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MORE AMERICAN BLACK SAPOTES: NEW DIOSPYROS (EBENACEAE) FOR MEXICO AND CENTRAL AMERICA

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ABSTRACT

During the preparation of a monograph of the Ebenaceae for Mexico, numerous collections previously determined to be Diospyros conzattii Standley and Diospyros riojae Gomez-Pompa could not be reconciled with their original descriptions, type specimens and illustrations. It was determined that collections of putative D. conzattii from Costa Rica represent a new species, D. costaricensis, described here. All but one collection of putative D. riojae from the Mexican states of Queretaro, Hidalgo, Tamaulipas, and San Luis Potosi, represent a new species, D. gomeziorum, described here. Putative collections of D. riojae from Veracruz additionally include specimens of D. conzattii, a species previously unreported for the state, and a new species from the Sierra de Los Tuxtlaa, D. tuxtensis, described here. We provide emended descriptions of D. riojae and D. conzattii, and describe three new species of Diospyros for Tropical America. We also provide comments on distribution, ecology, conservation, ethnobotany, and provide illustrations for each of these taxa.

KEYWORDS: black sapote, Costa Rica, Diospyros gomeziorum, D. conzattii, D. costaricensis, D. pergamentacea, D. riojae, Diospyros rosei Complex, D. tuxtensis, Ebenaceae, granadilla, guacalillo, Mexico, new species, persimmon, zapote negro silvestre, zapotillo

RESUMEN

Durante la preparación de la monografía de Ebenaceae para México, numerosas colecciones previamente determinadas como Diospyros conzattii Standley y Diospyros riojae Gomez-Pompa no pudieron ser reconciliadas con las descripciones originales, el espécimen tipo y las ilustraciones. Se determinó que la colección putativa D. conzattii de Costa Rica, representa una especie nueva, D. costaricensis descrita aquí. Todas, excepto una de las colecciones putativas de D. riojae de los estados mexicanos de Querétaro, Hidalgo, Tamaulipas y San Luis Potosí representan una especie nueva de D. gomeziorum, descrita aquí. Adicionalmente, las colecciones putativas de D. riojae de Veracruz incluyen especimenes de D. conzattii, una especie no citada previamente para ese estado y de una especie nueva de la Sierra de los Tuxtlaa D. tuxtensis, descrita aquí. Proveemos descripciones corregidas de D. riojae y D. conzattii y descriptimos tres especies nuevas de Diospyros para América tropical. También hacemos comentarios sobre la distribución, ecología, conservación, etnobotánica y aportamos ilustraciones de todos los taxa.


INTRODUCTION

The pantropical genus *Diospyros* (Ebenaceae) consists of about 500 species of trees, shrubs, and suffrutices (White 1983). A treatment of the Mexican species of *Diospyros* in full has not appeared since Standley (1924). Modern treatments have dealt with smaller areas, such as Veracruz (Pacheco 1981), northeastern Michoacan, Guanajuato, and Queretaro (Carranza 2000), the Yucatan Peninsula (Lundell 1942), and the Tehuacán-Cuicatlán Valley, Oaxaca (Kelly 2001), or covered portions of southern Mexico within a larger flora (Whitefoord & Knapp 2001). Circumscription of the Mexican and Central America taxa is not entirely agreed upon. However, based on our preliminary work, a reasonable estimate of the number of native species occurring in Mexico is around 25.

In 1918, C. Conzatti collected a new black zapote from the coastal mountains northeast of San Pedro Pochutla, Oaxaca. He recorded some characteristics of the tree, especially those pertaining to the edible fruit, the taste of which he enjoyed. He believed that the fruit of the ‘zapote negro silvestre’ (Conzatti 3167) had potential as a new tree crop (Standley 1922). This zapote was formally described a few years later as *Diospyros conzatti* Standl. (Standley 1922). According to Trabut (1926), *D. conzatti* was introduced to California and Florida. However, he did not provide any specific details, and we are unaware of any other information that might corroborate the putative introduction of this species to the United States.

*Diospyros riojae* Gomez-Pompa was described from one fruiting collection made in the Misantla region of central Veracruz, Mexico (Gomez-Pompa 1964). Since then, collections of putative *D. riojae* have been made in several more locations in Veracruz, Tamaulipas, San Luis Potosi, Hidalgo, and numerous places in northeastern Queretaro. *Diospyros riojae* is considered an endangered species (Sánchez-Coello 2002).

During the preparation of a monograph of the Ebenaceae for Mexico, we noticed a large amount of morphological variation among collections of putative *D. riojae* and *D. conzatti*. While we had intended to examine the taxonomy of both species at a later time, in view of the endangered status of *D. riojae*, and a sense of some urgency regarding its protection (e.g., Sosa et al. 1998), we thought it would be prudent to proceed with the treatment of the following taxa now, lest the designation of protected areas, or expensive and time-consuming ecological research, be confounded by the unrecognized presence of similar-looking taxa.

About eighty-five specimens from seventeen herbaria were examined for this study. With the exception of one collection from San Luis Potosi, specimens of putative *D. riojae* collected outside of Veracruz represent a new species, *D. gomeziorum*, described here. Much of the material collected in Veracruz and attributed to *D. riojae* has been found to represent *D. conzatti*, and a species
new to science, *D. tuxtensis*, described here. Costa Rican material, previously ascribed to *D. conzattii*, clearly represents a third new species, *D. costaricensis*, which is described here. These species are best considered members of what we have informally recognized as the 'Diospyros rosei Complex' (Provance & Sanders 2005), a group that additionally includes: *Diospyros rosei* Standl., *Diospyros oaxacana* Standl., *Diospyros palmeri* Eastwood, *Diospyros californica* I.M. Johnston, *Diospyros sonorae* Standl., *Diospyros texana* Scheele, *Diospyros riojae* Gomez-Pompa, *Diospyros conzattii* Standl., *Diospyros rekoi* Standl., *Diospyros torresii* M.C. Provance & A.C. Sanders, *Diospyros morenoi* A. Pool and *Diospyros xolocotzi* Madrigal & Rzedowski. Previously (Provance & Sanders 2005), we called into question the distinctness of *D. morenoi*. At that time, we only had the holotype to examine. Very recent collections from Chiapas, Mexico, have inclined us to reevaluate our position on the status of this species. We now believe that it is a valid taxon, and we plan to address this issue further in the near future.

In this treatment we use 'lanceolate' in the sense of Jackson (1916), being broadest near the lower third of the leaf, not at mid-leaf in the sense of Stearn (2000). 'Scintillant' refers to the sparkling appearance of the epidermis of some plant structures when viewed under a dissecting microscope using bright light. Lengths for winged petioles are unavoidably approximate. Female inflorescences are inferred from fruiting specimens and persistent pedicels, where they are otherwise unknown for these taxa. The leaf venation for most taxa is 'arcolanguid,' defined here as an intermediate state between eucamptodromous and brochidodromous, in which major lateral veins nearly form distinct loops with superadjacent lateral veins, but tardily wane, becoming difficult to distinguish as loops. The term is coined for efficiency and out of necessity, since the term 'eucamptodromous-brochidodromous' of Todzia and Keating (1991) refers to a different type of intermediacy. Geographical coordinates, elevations, and similar estimations when made by us are presented in brackets.

**TAXONOMIC TREATMENT**


**Trees,** rarely shrubs, probably facultatively deciduous, to 25 m tall, and to 2.5 m in diameter. (Pacheco 1981); **trunk** channelled, rimo, **bark** dark-brown (Pacheco 1981); **aged stems** subterete to terete, **bark** shallow-fissured with dark ridges, gray and black, **stemwood** pale yellow; **2nd-3rd year stems** short-fissured, glabrous to furfuraceous-pulverulent, puncticulate, lenticellate, half-netted, gray above, tawny below; **current year's stems** angular, smooth to sulcate, glabrous
Fig. 1. A–G. *Diospyros riojae* Gomez-Pompa. A. Abaxial surface (left) and adaxial surface (right) surface of staminate petal lobe. B. Adaxial (left) and lateral (right) views of staminate inflorescence bract. C. Typical anther. D. Staminate flower. E. Abaxial surface of mature leaf showing detail of several degrees of venation. F. Fruiting stem. G. Fruit. A–D. Based on F. Ventura A. 15078. E–F. Based on J. Becerra Z. 83. G. Based on L. Pacheco & J.I. Calzada 18.
to sparingly subappressed puberulent, hirtellous at the base and near the apex, tan to reddish-brown, glandular. Petioles stout, thicker than width, (2–)4–6(–7) mm long, winged, rugose below, slightly pruinose, deeply concave to V-grooved above, ciliolate, glandular. Leaves alternate, simple, entire, subcoriaceous to coriaceous, (5)–7–13(–14.2) cm long, (2.5)–3–6(–7.5) cm wide, elliptic, widely elliptic, oblong, widely obovate, sub-oval, apex acutely to obtusely rounded, or short-acuminate to a rounded point, margin slightly recurved, ± thickened, sometimes ciliolate, base obtusely rounded, cuneate, or short-acuminate; lower leaf surface glabrous, puncticulate, sometimes slightly pruinose or scintillant, shiny, olive to brown; upper leaf surface glabrous, shiny, pale light-green to gray-green or copper-green, epidermal cells enlarged, the anticlinal walls thickened. Venation arcolanuid; midrib prominent below, chartreuse to reddish-brown, shallowly concave above, smooth to clavate glandular hairy, shiny, olive to yellow-green; 2–3° veins reticulated, raised below, fine with sharp relief, sometimes pruinose-scintillant, granular-papilllose, shiny, usually prominent above, lateral veins 8–12 pairs. Laminar extraloral nectaries abaxial, near base and midrib, round to narrowly elliptic, sometimes on lateral veins. Male inflorescence fascicle, 1–4 flowers from leaf axils of the previous year's growth, or from the base of new stems, sometimes a pair of solitary flowers from the new stem just above the fascicle; pedicels 4–7(–10) mm long, sparingly brown to claret velutinous, epidermis green; pedicel bracteoles 2, 1 mm long, oblong, ± flat to slightly concave, ascending wavy hairy below, the hairs thick, glistening. Male flowers 5-merous; calyx infundibuliform; calyx tube 1.5 mm long, glabrous or scantily minute subulate hairy; sepals triangular to ovate, 1.3–1.8 mm long, 0.7–0.9 mm wide, ciliolate, scantily minute appressed subulate hairy basally, becoming dark glandular wavy hairy apically; corolla urceolate-campanulate, tan to brown, reportedly white in living material; corolla tube constricted below the lobes, 4 mm long, 3 mm wide, interior grading from glabrous distally to minutely deltoid scaly at mid-tube, again becoming glabrous near the base, except near filament bases, exterior puberulent with hairs erratically directed, some glandular; corolla lobes oblong-squarish, emarginate, 2 mm long, 2 mm wide, interior pubescent, exterior minutely sericeous-puberulent, exmedially appressed, several black hairs present near the apex. Stamens 18, subexserted, adnate to corolla at mid-tube or lower, some inserted on the receptacle, some lower stamens extrorse, abruptly geniculate, and connected to introrse upper stamens by a superdermal vascular trace; filaments 1 mm long, hirtellous, especially on margin; anthers basifixed, lance-ovate, ± 2.5 mm long, laterally concave, apically constricted, opening by short apical slits; pistillode ± wheel-shaped, lobes 5, bilocular, glabrous, dark gray. Female inflorescence flowers solitary, from caducous bract scar axils near the base of young stems. Fruiting pedicels 7–12 mm long, stout, very minutely hirtellous. Fruiting calyx 5-lobed; fruiting calyx tube 3.5–4 mm long, explanate to reflexed; fruiting sepals accrescent, coriaceous.
arcuate-reflexed to spreading, 7–25 mm long, 7–13 mm wide, oblong, narrowly triangular or ovate, apex usually ascending to incurved, sometimes glaucous-pruinose to scintillant. Fruit berry, 3–5.5 cm long, up to 4.7 cm wide, subglobose, locules 8–10. mesocarp fleshy, yellow-orange in dried specimens; hypodermis thick and stony, epidermis smooth to bullate, shiny in living material, green to brown or black, herbarium material reddish-brown to dark-brown, immature fruits sometimes atropurpurose. Seeds not seen in available material (seeds orangish in photograph in Sánchez-Coello 2002 from Conde 2000), described by Pacheco (1981) as brownish to grayish, shiny, very rugose, and with a prominent raphe.


Distribution and Ecology.—The only known collection of this taxon made outside of the state of Veracruz is from Tamazunchale, San Luis Potosi. This 1937 collection (M.T. Edwards 670) is the earliest one of the species known to us. Tamazunchale is at 153 m, a low elevation based on the literature (e.g. Pacheco 1981). In northern Veracruz, this species occurs in the Sierra de Tantima. In central Veracruz, occurrences are in the Sierra de Chiconquiaco, the lowlands of its northern base, and the Misantla region. Populations in northern Veracruz are in isolated cloud forest patches. In central Veracruz, collection sites have been characterized as forested escarpments near pasture (Sosa et al. 1998), cloud forest, and deciduous forest (Pacheco 1981) at 750–1000 m. It seems not to be widely realized that this taxon also occurs at lower elevations at 100–300 m. Low elevation occurrences are associated with tropical evergreen forest with Quercus. In this community, they are known to flower during March. This species is considered to be in danger of extinction (Sánchez-Coello 2002).

Ethnobotany.—The tree is called ‘granadilla’ in the Sierra de Tantima region of northern Veracruz where it is considered edible (G. Castillo C. & C. Benavides M. 2265). The name ‘sapote prieto’, is indicated on the collection from Tamazunchale, San Luis Potosi.

2. Diospyros gomeziorum M.C. Provance & A.C. Sanders, sp. nov. (Fig. 2c). Type: MEXICO. QUEERETARO. Mpio. Jalpan de Serra. 5–6 km al NW de San Juan de los Duran. El Arroyo, 21° 48' N, 99° 12' W, escaso, bosque de pino encino, cedro blanco, orilla de arroyo, canadá, 1500–1600 m, 21 Aug 1991 (fr), Benito Servín 1274 (HOLOTYPE: IEB-150586).
Arbor frutexve usque ad 20 m alta, D. rojae Gómez-Pompa similis sed differt margine folii a pagina adaxiali usque ad paginam abaxialem extem obliquantibus, cellulis epidermalibus paginæ laminæ adaxialis non amplificatis, sine conspicue incrassatis parietibus celularum anticalinalibus; foliis saepè copiosis glaucoprunosis; calycis fructiferæ effuso et cum apicibus sepalorum ascendentiibus; pedicellis fructiferis non crassis.

Trees or shrubs to 20 m tall, facultatively deciduous; trunk reported to 12 cm diameter for a 5-6 m tree (Servin 1274) and 20 cm in diameter for a 4 m tree (R. Fernández N. 2459), erect, longitudinally fissured, bark gray, reportedly shiny; aged stems angular, bark verrucose, scarred, short-fissured, cinereous, stem wood yellow to yellow-orange; 2nd–3rd year stems angular to suberet, sometimes hirtellous, ± half-netted, the outer epidermal layer gray, tawny or reddish-brown, the lower layer cream to orangish; lenticels protruding, sometimes 2–3 mm long; current year's stems suberete, smooth to striate, densely hirtellous, reddish-brown, puncticulate. Petioles stout, often thicker than wide, 2–5(-8) mm long, glabrous to minutely erect hairy to deltoid scaly, rounded to ruminicate below, usually glistening, dark brown to olive green, narrowly channeled, flat or barely raised, furfuraceous-glandular, ascending ciliolate on margin, yellow-green to olive above. Leaves alternate, simple, entire, pergamentaceous to chartaceous, sometimes subcoriaceous, lanceolate to ovate to elliptic, 6–11–(11.5) cm long, 2–4.8 cm wide, apex acute, obtuse or acuminate to a rounded point, margin beveled outward from upper surface at 45° to the lower surface, somewhat sharp, shiny, sparsely to moderately ciliolate, base acute to obtuse, decurrent onto petiole; lower leaf surface glabrous to sparsely subpressed pubescent, hairs black or reddish, most common near the base, midrib, and apex, surface shiny, green to olive, puncticulate; upper leaf surface glabrous, glauceous to pruinose-scintillant, localized or covering most of surface, but not on the beveled margin, granular-papillose, olive or pale blue-olive to dark-olive or dark blue-green, usually darker above than below, young leaves tend to be lighter above. Venation arcuolanguid, granular-papillose, glaucous to pruinose-scintillant; midrib prominent below, glabrous to subpressed pubescent, hairs black, reddish-brown, or white, narrowly canaliculate above, sparsely to densely hirtellous to deltoid scaly, rarely glabrous, yellow-green; 2º venation subprominent below, lateral veins (8–)11–13–(14) pairs, 3º venation reticulate, obscure to prominent below, usually prominent above. Laminar extrafloral nectaries abaxial, minute, circular. Male inflorescence fascicles of 1–3(-5) flowers in leaf scar axils of previous year's growth, or one to several flowers at the base of new growth in scar axils of caducous bracts; pedicels 1–3 mm long, densely straight hairy, the hairs reddish, black, and white; pedicel bracts 2, 2–2.5 mm long, ± linear. Male flowers (4–5(-6)-merous, calyx infundibuliform–campanulate, deeply lobed, interior glabrate or scantily minute white hairy, exterior sparsely minute deltoid scaly; calyx tube 1.5–2 mm long, 2.3–3 mm wide, sparsely subpressed puberulent; sepals lance-ovate to triangular, 2–7 mm long, 1–4
mm wide, exterior glabrous to pubescent basally, subappressed pubescent apically, the hairs glossy, black to reddish, simple and glandular, epidermis viscous; corolla urceolate-campanulate, white in living material; corolla tube 3–5.5 mm long, 3–6 mm wide, exterior densely pubescent, most hairs distally oriented, some hairs irregular, interior sparingly hirtellous, hairs sometimes erratically directed; corolla lobes (4–5), spreading, oblate to squarish or widely obovate, often emarginate, 2–4 mm long, 2–3.5 mm wide, several short black hairs near the apex, interior sericeous. Stamens 20, equal to, or barely surpassing tube, most adnate to corolla, some inserted on the receptacle; filaments 0.3–0.8 mm long, ascending puberulent; anthers basifixid, oblong-ovate to ovate, 2 mm long, opening by short slits near apex, rarely by complete lateral slits, granuliferous, apex acute or rounded and mucronulate; pistillode conspicuously wheel-shaped, short, wide, corrugate. Female inflorescence flowers solitary, cauleine near the base of current season's growth, rarely from leaf scar axil of old growth (e.g. Ferguson 15), sometimes two opposite inflorescences, but two mature opposite fruit not seen. Female flowers not seen, but styles (4–5) as remnants on mature fruit, appressed white puberulent. Fruiting pedicels (4–5) 8–11 mm long, densely hirtellous. Fruiting calyx 5–6-lobed. Fruiting calyx tube 3–4 mm long; fruitlet sepals accrescent, ± spreading, 19–20 mm long, 8–11 mm wide, lanceolate to narrowly elliptic or obovate, glabrous to sparsely appressed hairy, apices rounded, sometimes ascending, surfaces often bluish-white glaucous, non-glaucous areas tawny, puncticulate. Fruit berry, subglobose to slightly obovoid, 3 cm long, 3.4–5 cm in diameter, green when immature, turning black (and then presumably ripe), atropurpureous in dried specimens, locules 10, mesocarp orange when dry; hypodermis thin, not very stony, often broadly rippled in specimens; epidermis orange-peel-textured, scintillant, glaucous-pruinose. Seeds 16–19 mm long, 9–10 mm wide, rugose, shiny, light brown.

Distribution and Ecology.—This species occurs in the Sierra Madre Oriental, including the Sierra Cucharas, just north of Gomez Farias in southwest Tamaulipas, mountainous regions southwest of Tamasopo in southeast San Luis Potosi, northeast Queretaro, and Barranca de Meztitlan in eastern Hidalgo. Collections are from a variety of vegetation types at elevations between 900 and 2200 m. More material, by far, has been collected in the state of Queretaro than any other state. In Queretaro, it has been described as abundant in pine-oak forest, oak forest, oak forest with Liquidambar, and Tilia forests. Other settings in which it has been reported but described as scarce include gallery forests with Platanus, and canyons with bosque mesofoîllo de montaña (cloud forest). An unusual association occurs in Hidalgo, where it was described as very abundant in a canyon with matorral espinoso and matorral crasicaule at 2200 m (F.G. Medrano et al. 7932). The five male flowering collections we examined were all taken in March. Some of these specimens were just leafing out at the time. The fruits ripen between September and early November.

Ethnobotany.—Queretaro: ‘zapote prieto’ (Rubio 1746), ‘zapote del monte’ (Servín 206), zapotillo (Carranza 2000).

Etymology.—The epithet is intended to honor both Arturo Gomez-Pompa, who discovered and described Diospyros riosiae, and has also been a great inspiration to our work on Latin American Diospyros, and also the late J. ‘Carmelo’ Gomez, who assisted the first author in the field on many occasions, and was very knowledgeable on local plant use in the Sierra Tlachichila, Zacatecas.

Collections of D. gomeziorum have often been confused with D. riosiae. A conspicuous feature that differentiates D. gomeziorum from D. riosiae is the leaf margin, which is beveled outward from the upper to the lower surface at about 45° in D. gomeziorum. The margin formed tends to be sharp, shinier, and greener, while that in D. riosiae is thick, not as shiny, and a paler green. Other differences include the upper leaf surface, which is often copiously glaucous-pruinose in D. gomeziorum, while typically the axillary abaxial leaf surface is slightly pru-
nose-scintillant in *D. riojae*. The epidermal cells of the upper leaf surface in *D. riojae* are large, with thickened anticlinal walls, a feature absent in *D. gomeziorum*. Leaf shape in *D. gomeziorum* ranges from elliptical to lance-ovate or ovate, while the leaves of *D. riojae* often tend to be oblong or obovate. However, this character overlaps, since both taxa may have elliptical leaves. In fruiting collections, the shorter, less stout, fruiting pedicels, the thinner, less sclerenchymatous fruit wall, and the glaucous-pruinose to scintillant fruit distinguish *D. gomeziorum*. The pedicel bracteoles of the male inflorescence in *D. gomeziorum* are twice as long as those in *D. riojae*, and are nearly folded lengthwise (navicular). The anthers in *D. gomeziorum* are minutely granular, lacking the apical constriction and smooth texture seen in *D. riojae*.

Carranza (2000) described male flowers of this species (as *D. riojae*) as cymose. We did not find cymes in material referable to either species. Developmentally, the inflorescences may be related to cymes, but, they appear to be fascicles. Some flowers may appear to be in dense terminal clusters (e.g., *H. Rubio* 1542). However, this appearance is superficial, since small terminal shoot apices can be found, although sometimes only with difficulty.

3. Diospyros conzattii Standl., J. Wash. Acad. Sci. 12(17):399, 1922. (Fig. 3) TYPE: MEXICO. OAXACA: Distrito de Pochutla, Cerro Espino, Cañadon San Rafael, 24 Apr 1917 (fr.), C. Conzatti 3167 (HOLOTYPE US-1014759 not seen, ISOTYPES: MO-879669 (in sched. 1,100 m, with Reko & Markrinos), MO-10391787, fragment US-892600; (in sched. 900 m, with Reko & Markrinos).

**Trees** or shrubs, 8–10 m tall, probably facultatively deciduous, trunk not reported; **aged stems** subterete to angular, **bark** verrucose, fissured, gray, **stemwood** off-white to yellowish or pale orange; **2nd–3rd year stems** angular to subterete, **bark** rimo, epidermis glabrous to sparsely hirtellous, sometimes pulverulent, sparingly clavate glandular hairy, densely lenticellate, puncticate, chestnut to tawny, becoming silvery gray; **current year's stems** quadrangular, finely subulate, glabrate to hirtellous, sometimes sparsely strigillose, the hairs off-white to brown, the epidermis shiny, viscous, olive to nearly black. **Petioles** usually thin, sometimes flexuous, 5–8 mm long, pale green to green-brown, rounded below, glabrous to appressed puberulent, conspicuously winged part way above, the wings becoming vertically oriented and narrow along the petiole, petiole slightly convex and minutely V-grooved above, to widely flat-channeled, to 3-channeled (main channel raised and skirted by side channels formed by vertical wings), glabrous to erect puberulent, sometimes clavate glandular hairy, especially in young leaves. **Leaves** alternate, simple, entire, pergamentaceous to chartaceous, lanceolate to elliptic to ovate, 5–14 (–14.7) cm long, (2.5–)3–5 (–6) cm wide, immature leaves membranaceous, **apex** acuminate to an acutely or obtusely rounded point, **margins** flat to subrevolute, curved downward near the base of the leaf, thickened **inframarginal zone** seen when viewed abaxially, hyaline and minutely ciliolate in immature leaves, base acutely or obtusely
Fig. 3. A–E. Diospyros conzattii Standl. A. Fruitting branchlet. B. Stamineate flowering branch. C. Adaxial surface of stamineate petal lobe (left) and typical anther (right). D. Stamineate flower. E. Adaxial surface of mature leaf (apex extrapolated) showing detail of several degrees of venation, and a lateral cross section of the leaf (outset detail). A. Based on J.L. Martinez & A. Hernandez 1302. B–E. Based on F. Ventura A. 7131.
rounded, sometimes cuneate, decurrent onto petiole, sometimes loosely recurved near the petiole; **lower leaf surface** usually glabrous, very rarely minutely white glandular hairy, puncticulate, dull, olive; **upper leaf surface** glabrous, glaucous, densely puncticulate, dull, olive. *Venation* arcolanguid; *midrib* very prominent below, slightly undercut, terete, glabrous, straw to light-green, weakly raised above, and then caniculate within the raised midrib, very sparsely minute erect hairy; 2°–3° *venation* reticulate, veins narrow, raised below and above, *lateral* veins 9–14 pairs, 2° arches formed with superadjacent lateral veins typically obscure. *Laminar extrafloral nectaries* abaxial, conspicuous, round to oval, dark-red to black, often evenly spaced and near the midrib. *Male inflorescences* cymes, 1(–2) near the base of current year’s stems, or (1–)2 leaf scar axils of the previous year’s growth, 1–3-flowered, black to amber velutinous, sparsely covered with minute clavate glandular hairs; *peduncles* 4–6 mm long, velutinous, amber to dark brown; *pedicels* slender, 5–7 mm long, vestiture as in peduncles; *pedicel bracts* 1–2, alternate or opposite, narrowly oblong, 1 mm long, 0.8 mm wide, amber; *Male flowers* 5(–6)-merous; *male flowering calyx* funnelform, drying very dark-brown to black, glabrate to appressed-pubescent, coterminous with pedicel and uninterrupted; *male flowering calyx tube* 2–3 mm long, 1.5–2 mm wide; *sepal* 5, acute-triangular, 2–4 mm long, ciliolate, apically vermiform glandular hairy, sinuses rounded; *corolla* 5–6-lobed, long-ureculate, drying very dark-brown to black, reportedly whitish in life; *corolla tube* widest above middle, 7–8.5 mm long, 4–5 mm wide, abruptly constricted distally, exterior densely minute white puberulent, hair density ± increasing distally, interior sparsely white puberulent, the hairs concentrated in regions of filament attachment; *corolla lobes* quadrate to oval, 2–2.5 mm long, 1.5–2 mm wide, asymmetrical, apex obtuse-rounded, truncate, emarginate, or trifid, often with several short dark hairs, exterior densely minute white puberulent, interior inflexed at the distal right margin, left margin slightly involute, pubescent. *Stamens* 30, sometimes attached in pairs, adnate to corolla from midpoint to bottom of tube, sometimes inserted on the receptacle; *filaments* 3 mm long, minutely hairy; *anthers* basifixed, lanceo-apiculate, 3–3.5 mm long, opening by terminal pores or short lateral slits, connective minutely deltoid-scyaly, *pistilloide* minute, obtruncate, smooth, nearly unlobed, having a few smooth very small basal lobes, glabrous. *Female inflorescence* flowers solitary, cauline, at the junction of current and previous year’s growth. *Fruiting pedicels* stout, (7–)12–15 mm long, glabrous to sparingly minute hirtellous. *Fruiting calyx* 5-lobed; *fruited calyx tube* 3 mm long, explanate to campanulate, usually with a conspicuous enlarged basal region encircling the pedicel joint; *fruited sepals* accrescent spreading to reflexed slightly, apices straight, coriaceous, narrowly to linearly triangular, 24–31 mm long, 5–8 mm wide, margins sometimes sharp edged, sometimes glaucous, glabrous, puncticulate. *Fruit* berry, depressed-globose slightly obvoid, up to 4 cm long, 4.5 cm in diameter, reportedly reddish (*Chazana* 3969) or green (*Standley*
1922) when ripe, mostly atropurpureous in herbarium material. **Locules** 10–12; **mesocarp** reportedly black when ripe, usually orange in dried specimens; **hypodermis** 0.2–0.5 mm thick, stony; **epidermis** bullate, glaucous-scintillant, usually wrinkled when dry. **Seeds** 15–16 mm long, 11–12 mm wide, 5.5–9.5 mm thick, sculpture cerebriform, chestnut.


**Distribution and Ecology.**—The type locality is in the Pacific coastal ranges of the Sierra Madre del Sur, Oaxaca. It occurs there in dry tropical forest on coastal slopes (Anonymous 1927). According to Conzatti (in Standley 1922), the fruit is ripe in April. In Veracruz, occurrences are near Pico de Orizaba, the Sierra de Tepuzitlan, and the Sierra de Chiconquiaco, between 920 and 2200 m altitude. It occurs on slopes with pine-oak woodland and Alnus, oak forests, and deciduous forests.

**Ethnobotany.**—Veracruz: ‘zapotillo’ (C. Gutierrez B. 3292). Oaxaca: ‘zapote negro montés’ (Standley 1922 [quoting Conzatti], and on US-892600), ‘zapote negro silvestre’ (Conzatti 3167 [in his own handwriting]). The wood is considered valuable (Anonymous 1927 [paraphrasing Conzatti]).

Only one of the isotypes we examined, MO-879066, included a fruit. Unfortunately, the large atropurpureous fruit is in rather poor condition. However, upon close examination it was clear that the epidermis is bullate, glaucous, although tending towards brown in some areas. The fruit wall is thick and quite stony. A fragment packet attached to another type, MO-1039787, contains a spreading fruiting calyx tube bearing the basal 5 mm of one sepal, and much less of the base of another. The sepals appear to have been quite narrow, ca. 4–5 mm wide at the base and further narrowed distally. Characteristics seen in the fruit of **D. conzattii** collections from Veracruz are consistent with the characteristics found in the isotype. An enlarged region below the fruiting calyx encircling the pedicel joint is only seen in the Veracruz material, but not the isotype. At this point, we are unsure of its significance.

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2 The label indicates the collection was made at 150 m. This seems to be a typographical error. The coordinates for Cuizalín are compatible with an elevation estimate of 1500 m.
4. **Diospyros costaricensis** M.C. Provance & A.C. Sanders, sp. nov. (Fig. 4b, e). **TYPE:** COSTA RICA. GUANACASTE. Cantón de Liberia. Parque Nacional de Guanacaste, Cordillera de Guanacaste, Cerro Cacao, Estación Cacao. 10° 55' 45"N, 85° 28' 15"W, 1100 m, 14 Jul 1991 (fr.), Carlos Chávez 569 (HOLOTYPE: MO-5316680; ISOTYPES: 4 duplicates” indicated on label, but not seen by us).

Arbor D. conozaithi Standl. similis sed anterideis-laciente, usque ad 35 m alta et 1.5 m diametro; petiolis adaxiale fere negris; zona intermarginali laminae neque incrassata neque elevata in pagina abaxiali; costa glabra ad aurantiella adaxiale, vadose (saeppe late) concava, aut ab lateribus contiguis laminae longistrorum crispi in speciminibus exsiccati.

**Trees**, probably facultatively deciduous, reportedly colonial, reportedly up to 35 m tall, and 1.5 m in diameter (Espinoza 54); **trunk** buttress-forming, channelled, smooth, greenish-black to greenish-brown, slash yellow and aromatic; **aged stems** somewhat angular, half-netted, black to gray above, lower layer beige to golden-brown, sometimes ± mottled, sometimes shallow-fissured, lenticellate; **2nd-3rd year stems** irregularly half-netted, beige beneath, black and grey above, hirtellous, pubescence sometimes persisting on three year old stems, lenticellate; **current year’s stems** quadrangular, sulcate to minutely ridged, sparsely subsapressed golden hairy, the hairs fine and ± straight, sparingly to very densely erect puberulent, dark-green to black, somewhat glandular, becoming lenticellate. **Petyoles** usually thin, somewhat flexuous, 3-6.5 mm long, wings tapering gradually from the decurrent lamina, and twisting abruptly into a vertical orientation along the margin, glabrous to hirtellous below, rugose to invaginate, light olive to very dark brown, concave above, often minutely V-grooved, usually golden hirtellous, often glandular, epidermis often nearly black. **Leaves** alternate, simple, entire, chartaceous to subcoriaceous, cartilaginous, ovate to elliptic, rarely widely-ovobate, 6.5-9.5(-10.2) cm long, 2.8-4(-5) cm wide, very often tattered around the margins, wrinkled, apex usually asymmetric, tapering to an obtusely rounded tip, margin curved under near the base of the leaf, base mostly obtuse and tardily abrupt-acuminate, sometimes acute, long decurrent onto the petiole; **lower leaf surface** sparsely appressed puberulent, puniculate, sometimes clavate glandular hairy near base, dull, brown to brown-green; **upper leaf surface** glabrous, very rarely glaucous-scintillant, papillose, puniculate, brown-green. **Venation** brochidromous, midrib prominent below, glabrous to sparsely appressed puberulent or hirtellous, epidermis green to brown-green, shallowly concave above, glabrous to golden hirtellous, sometimes partly shrouded by the lamina, then canaliculate and hairs criss-crossing, epidermis of basal half often black, otherwise greenish; 2° venation fine below, usually prominent, lateral veins 9-12 pairs, forming definite 2° arches with superadjacent lateral veins, arch apices 3 or more mm from the margin, venation tending to be obscure above, but variable; 3°-4° venation reticulated below, fine, usually apparent, but varying from obscure to prominent. **Laminar extrafloral nectaries** often up to 30, sometimes more, scattered on the abaxial side of the lamina, minute, peripherally rimmed with a narrow band
of raised tissue. Male inflorescence cymes, 2–3-flowered, 1–2 cymes per axil, from growth of the previous year, or from the base of new growth, densely subulate puberulent; peduncles up to 4 mm long, sparsely to densely pubescent to strigose with light brown to black hairs, epidermis dark brown; pedicels 0.5–3.5 mm long, vestiture and epidermis as in peduncles, pedicel bracts rarely persisting in herbarium material, 0.3–1 mm long, deltoid, densely hairy, the hairs dark-brown and straight. Male flowers 5-merous; calyx infundibuliform, exterior short-appressed gold to white puberulent, sometimes with clavate glandular hairs, epidermis dark brown; calyx tube 0.8–1.3 mm long, interior with ring of straight appressed white hairs; sepals usually erect, rarely slightly recurved, 2–3.5 mm long, 0.8–1.5 mm wide, interior glabrous to glandular setulose, exterior pubescent, often densely so at the apex, the hairs wavy and amber, appearing glandular; corolla long-urceolate; corolla tube 3.5–7.5 mm long, 3 mm wide, interior lower-third of tube short golden pubescent, hairs ± erratically directed, exterior evenly and densely short appressed to ascending golden hairy, also clavate glandular hairy; corolla lobes 5, quadrate to oval, 2–2.8 mm long, 1.2–2.5 mm wide; apex sometimes bearing a long flagellate trichome, interior right margins involute, interior glabrous, exterior appressed to ascending white puberulent, the left side of lobe densely appressed fine puberulent, sometimes with several minute black hairs near the apex. Stamens 17–19, adnate at various levels at and below the basal third of the corolla; filaments 1–1.5 mm long, narrowed distally, glabrous to densely erect hispidulous; anthers basifixed, 2.3–2.5 mm long, several minute hairs at the apex, surface light-yellow apically, opening by short lateral slits confined to the distal half to two-thirds of the anther, sometimes opening by a complete lateral slit, pistilode ± sub-conical, slightly wavy peripherally, ± 8 long straight hairs originating from the central apex, otherwise glabrous. Female inflorescence flowers solitary in leaf scar axils of 2nd year stems, or cauline at junction of previous and current growth. Fruiting pedicels stout, 3–18 mm long, sparsely hirtellous, reddish-gold, and gray, lenticellate. Fruiting calyx 5-lobed, sinuses acute; fruiting calyx tube explanate, sparsely appressed puberulent, scintillant, ± 3.5 mm long; fruiting sepals accrescent, coriaceous, lorate to lanceolate, 16–22 mm long, (5–)6–8(–9) mm wide, spreading to moderately reflexed, apex straight to quite incurved, puncticulate, shiny, golden brown, sparingly scintillant basally. Fruit berry, sometimes pendulant, depressed-globose, 2.5 cm tall, 4 cm wide, reportedly green in living material, dull, atropurpureus to dark-brown in herbarium material, locules 10; mesocarp reportedly yellow in living immature fruits, dark orange in herbarium material; hypodermis ± 0.5 mm thick, stony, not wrinkling in herbarium material; epidermis bullate, glaucous to pruinose-scintillant, either locally or over most of the fruit. Seeds not seen.

Paratypes: Costa Rica. Guanacaste. Cantón de Liberia: Parque Nacional de Guanacaste, Estación Caccao, 10° 55' 45" N, 85° 28' 15" W, 1100 m, 24 Nov 1990. R. Espinoza 54 (K, MO); Cordillera de Guanacaste,
Estación Cacao, sendero a Estación Maritza, 10° 55' 43"N, 85° 28' 10"W, 1100 m, 15 Jul 1996, José González et al. 1108(K). Canton de La Cruz: Parque Nacional de Guanacaste; Cordillera de Guanacaste. V Orosí. Sector Orosí (antes Maritza), sendero Casa Fram. 10° 57' 40"N, 85° 29' 45"W, 600 m, 13 Jul 1994, José González et al. 301 (MO [2 accessions]). Puntarenas, Canton de Puntarenas: Reserva Biológica, Monteverde, Cordillera de Tilarán. Altos de San Luis. Los Leitones. 10° 17' 25"N, 84° 48' 10"W, 1200 m, 4 Sep 1991, E. Bello 4014 (MO); sendero a la Catarata, por el rio, sendero Miguel Leitón. 10° 16' 20"N, 84° 49' 30"W, 1100 m, 11 Mar 1993, Zohaida Fuentes 248 (K, MO).

Distribution and Ecology.—As far as known, this tree is endemic to northwestern Costa Rica, where it occurs in the Cordillera de Tilarán and the Cordillera de Guanacaste, between 600 and 1200 m in elevation. Details concerning associated vegetation are mostly lacking on the collections from the Cordillera de Guanacaste, a drier and more seasonal mountain range than the Cordillera de Tilarán (Hammel et al. 2004). This species could be associated with deciduous forests of the region. The collections from Puntarenas come from the Pacific side of the Cordillera de Tilarán. Label data from one of the collections, Bello 4014, indicates that the tree was growing in charral, or young secondary forest (Kleinn et al. 2002). The other collection does not provide details about the associated vegetation. In a broad sense, the region of the occurrences in Puntarenas has been mapped as Costa Rican seasonal moist forests. These are deciduous forests that obtain 90% of their annual precipitation, (± 1500 mm total), during the months of April through October (World Wildlife Fund 2001). The formation of new leaves and male flowers apparently occur during March (only one flowering collection was examined).

Ethnobotany.—Known by the common name ‘guacalillo’ in Puntarenas, Costa Rica (Fuentes 248).

Etymology.—The epithet refers to the only country in which the species is currently known to occur.

This species is different from *D. conzattii* in several respects. First, it is a buttress-forming tree attaining 35 m in height; this is quite exceptional among *Diospyros* from Central America and Mexico. *Diospyros conzattii* is not known to reach over 10 m in height. The abaxial leaf venation is conspicuously brochi-dodromous, the lateral veins forming well defined secondary arches with the superadjacent lateral veins. Another interesting difference involves the distance from the outer-perimeter of secondary arches to the leaf margin, which is usually around 3–6 mm at about mid-leaf. This distance is 1–3 mm in *D. conzattii*. The marginal loops of *D. conzattii* often become difficult, but not impossible, to discern, hence the aforementioned distance is measurable. Some other vegetative differences useful for separating these species include yellowish to orange hairs on the adaxial midrib, and the converging adaxial lamina along the depressed midrib in *D. costaricensis*. The inflorescences of *D. conzattii* and *D. costaricensis* are clearly cymes, with peduncles around 6 mm and 4 mm long respectively.
5. **Diospyros tuxtlenesis** M.C. Provance & A.C. Sanders, sp. nov. (Fig. 5). **Type**: MEXICO. VERACRUZ. Mpio. San Andrés Tuxtla, borde de la cima del Cerro Mastagaga, al N del Ejido Ruiz Cortinez. Sierra de los Tuxlas, 30 May 1985, J.L. Cazada 11855 (holotype: IEB-48870; isotype: XAL).

Arbor usque ad 10 m alta, D. riajca Gómez-Pompa similis sed differt foliis ellipticis et non glaucis, marginibus non crassis et inter paginas oppositas rotundatis; pedicellis abaxialibus atropurpureis; sepalis fructiferis 26–40 mm longis, reflexissimis et com apicibus rectis; pedicellis fructiferis 14 mm longis.

**Trees** 8–10 m tall, probably facultatively deciduous; **aged stems** terete to subterete, ± glabrous, half-netted to squamose, dark-brown to grey-brown with beige, short-fissured stem wood yellowish to orange-brown; **2nd–3rd year stems** angular to subterete, glabrous, sulcate to shallow-fissured or half-netted, in combinations of dark-brown, gray, and orange-brown; **current year's stems** angular, smooth to finely sulcate, very cream to grey, shiny, lenticellate, glabrous to densely minute hirtellous, appressed off-white puberulent near apex, puncticulate. **Petioles** 4–7 mm long, glabrous, flat to slightly concave above, golden-brown, below widely rounded, glaucous-scintillant, dark-purple. **Leaves** alternate, simple, entire, pergamnentaceous to chartaceous, ± elliptic, 8–15 cm long, 3–5(–8) cm wide, widest at or just above the middle, both sides very sparsely scintillant, but leaf surface dull golden-brown to bronze between individual scintillae, apex usually acuminate, the acumen long, narrow, obtusely rounded at the tip, margin flat with slight intramarginal thickening, base acuminate to attenuate, decurrent onto petiole; **lower leaf surface** sometimes sparingly appressed puberulent near base and midrib, conspicuously puncticulate; **upper leaf surface** glabrous, papillose. **Venenation** arcolanguid to brochidodromous; **midrib** conspicuously flat and wide below, sulcate, purplish basally, becoming orange-red to golden-brown and somewhat keeled apically, sometimes sparsely appressed puberulent, glaucous, shallowly concave above, glabrous, not darkened; **2° venation** raised above, obscure, **lateral veins** 8–9 pairs, shiny, chartreuse to golden-brown and conspicuous; **3° venation** obscure below, granular-papillose, apparent above. **Laminar extrafloral nectaries** abaxial, common, sometimes along **2° veins**, rimmed with the same bright color seen in **2° veins**. **Male inflorescence** unknown. **Female inflorescence** flowers solitary, emerging at the junction of old and new growth. **Fruiting pedicels** stout, 14 mm long, 3 mm wide, wavy-rugose, minutely fissured, lenticellate, black and tan mottled. **Fruiting calyx** with lobes and distal portion of tube strongly reflexed, sinuses rounded; **fruited calyx tube** exterior sparsely appressed puberulent; **fruited sepals** 5, very accrescent, 26–40 mm long, 7.5–11 mm wide, ovate to widely lanceolate, narrowed basally, apex acutely pointed, sometimes rounded, sepals glabrous, golden-brown, sepal nerves distinct. **Fruit** berry, depressed-globose, up to 4 cm tall, 4.5 cm in wide, atropurpureous, number of locules indiscernible; **mesocarp** dark-brown in live material and in immature fruits of herbarium material; **hypodermis** ± 0.5 mm thick, sclereidic; **epidermis**
Fig. 5. Diospyros tuxtensis M.C. Provance & A.C. Sanders, sp. nov. Fruiting branch. Based on J.J. Calzada 11855.

Glaucous-scintillant, wrinkled. Seeds immature, sizes indiscernible (broken seeds only), dark reddish brown, granulate to minutely ruminate (sensu Stearn 2000, fig. 38).


Distribution and Ecology.—Apparently endemic to the Sierra de Los Tuxtlas,
Veracruz, Mexico. Only one elevation recorded, 920 m (R. Acosta P. & C. González R. 1312). The associated vegetation types for the known collections have included primary selva mediana perennifolia, selva baja perennifolia, and deciduous forest. It was considered common in selva baja perennifolia with elements of deciduous forest (Calzada 11855).

Ethnobotany.—A common name has not been reported, but since the fruits are likely to be edible, the species may be well-known to local residents. The species may eventually be found as a conserved tree near homes or pastures.

Etymology.—The epithet refers to Sierra de Los Tuxlas, Veracruz, Mexico, from where the only collections of this species have been made.

SPECIES OF UNCERTAIN STATUS

*Diospyros pergamentacea* Lundell, Contr. Univ Michigan Herb. 7:44. 1942. TYPE. MEXICO. CHIAPAS. Pico de Loro, near Escuintla, in advanced forest, 2220 m, 25 Jun 1941, Eitz Matuda 4278 (holotype: MICH not seen; isotypes: photo Al, photo CAS (sterile), photo Fl, IT not seen, photo LL-372460!, MO-1213673!, US-1849013!).

A redescription of this taxon did not seem appropriate, given that there are no new specimens. We do not think we can add much to the work of Lundell. Overall, this species looks quite similar to *D. conzatti*, with which some authors have considered it conspecific. This species is known only from the type specimen, collected on Pico de Loro, near Escuintla, Chiapas. The petioles are very long and flexuous, reported to be up to 15 mm long by Lundell (1942). There also seem to be differences in the sepals, they being strongly reflexed, and having a shape that is suggestive of some populations of *D. rosei* sensu lato. In fact, these differences are significant enough that we are not entirely convinced that it is synonymous with *D. conzatti*. The leaves of the isotypes we examined had a thin coating of clear glue on much of their surface, which may obscure some characters. We recommend re-evaluating the taxonomic status of this taxon when additional material from the Chiapas-Guatemala borderland becomes available. For the time being, we do not recommend reduction to synonymy with *D. conzatti*.

DISCUSSION

Neither the holotype nor the two isotypes of *D. riojae* were available for a first-hand examination. Unfortunately, there are no paratypes for *D. riojae*, *D. conzatti*, or *D. pergamentacea*. Microfiche of an isotype and the detailed description of *D. riojae* by Gomez-Pompa (1964) were valuable in completing this paper. The original description made use of tables and text in contrasting differences between *D. riojae* and *D. conzatti*. Additionally, it was supplemented

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3 For example: A. Gomez-Pompa (1964); F. White in 1968 and C. Whitefoord & S. Knapp in 1996, in both cases by annotation of the isotypes.
with an illustration prepared from the original collection (Gomez-Pompa, pers. comm.). The illustration is consistent with the type description, and the isotype at US, and in accordance with the Code, Article 9.2: Note 2 (Greuter et al. 2000), the illustration in the protologue represents original material.

Because fruiting *D. riojae* material keys to *D. conzattii* in Standley's treatment of *Diospyros* of Mexico (1924), Gomez-Pompa (1964) provided a table of leaf and fruit characters that could be used to separate these taxa. Admittedly, some of these characters overlap to some degree. When it is considered that Gomez-Pompa had one fruiting collection of *D. riojae*, one fruiting collection of *D. pergamentacea*, and probably only one collection of *D. conzattii* to examine, it is to his credit that the characters he emphasized are often still useful for separating these taxa. We have provided an updated character table (Table 1) that should be helpful in the differentiation of the three new species described here.

Redetermination of the available material resulted in roughly a 70% reduction in the number of documented occurrences of *D. riojae* from what might have been reported based on an uncritical review of locations based on herbarium material. At the least, this constitutes a reaffirmation of the rarity of this species. The realization that *D. conzattii* is an element of the Veracruz flora is very interesting. As far as we can tell, these are the first reports of the species for Veracruz. Material from the Cordillera de Guanacaste, and the Cordillera de Tilarán, Costa Rica, represents a distinct new species, *D. costaricensis*. The discovery of a new species, *Diospyros tuxtensis*, from the Sierra de Los Tuxtlas does not come as a shock, since this region is renowned for having numerous endemic species of plants and animals. The distributions of the closely allied taxa, *D. tuxtensis* and *D. costaricensis*, are notable in light of some recent interest in Los Tuxtlas-Costa Rica disjunctions (Hammel 1997). In addition to occurring in native stands of vegetation, individuals of this taxon should be sought as conserved trees in local gardens and pastures. This taxon seems to be a rare endemic of the Sierra de Los Tuxtlas, and could be in need of formal protection.

We have not seen female flowers of any of these species. The only description of a female flower that we have seen in the literature is by Carranza (2000) and refers to material from Queretaro (*D. gomeziorum*). The lack of flowering Ebenaceae material in herbaria, as pointed out by Gomez-Pompa (1964) and Wallnöfer (2001), and clearly demonstrated by our sample, makes searching for taxonomically informative vegetative characters a particularly attractive proposal (Gomez-Pompa 1964). Below we provide a key to the species described in this paper that emphasizes vegetative characters. Male flower and inflorescence characters (Table 2) can be used to supplement the following key if desired. It should be noted that *D. tuxtensis* is not treated in Table 2, since flowering material is not currently known.
<table>
<thead>
<tr>
<th></th>
<th>gomeziorum</th>
<th>costaricensis</th>
<th>conzattii</th>
<th>riojae</th>
<th>tuxtlenis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Life form and size</strong></td>
<td>Trees or shrubs to 20 m tall</td>
<td>Buttressed trees to 35 m tall</td>
<td>Trees or shrubs, 8-10 m tall</td>
<td>Trees, rarely shrubs, to 25 m tall</td>
<td>Trees, 8-10 m tall</td>
</tr>
<tr>
<td><strong>Leaf shape</strong></td>
<td>lanceolate to ovate to elliptic</td>
<td>ovate to elliptic, rarely widely-oblanceolate to elliptic to ovate curve under near base, intramarginal thickening curve under near base, intramarginal thickening</td>
<td>curve under near base, intramarginal thickening</td>
<td>elliptic, oblong, obovate, or nearly oval, slightly recurved, thickened, sometimes ciliate shiny, glabrous</td>
<td>flat, slight intramarginal thickening</td>
</tr>
<tr>
<td><strong>Leaf margin</strong></td>
<td>beveled, sometimes ciliate, not thickened</td>
<td>dull sparsely appressed hairy, sometimes glandular</td>
<td>dull usually glabrous, very rarely glandular</td>
<td>dull, ciliate, shiny, glabrous</td>
<td>dull, glabrous to sparingly appressed puberulent</td>
</tr>
<tr>
<td><strong>Leaf luster (both sides)</strong></td>
<td>shiny glabrous to sparsely subapressed hairy</td>
<td>dull sparsely appressed hairy, sometimes glandular</td>
<td>dull usually glabrous, very rarely glandular</td>
<td>dull, ciliate, shiny, glabrous</td>
<td>dull, glabrous to sparingly appressed puberulent</td>
</tr>
<tr>
<td><strong>Leaf bloom above</strong></td>
<td>glaucous to pruinose-scintillant</td>
<td>very rarely glaucous-scintillant</td>
<td>glaucous</td>
<td>sometimes slightly pruinose or scintillant</td>
<td>slightly scintillant</td>
</tr>
<tr>
<td><strong>Epidermal cells of lamina above</strong></td>
<td>not large and not thickened punctulate</td>
<td>not large and not thickened punctulate</td>
<td>not large and not thickened punctulate</td>
<td>not large and not thickened punctulate</td>
<td>somewhat large and thickened, conspicuously punctulate</td>
</tr>
<tr>
<td><strong>Epidermal cells of lamina below</strong></td>
<td>not large and not thickened punctulate</td>
<td>not large and not thickened punctulate</td>
<td>not large and not thickened punctulate</td>
<td>not large and not thickened punctulate</td>
<td>not large and not thickened punctulate</td>
</tr>
<tr>
<td><strong>Midrib vestiture above</strong></td>
<td>sparingly to densely hirtellous to deltoid scaly</td>
<td>glabrous to golden hirtellous</td>
<td>very sparsely hirtellous</td>
<td>glabrous, sometimes sparingly glandular</td>
<td>glabrous</td>
</tr>
<tr>
<td><strong>Midrib topography above</strong></td>
<td>narrowly canaliculate</td>
<td>shallowly concave</td>
<td>canaliculate, sometimes raised</td>
<td>shallowly concave</td>
<td>shallowly concave</td>
</tr>
<tr>
<td><strong>Number of major lateral veins</strong></td>
<td>(8-11)13(-14)</td>
<td>9-12</td>
<td>9-14</td>
<td>8-12</td>
<td>8-9</td>
</tr>
<tr>
<td><strong>Emergences on venation above</strong></td>
<td>2°-3° granular papillose</td>
<td>none</td>
<td>none</td>
<td>2°-3° granular papillose</td>
<td>3° granular papillose</td>
</tr>
<tr>
<td><strong>Petiole color above</strong></td>
<td>yellow-green to olive-green</td>
<td>nearly black</td>
<td>pale green to green-brown</td>
<td>light green to chartreuse to amber</td>
<td>golden-brown</td>
</tr>
<tr>
<td>Character</td>
<td>gomeziorum</td>
<td>costaricensis</td>
<td>conzattii</td>
<td>riojae</td>
<td>tuxtlensis</td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------------------------------</td>
<td>--------------------------------</td>
<td>-------------------------------</td>
<td>-------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>Petiole color below</td>
<td>olive-green to dark brown, glistening spreading</td>
<td>light olive-green to very dark brown spreading to moderately reflexed</td>
<td>pale green to green-brown spreading to slightly reflexed</td>
<td>light green to chartreuse to amber arcuate-reflexed to spreading</td>
<td>dark purple strongly reflexed</td>
</tr>
<tr>
<td>Fruiting calyx posture</td>
<td>apices ascending</td>
<td>apices straight to quite incurved</td>
<td>apices straight</td>
<td>apices incurved to ascending</td>
<td>apices straight</td>
</tr>
<tr>
<td>Fruiting sepal length</td>
<td>19–20 mm long</td>
<td>(16–)22 mm long</td>
<td>24–31 mm long</td>
<td>7–25 mm long</td>
<td>26–40 mm long</td>
</tr>
<tr>
<td>Fruiting sepal shape</td>
<td>lanceolate to narrowly elliptic or obovate</td>
<td>lorate to lanceolate</td>
<td>narrow to linear triangular</td>
<td>oblong, narrowly deltoid or ovate</td>
<td>ovate to widely lanceolate</td>
</tr>
<tr>
<td>Fruiting pedicels</td>
<td>(4)5–8(–11) mm long, not stout thin</td>
<td>3–18 mm long, stout</td>
<td>(7–)12–15 mm long, stout intermediate</td>
<td>7–12 mm long, stout</td>
<td>14 mm long, stout</td>
</tr>
<tr>
<td>Fruit hypodermis</td>
<td>thick</td>
<td>thick</td>
<td>thick</td>
<td>thick</td>
<td>thick</td>
</tr>
</tbody>
</table>
Table 2. Reproductive morphology of four similar taxa from Mexico and Costa Rica.

<table>
<thead>
<tr>
<th></th>
<th>Diospyros gomeziorum</th>
<th>Diospyros costaricensis</th>
<th>Diospyros conzattii</th>
<th>Diospyros riojae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male inflorescence</td>
<td>fascicles on previous year's growth, solitary on new growth</td>
<td>cymes from previous year's growth, cymes from new growth</td>
<td>cymes from previous year's growth, cymes from new growth</td>
<td>fascicles from previous year's growth, fascicles from new growth</td>
</tr>
<tr>
<td>Male corolla tube shape</td>
<td>urceolate-campanulate</td>
<td>long-urceolate</td>
<td>long-urceolate</td>
<td>urceolate-campanulate</td>
</tr>
<tr>
<td>Male corolla tube interior vestiture</td>
<td>sparingly hirtellous, hairs sometime erratic</td>
<td>lower-third of tube short golden pubescent, hair direction erratic</td>
<td>sparsely puberulent, densest from mid-tube to tube bottom</td>
<td>deltoid scaly at mid-tube</td>
</tr>
<tr>
<td>Stamens</td>
<td>20</td>
<td>17–19</td>
<td>30</td>
<td>18</td>
</tr>
<tr>
<td>Anthers</td>
<td>2.3–2.5 mm long, oblong-ovate to ovate, minutely granular, short slits near apex</td>
<td>3–3.5 mm long, lanceolate, apiculate, short lateral slits near apex</td>
<td>1 mm long, hirtellous, especially along margin</td>
<td></td>
</tr>
<tr>
<td>Filaments</td>
<td>0.3–0.8 mm long, ascending-puberulent</td>
<td>1–1.5 mm long, glabrous to densely erect hispidulous</td>
<td>3 mm long, minutely hairy</td>
<td></td>
</tr>
</tbody>
</table>
A KEY TO DIOPSYROS RIOJAEE, DIOPSYROS CONZATTII
AND SOME ALLIED BLACK ZAPOTES

1. Leaves dull, laxly revolute (loosely rolled under) near the base of the leaf; neither the 2nd nor the 3rd upper leaf surface venation granular papillose.

2. Buttressed trees up to 35 m tall and 1.5 m in diameter; petiole color above nearly black; leaf margin or intramarginal zone not thickened (viewing bottom surface); midrib above shallowly, and often widely, concave, or crimped lengthwise by the adjacent sides of the lamina (boxed in); midrib glabrous to golden hirtellous, currently known only from Costa Rica

4. Diospyros costaricensis

2. Trees or shrubs, 8–10 m tall, lacking buttresses as far as known; petiole color above pale green to green-brown; leaf margin or intramarginal zone thickened (on bottom surface); midrib above narrowly canaliculate, the canalis raised or ± even with the lamina; midrib very sparsely hirtellous; currently known only from Veracruz, Oaxaca, and possibly from Chiapas

3. Diospyros connzattii

1. Leaves shiny or dull, margins flat or sometimes subrevolute, but never loosely rolled under near the base; 2nd or 3rd venation, or both, usually granular papillose on upper leaf surface.

3. Leaf margin beveled outward from the upper leaf surface, down to the lower leaf surface; epidermal cells of the upper lamina surface not large and conspicuous with thickened anticinal cell walls; leaves often copiously glaucescent-prunose; fruiting calyx spreading, fruiting sepals with ascending apices; fruiting pedicels generally slender

2. Diospyros gomeziorum

3. Leaf margin never beveled; epidermal cells of the upper lamina surface large and conspicuous; having thickened anticinal cell walls; leaves sometimes somewhat prunose or scintillant, but never with copious bloom; fruiting calyx spreading to strongly reflexed, apices various; fruiting pedicels very stout

4. Leaves shiny, often tending towards oblong, oval or obovate; but may also be elliptic; leaf margins thickened, rounded from the top leaf surface to the bottom; petiole color below light green to chartreuse or amber; fruiting sepals 7–25 mm long, spreading to arcuate-reflexed; the apices incurved to ascending; fruiting pedicels 7–12 mm long

1. Diospyros riojaee

4. Leaves dull, elliptic; leaf margins flat or with a slight intramarginal thickening visible on the bottom surface; petiole dark purple below; fruiting sepals 26–40 mm long, strongly reflexed, the apices straight; fruiting pedicels 14 mm long

5. Diospyros tuxtlensis

ACKNOWLEDGMENTS

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the Plant Resource Center, Austin, for providing images useful in this study. The first author would like to extend a warm thanks to Juanita and Seychelle Provance for their financial support, logistic tolerance, and patience. We would like to thank Giles Waines and Arturo Gomez-Pompa for their insight and encouragement. We are grateful to the Remif Database and Jose L. Panero (TEX, LL), the caretaker of the node that helped pinpoint El Cuizalín, Veracruz. Finally, we thank UCMEXUS and the UCR Center for Conservation Biology for generously supporting a visit to XAL to photograph specimens.

REFERENCES


MORE AMERICAN BLACK SAPOTES: NEW DIOSPYROS
(EBENACEAE) FOR MEXICO AND CENTRAL AMERICA

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ABSTRACT

During the preparation of a monograph of the hbenaceae for Mexico, numerous collections previously determined to be Diospyrs conzattii Standley and Diospyros riojae Gomez-Pompa could not be reconciled with their original descriptions, type specimens and illustrations. It was determined that collections of putative D. conzattii from Costa Rica represent a new species, D. costaricensis, described here. All but one collection of putative D. riojaco from the Mexican states of Queretaro, Hidalgo, Tamaulipas, and San Luis Potosi, represent a new species, D. gomeziorum, described here. Putative collections of D. riojaco from Veracruz additionally include specimens of D. conzattii a species previously unreported for the state, and a new species from the Sierra de Los Tuxtlas, D. tuxtIsnis, described here. We provide emended descriptions of D. riojaco and DI conzattii, and describe three new species of Diospyros for Tropical America. We also provide comments on distribution, ecology, conservation, ethnobotany, and provide illustrations for each of these taxa.

Keywords: black sapote, Costa Rica, Diospyros gomeziorum, D. conzattii, D. costaricensis, Diospyros rusei Complex, D. tuxtIsnis. Ebenaceae, granadilla, guacalillo. Mexico, new species, persimmon, zapote negro silvestre. zapotillo

RESUMEN

Durante la preparacion de la monograf ia de Ebenaceae para Mexico, numerosas colecciones previamente determinadas como Diospyrs cLniizuii Standley y Diospyros riojaco Gomez-Pompa no pudieron ser reconciliadas con las descripciones originales, el especimen tipo y las ilustraciones. Se determino que la coleccion putativa D. conziitii de Costa Rica, representa una especie nueva. D. costaricensis descrita aqui. Todas, excepto una de las colecciones putativas de D. riojaco de los estados mexicanos de Queretaro, Hidalgo, Tamaulipas y San Luis Potosi representan una especie nueva de D. gomeziorum, descrita aqui. Adicionalmente, las colecciones putativas de D. riojaco de Veracruz incluyen especimenes de D. conzattii, una especie no citada previamente para ese estado y de una especie nueva de la Sierra de los Tuxtlas D. tuxtIsnis, descrita aqui. Proveemos descripciones
The pantropical genus Diospyros (Ibenaceae) consists of about 500 species of trees, shrubs, and suffrutescences (White 1983). A treatment of the Mexican species of Diospyros in full has not appeared since Standley (1924). Modern treatments have dealt with smaller areas, such as Veracruz (Pacheco 1981), northeastern Michoacan, Guanajuato, and Queretaro (Carranza 2000), the Yucatan Peninsula (Lundell 1942), and the Tehuacan-Cuicatlan Valley. Oaxaca (Kelly 2001), or covered portions of southern Mexico within a larger flora (Whitefoord & Knapp 2001). Circumscription of the Mexican and Central America taxa is not entirely agreed upon. However, based on our preliminary work, a reasonable estimate of the number of native species occurring in Mexico is around 25.

In 1918, C. Conzatti collected a new black zapote from the coastal mountains northeast of San Pedro Pochutla, Oaxaca. He recorded some characteristics of the tree, especially those pertaining to the edible fruit, the taste of which he enjoyed. He believed that the fruit of the ‘zapote negro silvestre’ (Conatti, 3167) had potential as a new tree crop (Standley 1922). This zapote was formally described a few years later as Diospyros conzatti Standl. (Standley 1922). According to Trabut (1926), D. conzatti was introduced to California and Florida. However, he did not provide any specific details, and we are unaware of any other information that might corroborate the putative introduction of this species to the United States.

Diospyros riojiae Gomez-Pompa was described from one fruiting collection made in the Misantla region of central Veracruz, Mexico (Gomez-Pompa 1964). Since then, collections of putative D. riojiae have been made in several more locations in Veracruz, Tamaulipas, San Luis Potosi, and numerous places in northeastern Queretaro. Diospyros riojiae is considered an endangered species (Sanchez-Coello 2002).

During the preparation of a monograph of the Ibenaceae for Mexico, we noticed a large amount of morphological variation among collections of putative Diospyros riojiae and D. conzatti. While we had intended to examine the taxonomy of both species at a later time, in view of the endangered status of D. riojiae and...
a sense of some urgency regarding its protection (t.g., Sosa et al. 1998) we thought it would be prudent to proceed with the treatment of the following taxa now, lest the designation of protected areas, or expensive and time-consuming ecological research, be confounded by the unrecognized presence of similar looking taxa.

About it igit-five specimens from seventeen herbaria were examined for this study. With the exception of one collection from San Luis Potosi, specimens of putative D. rioja collected outside of Veracruz represent a new species, D. omceiziorum, described here. Much of the material collected in Veracruz and attributed to D. rioja has been found to represent D. conatti and a species

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new to science, D. tuftensis, described here. Costa Rican material, previously ascribed to D. conzattii, clearly represents a third new species, D. costaricensis, which is described here. These species are best considered members of what we have informally recognized as the 'Diospyros rosei Complex' (Provance & Sanders 2005), a group that additionally includes: Diospyros roschi Standl., Diospyros oaxacana Standl., Diospyros m'ei Eastwood, Diospyros californica I.M. Johnston, Diospyros sonorae Standl., Diospyros texana Scheele, Diospyros riojae Gomez-Pompa, Diospyros conzattii Standl., Diospyros rekoi Standl., Diospyros tuxtlensis M.C. Provance & A.C. Sanders, Diospyros morenoid A. Pool and Diospyros xolocotzii Madrigal & Rzedowski. Previously (Provance & Sanders 2005), we called into question the distinctness of D. morenoid. At that time, we only had the holotype to examine. Very recent collections from Chiapas, Mexico, have inclined us to reevaluate our position on the status of this species. We now believe that it is a valid taxon, and we plan to address this issue further in the near future.

In this treatment we use 'lanceolate' in the sense of Jackson (1916), being broadest near the lower third of the leaf, not at mid-leaf in the sense of Stearn (2000). 'Scintillant' refers to the sparkling appearance of the epidermis of some plant structures when viewed under a dissecting microscope using bright light. Lengths for winged pedioles are unavoidably approximate. Female inflorescences are inferred from fruiting specimens and persistent pedicels, where they are otherwise unknown for these taxa. The leaf venation for most taxa is arcolanguid,' defined here as an intermediate state between eucamptodromous and brochidodromous, in which major lateral veins nearly form distinct loops with superadjacent lateral veins, but tardily wane, becoming difficult to distinguish as loops. The term is coined for efficiency and out of necessity, since the term 'eucamptodromous-brochidodromous' of Todzia and Keating (1991) refers to a different type of intermediacy. Geographical coordinates, elevations, and similar estimations when made by us are presented in brackets.
TAXONOMIC TREATMENT


Trees, rarely shrubs, probably facultatively deciduous, to 25 m tall, and to 2.5 m in diameter. (Pacheco 1981); trunk channeled, rimose, bark dark-brown (Pacheco 1981); aged stems subterete to terete, bark shallow-fissured with dark ridges, gray and black, stem wood pale yellow; 2nd-3rd year stems short-fissured, glabrous to furfuraceous-pulverulent, puncticulate, lenticellate, half-netted, gray above, tawny below; current year's stems angular, smooth to sulcate, glabrous.

<table>
<thead>
<tr>
<th>BRIT.ORG/SIDA 22(1)</th>
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<tbody>
<tr>
<td>A</td>
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<tr>
<td>2.5 mm</td>
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<td>150 mm</td>
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green to gray-green or copper-green, epidermal cells enlarged, the anticlinal walls thickened. Venation arcolanguid: midrib prominent below, chartreuse to reddish-brown, shallowly concave above, smooth to clavate glandular hairy, shiny, olive to yellow-green; 2-3 veins reticulated, raised below, fine with sharp relief, sometimes pruinose-scintillant. granular-papillose. shiny, usually prominent above, lateral veins 8-12 pairs. Laminar extrafloral nectaries abaxial, near base and midrib, round to narrowly elliptic, sometimes on lateral veins. Male inflorescence fascicle, 1-4 flowers from leaf axils of the previous years growth, or from the base of new stems, sometimes a pair of solitary flowers from the new stem just above the fascicle: pedicels 4-7(-10) mm long, sparingly brown to claret velutinous, epidermis green; pedicel bracteoles 2-1 mm long, oblong, flat to slightly concave, ascending wavy hairy below, the hairs thick, glistening. Male flowers 5-merous; calyx intundibuliform: calyx tube 1.5 mm long, glabrous or scantly minute subulate hairy; sepals triangular to ovate, 1.3-1.8 mm long, 0.7-0.9 mm wide, ciliolate, scantly minute appressed subulate hairy basally, becoming dark glandular wavy hairy apically; corolla urccolate-campanulate, tan to brown, reportedly white in living material; corolla tube constricted below the lobes, 4 mm long, 3 mm wide, interior grading from glabrous distally to minutely deltoid scaly at mid-tube, again becoming glabrous near the base, except near filament bases, exterior puberulent with hairs erratically directed, some glandular; corolla lobes oblong-squarish, emarginate, 2 mm long. 2 mm wide, interior pubescent, exterior minutely sericeous-puberulent, exmedially appressed, several black hairs present near the apex. Stamens 18, subexserted, adnate to corolla at mid-tube or lower, some inserted on the receptacle, some lower stamens extrorse, abruptly geniculate, and connected to introrse upper stamens by a superdorsal vascular trace; filaments 1 mm long, hirtellous, especially on margin; anthers basifixed, lance-ovate, +2.5 mm long, laterally concave, apically constricted, opening by short apical slits; pistillode + wheel-shaped, lobes 5, bifurcate, glabrous, dark gray Female inflorescence flowers solitary, from caducous bract scar axils near the base of young stems. Fruiting pedicels 7-12 mm long, stout, very minutely hirtellous. Fruiting calyx 5-lobed; fruiting calyx tube 3.5-4 mm long, explanate to reflexed: fruiting sepals accrescent, coriaceous, arcuate-rclexed to spreading, 7-25 mm long, 7-13 mm wide. oblong, narrowly triangular or ovate, apex usually ascending to incurved, sometimes glaucous-pruinose to scintillant. Fruit berry. 3-.5 cm long, up to 4.7 cm wide. subglobose. lci:ulcs8-10; mesocarp fleshy, yellow-orange in dried specimens; hypodermis thick and stony: epidermis smooth to bullate, shiny in living material, green to brown or black, herbarium material reddish-brown to dark-brown, immature fruits sometimes atropurpureous. Seeds not seen in available material (seeds orangish in photograph in Sanchez-oello 2002 from Conde 2000). described by Pacheco
(1981) as brownish to grayish, shiny, very rugose, and with a prominent raphe.  

Distribution and ecology.-The only known collection of this taxon made outside of the state of Veracruz is from Tamazunchale. San Luis Potosi. This 1937 collection (M.7 Edil) is the earliest one of the species known to us. Tamazunchale is at 153 m, a low elevation based on the literature (e.g. Pacheco 1981). In northern Veracruz, this species occurs in the Sierra de Tantima. In central Veracruz, occurrences are in the Sierra de Chi conquiaco. the lowlands of its northern base, and the Misantla region. Populations in northern Veracruz are in isolated cloud forest patches. In central Veracruz, collection sites have been characterized as forested escarpments near pasture (Sosa et al. 1998). cloud forest, and deciduous forest (Pacheco 1981) at 750-1000 m. It seems not to be widely realized that this taxon also occurs at lower elevations at 100-300 m. Low elevation occurrences are associated with tropical evergreen forest with Quercus. In this community, they are known to lower during March. This species is considered to be in danger of extinction (Sanchez (Coello 2002).

1. Diospyros gomeziorum M.C Provance & A.C Sanders, sp. nov. (Fig. 2e). h lwi

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2. Diospyros gomeziorum M.C Provance & A.C Sanders, sp. nov. (Fig. 2e). h lwi

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B

2mm
Trees or shrubs to 20 in tall. Tacultatively deciduous trunk reported to 12 cm diameter fr a 5-0 in tree (Scrvinil 1274) and 20 cm in diameter r or a 4 in tree (R. Itcnrt itic N. 245Q), crect, longitudinally tissured, barik gray, reported dark shiny: aged stems alngularl, btLrk verrucose, scarred, short-t isntired ci rlclouis, tIC o IA (10 yellow to 'yellow-orange: 2nd-3rd year stems angular to subterete. sometimes hirtellous, + hall-netted, the outer epidermal layer gray, t awnd or reddish-brown, till lower layer cream to orangish: lenticcls protruding, soiletimcs 2-3 mill long: current year's stems suberctc. smooth to striate, densely hirtellous, reddisl-bro, wni, pubntcliculate. Petioles stout, oltn thicker than w idc 2 i5-8) mm long, glabrous to minutely erie-t hairv to deltoid scal , rounded to ruiti-nate below, usually glistening, dark brown to olive green, narrowly channeled. I lt or barely rais ed. utraceous -gandular ascncdngciliiolatcon (margin, yell-
low-green to olive abCov e Leaves alternate, simple, entire pi rgainientaceous to charttaceous sollmeti es subcoriaceous, lanceolate to ovate to elliptic, 0- llt 11.5) cm long, 2-4.8 c. wide. ti ccpx acute, obtuse or acuminate to a rounded point, mu rgi n beveled out 'ward from upper surface at - 45 tithe lower surface, somc-
what sharp, shiny, sparsely to moderetelyl ililote, bst acute to obtuse, dec ur-
rent oint petiole: lower leaf surface glabrous to sparsely subappressed pubes cent, hairs black or reddish, most common near the base, miidrib, and apex, surfae shiill green to olive, puntcliculate upper leaf surface glabrous, glauc-
cous to pruinose-sc-intillant, localized or covering most ol surface, but not on the beveled margin, granular-papillose, olive or pale blue-olive to dark-olive or dark bl u green, usually cdrarker above than below, young leaves tend to be lighter above. Venation arcolanguid, granular-papillose, glaucous to pruinose-
seintillint: midrib prnminent below, glabrous to subapprccssed pu~bescent, hairs 
black, reddish broxwn, or wwhite, narrowly canalie ulat above, sparse ly to densely 
hirtellous to cdleltoid scal. rareil glabrous, e'llow-green: 2. venation 
subprontmale belowx litiiril vt ins (8-)ll 1 t -14) part: 3 venation reticulate. 
obsrec to prontinent belowv, usually prominent above. Laminar extrafloral ne-
taries abaxial, inute, circular. Male inflorescence fascites of 1 3- 1-5 lowers 
in lcat scar axils of previou s years growth. or lone to several f lowers at the base 
of new growth in scar axils of cadutuous bracts; pedicels l- 3 mm long densely 
straight hairy, the hairs reddish, black, and white, pedicel bracts 2. 2-25 mmmin 
ong. linear. Male flowers (4-)5.(-)-merous: calyx intunlibuliformi campan u-
late. deeply lobel, interior glabrate or scantily minute wltl e hairyv exterior 
sparsely mp II ia deltoiiid scalv: calyx tube 1.5-2 m long, 25- 3 nin wile. sparsely 
subappressed ptlherulent; sepals lance ovate tc ttriangular, 2-7 mm long, 1-4

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mm wide, exterior glabrous to pubescent basally, subapprcssed pubescent 
apically, the hairs glossy, black to reddish, simple and glandular, epidermis vis-
cous; corolla urceolate-campanulate, white in living material: corolla tube 3-
5.5 mm long, 3-6 mm wide, exterior densely pubescent, most hairs distally ori-
eted, some hairs irregular, interior sparingly hirtellous, hairs sometimes 
erratically directed: corolla lobes (4-)5. spreading, oblate to squarish or widely 
obovate, often emarginate, 2-4 mm long, 2-3.5 mm wide, several short black 
hairs near the apex, interior sericeous. Stamens 20, equal to. or barely surpass-
ing tube, most adnate to corolla, some inserted on the receptacle: filaments 0.3-
0.8 mm long, ascending puberulent; anthers basifixed. oblong-ovate to ovate, 2 
mm long, opening by short slits near apex, rarely by complete lateral slits, 
granuliferous, apex acute or rounded and mucronulate; pistillodeconspicuously 
wheel-shaped, short, wide, corrugate. Female inflorescence flowers solitary. 
cauline near the base of current seasons growth, rarely from leaf scar axil of 
old growth (e.g. Fretguson 15), sometimes two opposite inflorescences, but two 
mature opposite fruit not seen. Female flowers not seen, but styles (4-)5 as rem-
nants on mature fruit, appressed white puberulent. Fruiting pedicels (4-)5-8(- 
11) mm long, densely hirtellous. Fruiting calyx 5-6-lobed. Fruiting calyx tube 3-
4 mm long: fruiting sepals accrescent, spreading. 19-20 mm long, 8-11 mm 
wide, lanceolate to narrowly elliptic or obovate, glabrous to sparsely appressed 
hairy, apices rounded, sometimes ascending, surfaces often bluish-white glau-
cous, non-glaucous areas tawny, puncticulate. Fruit berry, subglobe to slightly 
obovoid, 3 cm long, 3-4.5 cm in diameter, green when immature, turning black 
(and then presumably ripe), atropurpurreous in dried specimens, loculcs 10; 
mesocarp orange when dry; hypodermis thin, not very stony, often broadly 
rippled in specimens: epidermis orange-peel-textured, scintillant, glaucous-
pruinose. Seeds 16-19 mm long, 9-10 mm wide, rugose, shiny, light brown.

99- 10\N 100 m 14 May 1) 100 Bnito Servin 20((CllIIIDIR. IEB) 2-3 km al Sde I.a Parada. 21 32 \.

09) 10\W'. 20 Mar 2000! Benito Scrvin 58t(FFB). 6-7 km al Oriente de I.a Parada. 21 305) N. 08\V5 1400m 5 Apr 19900 ciftoScriviti 96(1:3B): 2-3 km al N de I.a Parada. 21 32 N 09 10'V 1100 m. 13AugU! o00, lino itSni toci n 412 (IEB): 2 km al W del Parada, (Cuesta de los irios 21' 305N, 10)'


20 48N, 100 0 33\ 1250 in. 2 Apr 1982. EliNzait Ih ArquclIC> 1761(l )ES) Mpio. Pinal de Amoles: 1 km S de Escancellla, sobre la carrtcera a Pinal dc Amoles, 21 9N. 0- 33\ 1250 min 18 May 1087 /

Re1I.dotlw>l. 43.305i t ILA. I1B)1: + 4 km al SE dc Santa Agucda. 21 14 29'sD 0O 37 1-t V 1100 m. 18 Apr 8 . 18 . ( r ta a a (10 11 3 )3km al S dc scanelillla. 21 102'N 0 34'1 1100 in. Mar l85. R Fctnamidi N 2829 (US)- samcr location, 30 Jul 1984. RR. IF'miande N. 24.5t li[l]. Mpio. Landa dc Matamoros: 11 km at SW; dc I l Naranjo, 21 01' 18"N. 99 27 42'", 000 in, 10 Mar 19)0. Hiram Ru i 1.542 t(FB): 1 km al Poniento dic -1 Cerro de la Palmna. 21 12 28'N. -) 04 32"V 1500 in. 2 Mar 1)00 Hiram lRunio 1520 (11E13 ccrca de Tres Lagunas, 21' 1 30'N. )9' 12 "12"\V 1700 m. 22 Jun 1188 /

[Begin Page: Page 286]
in which it has been reported but described as scarce include gallery forests with Plalianuts, and canyons with bosque melsofilode montauna (cloud forest). An unusual association occurs in Hidalgo, where it was described as very abundant in a canyon with mato iral esci noses and muotrric aucu (t.G. Mfled t no iet al 79 32). The five male flowering collections we examined were all taken in March. Some of these specimens were just leafing out at the time. The fruits ripen between September and early November. 

il/h nobinlan 1 -Queretaro: zapote prieto (Rubl.io 1746) ’:za pote del monte (Servin 206), zapotillo (Carranza 2000).

Iv nii)logly. Thle epithet is intended to honor both Arturo Goimez-Pompa, who discovered and described Diospyryrs riocje, and has also been a great inspiration to our work on Latin American DiospNyrs. and also the late J. Carinelo Gomez, who assisted the first author in the field on many occasions, and was very knowledgeable on local plant use in the Sierra Tlachichila, Zacatecas.

Collections of Diospyros gomeziorum have often been confused with Diospyros riojae. A conspicuous feature that differentiates Diospyros gomeziorum from Diospyros riojae is the leaf margin, which is beveled outward from the upper to the lower surface at about 45 in Diospyros gomeziorum. The margin formed tends to be sharp, shinier, and greener, while that in Diospyros riojae is thick, not as shiny, and a paler green. Other differences include the upper leaf surface, which is often copiously glaucous-pruinose in Diospyros gomeziorum, while typically only the abaxial leaf surface is slightly prui-

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nose-scintillant in Diospyros riojae. The epidermal cells of the upper leaf surface in Diospyros riojae are large, with thickened anticlinal walls, a feature absent in Diospyros gomeziorum. Leaf shape in Diospyros gomeziorum ranges from elliptical to lance-ovate or ovate, while the leaves of Diospyros riojae often tend to be oblong or obovate. However, this character overlaps, since both taxa may have elliptical leaves. In fruiting collections, the shorter, less stout, fruiting pedicels, the thinner, less sclerenchymatous fruit wall, and the glaucous-pruinose to scintillant fruit distinguish Diospyros gomeziorum. The pedicel bracteoles of the male inflorescence in Diospyros gomeziorum are twice as long as those in Diospyros riojae, and are nearly folded lengthwise (navicular). The anthers in Diospyros gomeziorum are minutely granular, lacking the apical constriction and smooth texture seen in Diospyros riojae.

Carranza (2000) described male flowers of this species (as Diospyros riojae) as cy-mose. We did not find cymes in material referable to either species. Developmentally, the inflorescences may be related to cymes, but, they appear to be fascicles. Some flowers may appear to be in dense terminal clusters (e.g., H. Rubio 1542). However, this appearance is superficial, since small terminal shoot apices can be found, although sometimes only with difficulty.

3. Diospyros conzattii Standl., J. Wash. Acad. Sci. 12(17):399.1922. (Fig. 3). rTY; MEXICO).OA ) \ A Distrito de iPochutla, Cerro Espino (Caetal San Rafael, 24 Apr 1017 ir) C
Trees or shrubs, 8-10 m tall, probably facultatively deciduous, trunk not reported; aged stems subterete to angular, bark verrucose, fissured, gray, stem wood off-white to yellowish or pale orange; 2nd-3rd year stems angular to subterete, bark rimose, epidermis glabrous to sparsely hirtellous, sometimes pulverulent, sparingly clavate glandular hairy, densely lenticellate, puncitculate, chestnut to tawny, becoming silvery gray; current year's stems quadrangular, finely sulcate, glabrate to hirtellous, sometimes sparsely strigillose, the hairs off-white to brown, the epidermis shiny, viscous, olive to nearly black. Petioles usually thin, sometimes flexuous, 5-8 mm long, pale green to green-brown, rounded below, glabrous to appressed puberulent, conspicuously winged part way above, the wings becoming vertically oriented and narrow along the petiole, petiole slightly convex and minutely V-grooved above, to widely flat-channeled, to 3-channeled (main channel raised and skirted by side channels formed by vertical wings), glabrous to erect puberulent, sometimes clavate glandular hairy, especially in young leaves. Leaves alternate, simple, entire, pergamentaceous to chartaceous, lanceolate to elliptic to ovate, 5-14(-14.7) cm long, (2.5-)3-5(-6) cm wide, immature leaves membranaceous, apex acuminate to an acutely or obtusely rounded point, margins flat to subrevolute, curved downward near the base of the leaf, thickened intramarginal zone seen when viewed abaxially, hyaline and minutely ciliolate in immature leaves, base acutely or obtusely
rounded, sometimes cuneate, decurrent onto petiole, sometimes loosely recurved near the petiole; lower leaf surface usually glabrous, very rarely minutely white glandular hairy, puncticulate, dull, olive; upper leaf surface glabrous, glaucous, densely puncticulate, dull, olive. Venation arcolanguid; midrib very prominent below, slightly undercut, terete, glabrous, straw to light-green, weakly raised above, and then caniculate within the raised midrib, very sparsely minute erect hairy: 2-3 venation reticulate, veins narrow raised below and above, lateral veins 9-14 pairs, 2 arches formed with superadjacent lateral veins typically obscure. Laminar extrafloral nectaries abaxial, conspicuous, round to oval, dark-red to black, often evenly spaced and near the midrib. Male inflorescences cymes, 1(-2) near the base of current years stems, or (1-)2 leaf scar axils of the previous years growth, 1-3-flowered, black to umber velutinous, sparsely covered with minute clavate glandular hairs; peduncles 4-6 mm long, velutinous, umber to dark brown; pedicels slender, 5-7 mm long, vestiture as in peduncles: pedicel bracts 1-2, alternate or opposite, narrowly oblong, 1 mm long, 0.8 mm wide, umber. Male flowers 5(-6)-merous; male flowering calyx funneiform, drying very dark-brown to black, glabrate to appressed-pubescent, coterminous with pedicel and uninterrupted; male flowering calyx tube 2-3 mm long, 15-2
mm wide, sepals 5, acute-triangular, 2-4 mm long, ciliolate, apically vermiform glandular hairy, sinuses rounded; corolla 5-6-lobed, long-urceolate, drying very dark-brown to black, reportedly whitish in life; corolla tube widest above middle, 7-8.5 mm long, 4-5 mm wide, abruptly constricted distally, exterior densely minute white puberulent, hair density increasing distally interior sparsely white puberulent, the hairs concentrated in regions of filament attachment; corolla lobes quadrate to oval, 2-2.5 mm long, 1.5-2 mm wide, asymmetrical, apex obtuse-rounded, truncate, emarginate, or trifid, often with several short dark hairs, exterior densely minute white puberulent, interior inflexed at the distal right margin, left margin slightly involute, pubescent. Stamens 30, sometimes attached in pairs, adnate to corolla from midpoint to bottom of tube, sometimes inserted on the receptacle; filaments 3 mm long, minutely hairy; anthers basifixed, lanceo-apiculate, 3-3.5 mm long, opening by terminal pores or short lateral slits, connective minutely deltoid-scaly, pistillode minute, obturinate, smooth, nearly unlobed, having a few smooth very small basal lobes, glabrous. Female inflorescence flowers solitary, cauline, at the junction of current and previous year's growth. Fruiting pedicels stout, (7-)12-15 mm long, glabrous to sparingly minute hirtellous. Fruiting calyx 5-lobed, fruiting calyx tube 3 mm long, explanate to campanulate, usually with a conspicuous enlarged basal region encircling the pedicel joint; fruiting sepals accrescent spreading to reflexed slightly, apices straight, coriaceous, narrowly to linearly triangular, 24-31 mm long, 5-8 mm wide. margins sometimes sharp edged, sometimes glaucous, glabrous, puncitulate. Fruit berry, depressed-globose slightly obovoid, up to 4 cm long, 4.5 cm in diameter, reportedly reddish (Chazaro 3969) or green (Standley

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BRIT.ORG/SIDA 22(1)

1922) when ripe, mostly atropurpureous in herbarium material. Locules 10-12; mesocarp reportedly black when ripe, usually orange in dried specimens; hypodermis 0.2-0.5 mm thick, stony; epidermis bullate, glaucous-scintillant, usually wrinkled when dry. Seeds 15-16 mm long, 11-12 mm wide, 5.5-9.5 mm thick, sculpture cerebriform, chestnut.

Additional material examined: MEXICO. Veracruz. Mpio. Calcahualco: 4.2 km \N ol Escola, 19) 10'N 7" 10'\, 2200 in, 12 an 1081 (Or M N Oee & ( S h ft: (9777 (XAI). Mpio. Chiconquiaco: abajo de Vaqueria direccion Arroyo Colorado, 19° 4b'N, 90 45'W, 150 in 25 Oct 1988 il r), (lur icrilZ B1.3292 (XAI.) i r 3293 (XA1-). Mpio Coscomatepec: 3 km al SH de la antigua Xicola, Cina del Cerro 1-a Magdalena, II) 00'N. N7O 04'W 1900 m, 2 Apr 1087 (fr) ,J.L. Marni in A. Hcnnandoc 1302 (XAI Mpio. jalacingo: Il Cuizalin, ca 1 50 N, 97 'W 1500' m, 22 May 1982 (pist. 11). F- Vent tira A. 713 (l3, MiO,XA l). Mpio. Tatatila: cammino de herradura de Tatatila a Escalonc (o Pucnte Caballos), [+ 1'- 42'N, O7 'W, 1500 tm] 14 Jan 1080 (tr), M. C(ii)aiui &- Roberto A osita 3969 (WIS. XAI.) Mpio. Tlacolulan: Ahaio del Saucal, dir ccion Agustin Melgar 19° 45'N, 90 57', 1180 mi 14 Aug 190 (i r). C. (ui ir . 1. 4-056 tXAI )

Distribution and Ecology.-The type locality is in the Pacific coastal ranges of
the Sierra Madre del Sur, Oaxaca. It occurs there in dry tropical forest on coastal slopes (Anonymous 1927). According to Conzatti (in Standley 1922), the fruit is ripe in April. In Veracruz, occurrences are near Pico de Orizaba, the Sierra de Tezuitalan, and the Sierra de Chiconquiaco, between 920 and 2200 m altitude. It occurs on slopes with pine-oak woodland and Alnus, oak forests, and deciduous forests.

ELth botany.- Veracruz: ‘zapotillo’ (C. Gutierrez B. .3292). Oaxaca: zapote negro montes’ (Standley 1922 [quoting Conzatti], and on US-892600), ‘zapote negro silvestre’ (Conzatti 3167 [in his own handwriting]). The wood is considered valuable (Anonymous 1927 [paraphrasing Conzatti]).

Only one of the isotypes we examined, MO-879066, included a fruit. Unfortunately, the large atropurpureous fruit is in rather poor condition. However, upon close examination it was clear that the epidermis is bullate, glaucous, although tending towards brown in some areas. The fruit wall is thick and quite stony. A fragment packet attached to another type, MO-1039787, contains a spreading fruiting calyx tube bearing the basal 5 mm of one sepal, and much less of the base of another. The sepals appear to have been quite narrow ca. 4-5 mm wide at the base and further narrowed distally. Characteristics seen in the fruit of D. contattii collections from Veracruz are consistent with the characteristics found in the isotype. An enlarged region below the fruiting calyx encircling the pedicel joint is only seen in the Veracruz material, but not the isotype. At this point, we are unsure of its significance.

PROVANCE AND SANDERS, NEW SPECIES OF DIOSPYROS FROM MEXICO AND CENTRAL AMERICA

4. Diospyros costaricensis M.C. Provance & A.C. Sanders, sp. nov (Fig. 4b, e). T- i

(C)OSTA RICA. (GI \NA( As E. Cantrin de liberia: Parquc Nacional de Guanacaste. Cordillera de Guanacaste, Cerro (acao, Estacion Cacao, 10 55' 45"N,85" 28 15"W 1100 m. 14 Jul 1901 ( r. C (rios Chcivez 56(9)O I.O Y MO-5310080': li ol h'tl s "4 duplicates" indicated on label, but not seen by us)

Arbor l) con.:t atii Standl similis sed anteriide taciente, usque ad 35 m alta t 15 in diametro: pctlolis adaxialc tcc negris: zona intcmmarginali laminac neque in rassata neque elevata in pagina abaxiali: costa glabra ad aurohirtclla adaxiale vadose (sacpe late) concava, aut ab lateribus contiguis laininae longistrorsum crispanti in speciminius exsiccatis.

Trees, probably facultatively deciduous, reportedly colonial, reportedly up to 35 m tall, and 1.5 m in diameter (Espinoza 54); trunk buttress-forming, channelled, smooth, greenish-black to greenish-brown, slash yellow and aromatic; aged stems somewhat angular, hall-netted, black to gray above, lower layer beige
to golden-brown, sometimes + mottled, sometimes shallow-fissured, lenticellate; 2nd-3rd year stems irregularly half-netted, beige beneath, black and grey above, hirtellous, pubescence sometimes persisting on three year old stems, lenticellate; current year's stems quadrangular, sulcate to minutely ridged, sparsely subappressed golden hairy, the hairs fine and straight, sparingly to very densely erect puberulent, dark-green to black, somewhat glandular, becoming lenticellate. Petioles usually thin, somewhat flexuous, 3-6.5 mm long, wings tapering gradually from the decurrent lamina, and twisting abruptly into a vertical orientation along the margin, glabrous to hirtellous below rugose to invaginate, light olive to very dark brown, concave above, often minutely V-grooved, usually golden hirtellous, often glandular, epidermis often nearly black. Leaves alternate, simple, entire, chartaceous to subcoriaceous, cartilaginous, ovate to elliptic, rarely widely-ovate, 6.5-9.5(-10.2) cm long, 2.8-4(-5) cm wide, very often tattered around the margins, wrinkled, apex usually asymmetric, tapering to an obtusely rounded tip, margin curved under near the base of the leaf, base mostly obtuse and tardily abrupt-acuminate, sometimes acute, long decurrent onto the petiole; lower leaf surface sparsely appressed puberulent, puncticulate, sometimes clavate glandular hairy near base, dull, brown to brown-green; upper leaf surface glabrous, very rarely glaucous-scintillant, papillose, puncticulate, brown-green. Venation brochidodromous; midrib prominent below, glabrous to sparsely appressed puberulent or hirtellous, epidermis green to brown-green, shallowly concave above, glabrous to golden hirtellous, sometimes partly shrouded by the lamina, then canaliculate and hairs crisscrossing, epidermis of basal half often black, otherwise greenish; 2 venation fine below usually prominent, lateral veins 9-12 pairs, forming definite 2 arches with superadjacent lateral veins, arch apices 3 or more mm from the margin, venation tending to be obscure above, but variable; 3-4o venation reticulated below, fine, usually apparent, but varying from obscure to prominent. Laminar extrafloral nectaries often up to 30. sometimes more, scattered on the abaxial side of the lamina, minute, peripherally rimmed with a narrow band

3 mm

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of raised tissue. Male inflorescence cymes, 2-3-flowered, 1-2 cymes per axil, from growth of the previous year, or from the base of new growth, densely subulate puberulent; peduncles up to 4 mm long, sparsely to densely pubescent to stigose with light brown to black hairs, epidermis dark brown; pedicels 0.5-3.5 mm long, vestiture and epidermis as in peduncles, pedicel bracts rarely persisting in herbarium material, 0.3-1 mm long, deltoid, densely hairy, the hairs dark-brown and straight. Male flowers 5-merous; calyx infundibuliform, exterior
short-appressed gold to white puberulent, sometimes with clavate glandular
hairs, epidermis dark brown; calyx tube 0.8-1.3 mm long, interior with ring of
straight appressed white hairs; sepals usually erect, rarely slightly recurved, 2-
3.5 mm long, 0.8-1.5 mm wide, interior glabrous to glandular setulose, exterior
pubescent, often densely so at the apex, the hairs wavy and amber, appearing
glandular; corolla long-urceolate; corolla tube 3.5-7.5 mm long, 3 mm wide, in-
terior lower-third of tube short golden pubescent, hairs + erratically directed,
exterior evenly and densely short appressed to ascending golden hairy, also clay-
ate glandular hairy; corolla lobes 5, quadrate to oval, 2-2.8 mm long, 1.2-2.5 mm
wide; apex sometimes bearing a long flagellate trichome, interior right mar-
gins involute, interior glabrous, exterior appressed to ascending white puberu-
lent, the left side of lobe densely appressed fine puberulent, sometimes with
several minute black hairs near the apex. Stamens 17-19, adnate at various lev-
els at and below the basal third of the corolla; filaments 1-1.5 mm long, nar-
rowed distally, glabrous to densely erect hispidulous; anthers basifixed. 2.3-2.5
mm long, several minute hairs at the apex, surface light-yellow apically, open-
ing by short lateral slits confined to the distal half to two-thirds of the anther,
sometimes opening by a complete lateral slit, pistilode + sub-conical, slightly
wavy peripherally, + 8 long straight hairs originating from the central apex,
otherwise glabrous. Female inflorescence flowers solitary in leaf scar axils of
2nd year stems, or cauleine at junction of previous and current growth. Fruiting
pedicles stout, 3-18 mm long, sparsely hirtellous, reddish-gold, and gray,
lernticellate. Fruiting calyx 5-lobed, sinuses acute; fruiting calyx tube explanate,
sparsely appressed puberulent, scintillant, + 3.5 mm long; fruiting sepals
accrescent, coriaceous, lorate to lanceolate, (16-)22 mm long, (5-)6-8(-9) mm
wide, spreading to moderately reflexed, apex straight to quite incurved,
puncticulate, shiny, golden brown, sparingly scintillant bas ally. Fruit berry,
sometimes pendulant, depressed-globose, 2.5 cm tall, 4 cm wide, reportedly
green in living material, dull, atropurpureus to dark-brown in herbarium ma-
terial, locules 10; mesocarp reportedly yellow in living immature fruits, dark
orange in herbarium material; hypodermis 0.5 mm thick, stony, not wrink-
ing in herbarium material; epidermis bullate, glaucous to pruinose-scintillant,
either locally or over most of the fruit. Seeds not seen.
PA \R 'I : Costa Rica. Guanacaste. Canton de Liberia: Parque Nacional de Guanacaste. Estacion Ca-
caco, 10° 55 4TN, 83 28 15°W  1100 in 24 Nov 1(90, R. Espinoza 54 (K. MO): Cordillera de Guanacastc.
Diospyros tuxtlensis M.C. Provance & T.A.C. Sanders, sp. nov. (Fig. 5). In MEXICO \\ IRA CRL Z7 Mpin S.an Andrés Tuxtla. bordC d la cima del Crrro Mastagaga al N del Ejido Ruiz•li.ortnc zSierra de los Tuxlas. 30 May 1085 ) I, C( Iadcmi 1185i I i i iOYPE : 1EB-48870 I101YPI I. XA .).
Arbor usquac ad 10 mn alta, D r jiijc (omncz- ompa similis scd dillert folis clipticis ct non glauciis, marginibus non crl assi set inter paginas opposi tas rotundatis, pcdicellishabaxialc atropurpureis:sepalis Iructiferis 26-40 mm longis. ret lexissimis ct om apic ibus rctis: pedicel is Iructfn ris 14 mm longis Trees 8-10 m tall, probably facultatively deciduous; aged stems terete to subterete, glabrous, half-netted to squamose, dark-brown to grey-brown with beige, short-fissured steni wood yellowish to orange-brown; 2nd-3rd year stems angular to subterete, glabrous, sulcate to shallow-fissured or half-netted, in combinations of dark-brown, gray, and orange-brown; current year's stems angular, smooth to finely sulcate, very cream to grey, shiny, lenticellate, glabrous to densely minute hirtellous, appressed off-white puberulent near apex, puncticulate. Petioles 4-7 mm long, glabrous, flat to slightly concave above, golden-brown, below widely rounded, glaucous-scintillant, dark-purple. Leaves alternate, simple, entire, pergamentaceous to chartaceous, elliptic, 8-15 cm long, 3-5(-5.8) cm wide, widest at or just above the middle, both sides very sparsely scintillated, but leaf surface dull golden-brown to bronze between in dividual scintillae, apex usually acuminate, the acumen long, narrow obtusely rounded at the tip, margin flat with slight intramarginal thickening, base acuminate to attenuate, decurrent onto petiole; lower leaf surface sometimes sparsely appressed puberulent near base and midrib, conspicuous ly puncticulate; upper leaf surface glabrous, papillose. Venation arcolanguid to brochidodromous; midrib conspicuously flat and wide below. sulcate, purplish basally, becoming orange-red to golden-brown and somewhat keeled apically, sometimes sparsely appressed puberulent, glaucous, shallowly concave above, glabrous, not darkened; 2 venation raised above, obscure, lateral 'eli ns 8-9 pairs, shiny, chartreuse to golden-brown and conspicuous; 3 venation obscure be- low, granular-papillate, apparent above. Laminar extrafloral nectaries abaxial. common, sometimes along 2” veins, rimmed with the same bright color seen in 2 veins Male inflorescence unknown. Female inflorescence flowers solitary, emerging at the junction of old and new growth. Fruiting pedicels stout, 14 mm long, 3 mm wide, wavy-rugose, minutely fissured, lenticellate, black and tan mottled. Fruiting calyx with lobes and distal portion of tube strongly ref lexed, sinuses rounded: fruiting calyx tube exterior sparsely appressed puberulent; fruiting sepals 5, very accrescent, 26-40 mm long, 7.5-11 mm wide, ovate to widely lanceolate, narrowed basally, apex acutely pointed, sometimes rounded, sepals glabrous, golden-brown, sepal nerves distinct. Fruit berry, depressed-globose, up to 4 cm tall. 4.5 cm in width, atropurpureous, number of locules indiscernible: mesocarp dark-brown in live material and in immature fruits of herbarium material; hypodermis 0.5 mm thick, scleridic; epidermis
Fie. 5. Diospyros tuxtlensis M.C. Provance & A.C. Sanders, sp. nov. Fruiting branch. Based on I. Calzada 11855.

glaucous-scintillant, wrinkle-d. Seeds immature, sizes indiscernible (broken seeds only I dark reddish brown, granulate to minutely ruminate (sensu Stearn 2000, fig. 38)

I’i " ri "., Mexico. Veracruz. Mpio. San Andres Tuxtla: senda parai cl (Ccrio l3.xin, al N dc San And ll luxtla tierra dc I os luxtlas. 0 Mar 1)i. 15 (1 alai, a 119209 ii 21 XA1 Mpio. Soteapan: L.|ido iianta SMaria amine a la V'tntana, 18 ll' N', 4\ O m 0-l-p li Ri ,A P 5 ii n i 12 il st XAI. i

[Begin Page: Page 297]

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Veracruz, Mexico. Only one elevation recorded, 920 m (R. Acosta P & C. Gonzalez R. 1312). The associated vegetation types for the known collections have included primary selva mediana perennifolia, selva baja perennifolia, and deciduous forest. It was considered common in selva baja perennifolia with elements of deciduous forest (Calzada 11855).

Ethnobotany.-A common name has not been reported, but since the fruits are likely to be edible, the species may be well-known to local residents. The species may eventually be found as a conserved tree near homes or pastures.

Etymology-The epithet refers to Sierra de Los Tuxlas. Veracruz, Mexico, from where the only collections of this species have been made.

SPECIES (F UNCERTAIN STATUS

Diospyros pergamentacea Lundell, Contr. Univ Michigan Herb. 7:44. 1942. TYVH.

MEXICO. Cl (i 'A\: Pico de ILoro, near Escuintla, in advanced forest, 2200m. 25 Jun 1041, Eizi Mat uda 4278 (oi IT i+Y MICH not seen: is) 'l'-: photo Al, photo CASI(sterile) photo FCA IT not seen, photo 1.1 3724600! MO-1213673! LS-1840013!).
A redescription of this taxon did not seem appropriate, given that there are no new specimens. We do not think we can add much to the work of Lundell. Overall, this species looks quite similar to D. conzattii, with which some authors have considered it conspecific. This species is known only from the type specimen, collected on Pico de Loro, near Escuintla, Chiapas. The petioles are very long and flexuous, reported to be up to 15 mm long by Lundell (1942). There also seem to be differences in the sepals, they being strongly reflexed, and having a shape that is suggestive of some populations of D. rosei sensu lato. In fact, these differences are significant enough that we are not entirely convinced that it is synonymous with D. conzattii. The leaves of the isotypes we examined had a thin coating of clear glue on much of their surface, which may obscure some characters. We recommend re-evaluating the taxonomic status of this taxon when additional material from the Chiapas-Guatemala borderland becomes available. For the time being, we do not recommend reduction to synonymy with D. conzattii.

DISCUSSION
Neither the holotype nor the two isotypes of D. riojae were available for a first-hand examination. Unfortunately, there are no paratypes for D. riojae, D. conzattii, or D. procementacea. Microfiche of an isotype and the detailed description of D. riojac by Gomez-Pompa (1964) were valuable in completing this paper. The original description made use of tables and text in contrasting differences between D. riojae and D. conzattii. Additionally, it was supplemented with an illustration prepared from the original collection (Gomez Pompa, pers. comm.). The illustration is consistent with the type description, and the isotype at .US, and in accordance with the Code, Article 2: Note 2 (Creuter et al. 2000). The illustration in the protologue represents original material.

Because fruiting I). rio-c material keys to I). iton atli in Standley's treatment of Diospyros species of Mexico (.124.). Gomez-Polnpa (y04) provided a table of leaf and fruit characters that could be used to separate these taxa Admittedly some of these characters overlap to some degree. When it is considered that Gomez-Pompa had one fruiting collection of I. riojac, one fruiting collection of I). plrego m 1 etai ea. and probably only one collection of f) on( *tii i to examine, it is to his credit that the characters le emphasized are often still useful for separating these taxa. We have provided an updated character table (able 1) that should be helpful in the differentiation of the t three new species described here.

Recdetermination of the available material resulted in roughly a 70 o re-
duction in the number of documented occurrences of D. rioja from what might have been reported based on an uncritical review of locations based on her bariumi material. At the least, this constitutes a reaffirmation of the rarity of this species. The realization that I). cioatl ii is an element of the Veracruz flora is very interesting. As far as we can tell, these are the first reports of the species I) Veracruz. Material from the Cordillera de Guanacaste and the Cordillera de Tlaltenango Costa Rica, represents a distinct new species. I). l.(Ostan) ncssi. The discovery of a new species, DigslPyn(S tix(en sis. from the Sierra de I.os Tuxtlas does not come as a shock, since this region is renowned for having numerous endemic species of plants and animals. The distributions of the closely allied taxa, 1). t u le.t N rsis and D. c.;. aricenses, are notable in light of some recent interest in I/os ITuxtlas-(c sta Rica disjunctions) (Ilamnne 1977). In addition to occurring in native stands of vegetation, individuals of this taxon should be sought as conserved trees in local gardens and pastures. This taxon seems to be a rare endemic of the Sierra de I/os Tuxtlas, and could be in need of formal protection.

We have not seen female flowers of any of these species. The only description of a female flower that we have seen in the literature is by (Carralma 2000) and refers to material from Queretaro (l g onrio ul ni). The lack of lowering I benaceae material in herbaria, as pointed out by (omez-Lompa 104) and Wallnater (2001), and clearly demonstrated by our sample, makes searching for taxonomically informative vegetative characters a particularly attractive proposal (Comez-Pompa 1904). Below we provide a key to the species described in this paper that emphasizes vegetative characters. Male flower and inflorescence characters table 2) can be used to supplement the following key if desired. It should be noted that I)D lui x lensis is not treated in Table I. since I lowering material is not currently known.

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T. Vegetative and flowering morphology across the described taxa

gomeziorum      costaricensis      conzattii      riojae      tuxtlensis

Life form and size

Leaf shape

Leaf margin

Leaf luster (both sides)
Leaf vestiture below
Leaf bloom above
Epidermal cells of lamina above
Epidermal cells of lamina below
Midrib vestiture above

Midrib topography above
Number of major lateral veins
Emergences on venation above
Petiole color above

Irees or shrubs to 0 ri
e rate to v oto
tall
teveed, someti res
( iiolate, not th< kened
shiny
ulabrous to sparsely
subappressed hairy
glaucous to pruinose-
scintillant
not large and not
thickened
punct culate

sparsely to densely
hirtellous to deltoid
s aly
nr ] a t t ca r oe

13( i4

Yi 3 granular

yel ow- geen to olive

1

Buttressed tres to 35 m
ovate to eaim, arely idey tobeoi•e
curved under near base,
not thickened
dull
sparse y appressed hairy, sometimes glandular
very rarely glaucous-scintillant
not large and not thickened puncticulate
glabrous to golden hirtellous
shalo,•ly con ave
a 12

none
nearly black

Trees or shrubs, 8 10 m
tal lanceoate elliptic to ovate
curved under near base,
intramarginal thickening
dull usal i La:rous.v ery rare v lan tular
glaucous
not large and not thickened
puncticulate
very sparsely hirtellous
caniculate, olnetimes
times raised
r 11
caniculate, olnetimes
raised
r 11
none n
pale grreer to I reen
Trees, rarely shrubs, to 25 m tall

elliptic, oblongate, or nearly oval
slightly recurved, thickened, sometimes
ciliolate

sometimes slightly pruinose or scintillant
arge and thickened
puncticulate

glabrous, sometimes sparingly glandular

...ow y(:ncave

p 1 a

2 3 granular papillose
light green to chestnut
orange to amber

Trees, 8-10 m tall

elliptic

thickening

iabrous to sparingly appressed puberuln

slightly scintillant

somewhat arge and thickened
conspicuously
puncticulate
<table>
<thead>
<tr>
<th>Species</th>
<th>Petiole Color Below</th>
<th>Fruiting Calyx Posture</th>
<th>Fruiting Sepal Apices</th>
<th>Fruiting Sepal Length</th>
<th>Fruiting Sepal Shape</th>
<th>Fruiting Pedicels</th>
<th>Fruit Hypodermis</th>
</tr>
</thead>
<tbody>
<tr>
<td>gomeziorum</td>
<td>oliv green to dark</td>
<td>reflexed</td>
<td>apices straight</td>
<td>long (16) mm long</td>
<td>at o</td>
<td>4 - 18 m long</td>
<td>e</td>
</tr>
<tr>
<td>costaricensis</td>
<td>light olive green to very pale green to green</td>
<td>spreade</td>
<td>apices straight</td>
<td>24 - 31 mm long</td>
<td>narr'</td>
<td>m long, stout</td>
<td>'i</td>
</tr>
<tr>
<td>conzattii</td>
<td>light green to dark purple</td>
<td>reflexed</td>
<td>apices straight</td>
<td>25 mm long</td>
<td>narrow</td>
<td>m long, stout</td>
<td></td>
</tr>
<tr>
<td>riojae</td>
<td>dark brown</td>
<td>reflexed</td>
<td>apices straight</td>
<td>24 - 31 mm long</td>
<td>long</td>
<td>m long, stout</td>
<td></td>
</tr>
<tr>
<td>tuxtlensis</td>
<td>light green to dark purple</td>
<td>spreade</td>
<td>apices straight</td>
<td>4 - 31 mm long</td>
<td>long</td>
<td>m long, stout</td>
<td></td>
</tr>
</tbody>
</table>
**TA-i 2. Reproductive morphology of four similar taxa from Mexico and Costa Rica.**

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Reproductive Morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diospyros gomeziorum</strong></td>
<td>Male fascicles on previous year's inflorescence, solitary on new growth. Male corolla urceolate-campanulate. Male corolla paringl hirsos, tube interior ars ete. Stamens 0. Anthers 2r mr oblong ovate, to ovate, minutely granular, short slits near apex. Filaments 0.3-0.8 mm long, hirsellous, especially ascending-puberulent.</td>
</tr>
<tr>
<td><strong>Diospyros costaricensis</strong></td>
<td>Cymes from previous year's growth, solitary on new growth. Male corolla long urceolate. Male corolla paringl hirsos, tube interior lrrat r go den pubescent, densest from mid-tube vestiture to tube bottom. Stamens 30. Anthers 3-2 mm long. Filaments 1.5 mm long.</td>
</tr>
<tr>
<td><strong>Diospyros conzattii</strong></td>
<td>Cymes from previous year's growth, cymes from new growth growth, cymes from new growth growth. Male corolla long-urceolate. Male corolla paringl hirsos, tube interior sparsely puberulent, densest from mid-tube vestiture to tube bottom. Stamens 18. Anthers 3-3.5 mm long. Filaments 3 mm long, minutely hair.</td>
</tr>
<tr>
<td><strong>Diospyros riojae</strong></td>
<td>Fascicles from previous years inflorescence. Male corolla urceolate. Male corolla paringl hirsos, tube interior deltoid scaly at mid. Stamens 1. Anthers 2.5 mm long, lanceolate, constricted near the apex. Filaments 1 mm long, erect hispidulous.</td>
</tr>
</tbody>
</table>

*BRIT.ORG/SIDA 22(1)*
4. Diospyros costaricensis

3. Diospyros conzattii

. Diospyros gomeziorum...
2. Diospyros gomeziorum

1. Diospyros riojae

5. Diospyros tuxtlensis

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PROVANCE AND SANDERS, NEW SPECIES OF DIOSPYROS FROM MEXICO AND CENTRAL AMERICA

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