' W], selva mediana subcaducifolia con *Thouinidium decandrum*, *Astronium graveolens*, *Tabebuia rosea*, (fr), 10 Sep. 1983, **E.J. Lott & J.A. Solís Magallanes 1855** [FHO], "arbusto delgado 3 m; frutos inmaduros amarillos"; – along road to Playa Tamarindo, ca. 0.5–3 km SSW of La Manzanilla, ca. 12 km (by air) WNW of Barra de Navidad, 0–100 m, 19°16–17' N, 104°46–47' W, in cow pasture near forest; thickets and secondary vegetation in former *Orbignya cohune*, *Ficus*, *Bursera simaruba*, *Brosimum alicastrum* semievergreen tropical seasonal forest (bosque tropical subcaducifolia), (fr), 10 Jan. 1984, **H.H. Iltis & J.A. Vasquez 29150** [MICH, WIS], "shrub 2 m, with 3 cm diam. green fruit"; – 3–15 km by road S of Jilotlán [de los Dolores], ca. 800 m, [ca. 19°20' N, 103°1' W], steep hills, deciduous forest now leafless, with *Bursera*, *Randia*, *Acacia*, *Cordia*; this plant: in ravine, (fr), 9–10 Mar. 1965, **R. McVaugh 22913** [MICH], "one tree 5 m; fruit green". – Colima, Mpio. Ixtlahuacán, 6,3 km al SE [correct is E] de Agua de la Virgen, camino nuevo a El Camichin, ca. 575 m, [18°56' N, 103°36' W], selva baja caducifolia, (fr), 24 Mar. 1982, **E.J. Lott & J.A. Solís Magallanes 927** [FHO], "árbol 4 m; espinas [?] saliendo ca. 5 cm del tallo; fruto amarillo". – Michoacán, Mun. Gabriel Zamora, en Barranca Honda, 9 km N de Lombardía, 880 m, [19°13' N, 102°3' W], selva baja caducifolia, (fr), 14 Oct. 1985, **J.C. Soto Nuñez 10869** [MEXU n.s., W], "árbol 7 m; abundancia frecuente; fruto verde inmaduro"; – Cutzaro [probably Cútzaro near Pedernales, Municipio de Tacámbaro, 920 m, 19°7'44" N, 101°27'11" W], en etat sauvage, (fr), 9 Jan. 1866, **L. Hahn 502** [P]; – a 3 km al SW de Aquila, 385 m, [18°35' N, 103°31' W], veg. alterada de selva mediana subperennifolia en suelo rocoso, (fr), 30 Mar. 1981, **J.C. Soto Nuñez et al. 2869** [MEXU 2×, MO], "arbusto 3 m; fruto inmaduro; pulpa negra; escaso". – Guerrero, Municipio Chilpancingo, Cajeles, barranca y arroyo Santa Rosa, 4 km al oeste de Cajeles [according to wikimapia: Cajelitos], 999 m, 17°16'10" N, 99°30'25" W [correct seems to be 17°17' N, 99°32' W], orilla de arroyo, (fl female), 4 May 1969, **H. Kruse 2505** [M, MEXU n.s.], "árbol erguido, de copa abierta y ramas colgando"; – Municipio Acapulco, La Venta, Falda Este del Cerro El Peregrino, 999 m, 17°7'0" N, 99°35'30" W, (st), 3 Nov. 1968, **H. Kruse 1937b** [M n.s. (dig. photo), MEXU n.s.], "árbol; fruto amarillo cuando maduro y muy amargo"; – Parque Nacional El Veladero, Palma Sola, col. Independencia, 300 m, [16°55' N, 99°54' W], acahual; suelo pedregoso, arcilloso, (fr), 5 Mar. 1985, **N. Noriega Acosta 488** [MEXU], "arbusto 3,5 m; abundancia regular"; – Acapulco and vicinity, [16°51' N, 99°55' W], (fr), Oct. 1894–Mar. 1895, **E. Palmer 329** [A, F 2×, GH (only fruits seen), K, MO, US 2× (+ carp.)]; – along dirt road off of Mex. Hwy 200 at San Marcas [= San Marcos] past Piedra Parada, at Piedra Grande, ca. 10 km from Mex. Hwy 200, 310 m, 16°51' N, 99°21' W, (fr), 31 Jan. 1983, **J.S. Miller & P. Tenorio L. 559** [FHO, MEXU, MICH, MO], "tree 1.5 m tall; fruit yellow-orange".

Key to the species occurring in northwestern Mexico (Sonora, Sinaloa, Baja California Sur)

1 Calyx lobes 3-merous (rarely 4-merous) 2

1* Calyx usually 5-merous (rarely 4- or 6-merous) 3

2 Leaf lamina (0.3–) 1–2.5 cm long, (0.3–) 0.5–1.5 cm wide (sometimes up to 4.1 cm long and 2.3 cm wide on long-shoots), usually with hardly visible lateral veins; – southernmost Californian Peninsula (Baja California) ..... *D. intricata*

2* Leaf lamina usually much larger, with well visible lateral veins; – from Sinaloa southwards ..... *D. salicifolia* s.lat.

3 Young twigs densely covered with ± patent hairs which ± persist on older twigs; leaves with patent, straight and stiff, persistent hairs adaxially 4

3* Young twigs and both sides of the leaves scattered to medium densely covered

with appressed to spreading hairs when young, soon glabrescent 5

4 Petioles 1–1.5 (–2) mm long; base of the lamina abruptly cuneate; – Sonora .... *D. reinae*

4* Petioles (1–) 3–6 mm long; base of the lamina cordate or ± truncate, less frequently abruptly cuneate or broadly rounded; – southernmost Californian Peninsula (Baja California) ..... *D. californica*

5 Petioles (1.5–) 2–3 mm long (on long-shoots sometimes up to 4 mm long); leaf lamina (1–) 4–12 (–13) cm long, (0.9–) 1.5–5 (–6.5) cm wide; – Sonora and northern half of Sinaloa ..... *D. sonorae*

5* Petioles 5–10 mm long; leaf lamina (3–) 6–18 cm long, (2–) 3–8.7 cm wide; – from southern Sinaloa to Guerrero ..... *D. sphaerantha*

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