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THE SPECIES OF ZIZIPHUS INDIGENOUS TO UNITED STATES AND MEXICO¹

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ABSTRACT

JOHNSTON, MARSHALL C. (U. Texas, Austin.) The species of *Ziziphus* indigenous to United States and Mexico. Amer. Jour. Bot. 50(10):1020-1027. Illus. 1963.—Taxonomic treatment is presented for the 7 species of *Ziziphus* P. Mill. (Rhamnaceae: Dicotyledoneae) recognized in United States and Mexico, with key, synonymies, descriptions, and distribution maps. The taxon *Condaliopsis* is restored to *Ziziphus* after having been treated as a subgenus of *Condalia* Cav. for more than 60 years on the basis of superficial vegetative characters. The name *Z. sonorensis* S. Wats. for the widespread Mexican species is replaced by the prior *Z. amole* (Sessé & Mocino) comb. nov. The genus *Sarcomphalus* P. Br. is referred to *Ziziphus*, the type species becoming *Z. sarcomphalus* (L.) comb. nov. Some fossil remains attributed to this genus are mentioned, but phyletic speculations are advisedly postponed until the whole genus and related genera can be reviewed.

ZIZIPHUS P. Mill., a cosmopolitan genus of about 100 species of trees, shrubs and lianes, was last monographed by A. P. deCandolle (1825) and, needless to say, is badly in need of revision. A conspectus was published by Suessenguth (1953) but he was able to provide a key for fewer than half the species which have been proposed. On the basis of study of the inadequate material in American herbaria, I think the Old World species, including two-thirds the total number, comprise several phyletic series all of which are adequately distinct from the New World species. The latter can, therefore, be treated separately without fear that vital affinities will be missed.

The Old World species are represented with us by the cultivated and/or escaped *Z. jujuba* P. Mill., which is the type species of the genus, and *Z. mauritiana* Lam., which often passes under the illegitimate homonym *Z. jujuba* (L.) Lam. These 2 species furnish the edible jujube fruits of local commercial importance, and they are illustrative of characters of several Mediterranean and Near Eastern species, and of some species of *Paliurus* P. Mill., characters which are not found in any New World species. The spines are paired, appear to be stipular in nature, and are often markedly dissimilar in size and direction of curvature at each node. The branches are like fronds in that the leaves and the branches in their axils are distichous, coming off in a single plane.

In contrast, in many of the New World species, the structures which are commonly paired at the

nodes and which have, therefore, nearly always been called stipular spines (Johnston, 1962), are thorn-tipped lateral branches emerging from the lower nodes of the axillary bud (Malme, 1920). The stipules are minute and early deciduous, the thorns commonly stout and persistent. Such usually paired thorns are characteristic of the species of South America, a notable exception being *Z. cinnamomeum* Tr. & Pl. of Venezuela, which pertains to a peculiar Antillean triumvirate including *Z. chloroxylon* (L.) Oliv. and *Z. rhodoxylon* Urb.

The continental North American species include only one in which the characteristic paired thorns are present, the one which has up to now been called *Z. sonorensis* S. Wats. (*Z. amole* of this paper). It is a widespread arid tropical species most closely related to the South American *Z. mistol* Griseb. and *Z. oblongifolia* S. Moore. The other Mexican species have thorn-tipped branchlets but these are rarely paired at the nodes. For more than 50 years these species, on the basis of the superficial characters of unpaired, thorn-tipped branchlets and small leaves, have been included in the remotely related genus *Condalia* Cav. as subgenus *Condaliopsis* Weberb. Reasons for excluding these species from *Condalia* were given in a revision of that genus (Johnston, 1962). I have been unable to find characters to exclude them from *Ziziphus*. One of them, the distinctive endemic *Z. yucatanensis* Standl., shows close relationship to the type species of the West Indian genus *Sarcomphalus* P. Br., which displays the thorn-tipped branchlets of *Ziziphus* (Urban, 1924) and has been separated by the supposed character of the extrorse placement and dehiscence of the anthers. In most Rhamnaceae the anthers are essentially latrorse or slightly introrse, and though they are more extrorse in *Sarcomphalus* (as in *Ceanothus* L. and some of the colletoid genera), the difference is one of degree. Grisebach (1864), who remarked that there was nothing peculiar about the anthers, maintained

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KEY TO THE SPECIES OF MEXICO AND UNITED STATES

1. Thorn-tipped branchlets, or most of them, paired at the nodes 1. *Z. amole*.
1. Thorn-tipped branchlets not paired or if rarely so then members of the pairs markedly unequal 2.
 2. Leaves obovate, 2–4 cm long; thyrses several cm long, interrupted; plants of Yucatan; thorns very short 2. *Z. yucatanensis*.
 2. Leaves oblong or at least not obovate; inflorescences shorter, usually not interrupted; thorn-tipped branchlets often several cm long 3.
3. Leaves opposite to subopposite or in few-leaved fascicles; thyrses usually 1–2 cm long; plants of southern Mexico 4.
3. Leaves alternate or in several-leaved fascicles; inflorescences short thyrses or cymes or else flowers solitary in the axils; plants of central, northern, and western Mexico and southwestern United States 5.
 4. Leaf-blades 3.5–8 cm long, 2–4 cm broad, petioles 4–12 (–16) mm long 3. *Z. mexicana*.
 4. Leaf-blades 1–2.5 cm long, 0.6–1.4 cm broad; petioles 1.5–2 mm long 4. *Z. pedunculata*.
5. Flowers in cymes or short thyrses 6.
5. Flowers fascicled at the short shoots, i.e., solitary in the axils of the leaves which are fascicled at many-noded short shoots 7.
 6. Inflorescence 1–6-flowered, the peduncle ca. 0.3 mm thick and much shorter than to nearly equalling the pedicels 5a. *Z. obtusifolia* var. *obtusifolia*.
 6. Inflorescences 5–30-flowered, the peduncle ca. 0.5–0.8 mm thick and much longer than, to nearly equalling, the pedicels 5b. *Z. obtusifolia* var. *canescens*.
7. Leaves glandular-serrulate or crenulate; epidermis of branchlet pubescent; Coahuila, Nuevo Leon, Zacatecas, San Luis Potosi 6. *Z. Lloydii*.
7. Leaves entire, pinnate-nerved; epidermis of branchlets glabrous; California and Baja California 8.
 8. Leaf-blades 10–30 mm long, 5–15 mm broad; petioles 2–6 mm long 7a. *Z. parryi* var. *parryi*.
 8. Leaf-blades 5–10 mm long, 2.5–4.5 mm broad; petioles 1–2 mm long 7b. *Z. parryi* var. *microphylla*.

the genus, using as a differential character the long, interrupted thyrses of the type species of Jamaica. Such inflorescences are also found in *Z. yucatanensis*. In fact, there is a series from *Sarcomphalus* species through *Z. yucatanensis* to *Condaliopsis* species showing reduction of the inflorescence and of the venation and size of the leaves (I suggest this as a morphic series, not necessarily an evolutionary one). There remains no basis for the genus *Sarcomphalus*. The type species becomes ***Ziziphus sarcomphalus*** (L.) M. C. Johnst., comb. nov., based on *Rhamnus sarcomphalus* L., Syst. ed. 10, p. 937. 1759. Three other species, *Z. havanensis* H.B.K., *Z. reticulata* (Vahl) DC., and *Z. rignoni* Delpon, already have valid combinations in *Ziziphus*. Transfer of the other 9 species should be deferred until a revision can be completed.

A large number of leaf impressions from Cretaceous and Cenozoic rocks of fairly high latitudes in North America (Knowlton, 1919; LaMotte, 1944, 1952) have been referred to *Ziziphus* and some arbitrarily to *Paliurus*, these 2 genera being indistinguishable by leaf characters alone.² As has been remarked by a number of authors, the identification of leaf impressions is hazardous. A

²The view of Berry (1916, 1924) and Mason (Van Rensselaer and McMinn, 1942) that leaves of *Ceanothus* L. and *Colubrina* Brogn. also cannot be distinguished definitely from *Ziziphus* probably needs to be modified. Tertiary venation seems to be fairly characteristic except in those with highly reduced leaves (Axelrod, 1939). Peculiarities of *Ceanothus* venation were pointed out by MacGinitie (1953).

modern reappraisal in the light of a broad survey of venation in living Rhamnaceae and other families should be undertaken not only of the putative specimens of "*Ziziphus*" but of various ones of "*Ficus*," "*Cinnamomum*," "*Populus*," etc. One study (Brown, 1939) has already led to the reassignment of many specimens from *Ziziphus* and *Paliurus* to *Cercidiphyllum* Sieb. & Zucc., a genus which has not been suggested as a relative of Rhamnaceae. Other sweeping revisions are to be expected. Study of the published illustrations of these leaf impressions convinces me that none represents a population ancestral to surviving species of continental North America, except those which pertain to the taxon *Condaliopsis* (Johnston, 1962). Phyletic speculations will be postponed until completion of my survey of the entire genus.

1. ***Ziziphus amole*** (Sessé & Moçoiño) M. C. Johnst., comb. nov.

Rhamnus amole Sessé & Moçoiño, La Naturaleza ser. 2, 1 (Pl. Nov. Hisp.) p. 38. 1888.

Z. sonorensis S. Wats. Proc. Amer. Acad. 24: 44. 1889, as "*Zizyphus*."

Z. seleri Loesener, Verh. Bot. Ver. Brand. 51: 29. 1909, as "*Zizyphus*."

Z. endlichii Loesener, Fedde Rep. Sp. Nov. 8: 296. 1910, as "*Zizyphus*."

Z. sonorensis f. *brevipedunculata* Suesseng. Fedde Rep. sp. nov. 50: 332. 1941, as "*Zizyphus*."

Trees 3–8 (–16) m tall with trunks 9–17 (–30) cm in diam., and dark-gray to brown bark, and dense mushroom-shaped crowns; branches very gnarled and flexuous, even the younger ones

stout and tough, zig-zag, with internodes 0.8–2.5 cm long; leafy branches of the season with grayish- or olive-green epidermis, densely short-strigose to glabrous; some branchlets paired at the lower nodes of the axillary buds, modified into short, stout thorns; leaves alternate or rarely subopposite; blades ovate, 4–7 cm long, 3–5 cm broad, dark- to olive-green, firm, glabrous except for strigose hairs along some of the larger veins, or densely strigose to almost velutinous, apically rounded and/or emarginate or less commonly angled (100° or more), basally broadly rounded to rarely shallowly cordate, marginally usually entire to less commonly coarsely crenate-serrate on the distal two-thirds with 6–10 teeth per side; midvein and 2 primary veins from the base slightly prominent beneath basally, camptodrome and dissipating near the margin two-thirds the distance from the base; secondary veins 2 or 3, diverging from the midvein near the middle at $45\text{--}55^\circ$ angles, camptodrome within and near the distal margins; petioles 3–6 mm long, glabrous to densely strigose; stipules subulate, 2 mm long, caducous. Flowers borne in dense peduncled thyrses (each 10–25-flowered); peduncles stout, 8–12 (–30) mm long, olive-green, glabrous to densely strigose; pedicels ca. 2 mm long, elongated in fruit to 4–6 mm and thickened, sericeous-strigose; cup hemispherical, 2–2.5 mm in diam., olive-purple, glabrous to basally somewhat silky-strigose; sepals triangular, greenish, 1.5–2 mm long; petals markedly clawed, shorter than the sepals, the blade minute, reflexed; stamens a little longer than the petals; pollen described by Wodehouse (Bull. Torr. Bot. Club 59: 332. 1932); disk thickened around the ovary but free from its sides, flat on top; ovary depressed-globose, completely 2-celled, each cell with 1 erect ovule;

style stout, purple, ca. 1.5 mm long, bifurcate one-fourth to one-third the length, the lobes tapering, at length divergent. Fruit globose at maturity, 0.9–1.5 cm in diam., dark reddish-black with a thin, juicy, astringent pulp, and a heavy-walled, 2-celled stone; seed solitary in each cavity, erect, brownish, greatly resembling an apple seed.

The distribution of this species is shown in the map (Fig. 1.) Representative specimens seen, including certain type specimens, are cited here:

MEXICO: Sonora, Guaymas, *E. Palmer* exs. 124=659, 1887 (GH, NY, UC, US, type of *Z. sonorensis*); Michoacán, *Sessé and Moçino* 817 (MA, Chicago Natural History Museum Photographic Negative No. 47645, type of *Z. amole*); Michoacán, Xochipala, *Langlassé* 1035, 24 May 1899 (GH, US, type collection of *Z. sonorensis* f. *brevipedunculata*).

Sessé and Moçino described the species rather fully, saying it is common in Michoacán, where its fruits are used for soap, hence the native name "amole" which is applied to a number of vegetable products similarly used. Although none of the collections of *Sessé and Moçino* (presently on loan from Madrid at the Chicago Natural History Museum) bears the name *Rhamnus amole*, one of them, cited above, has a specific adjective derived from the Latin word *saponis*. It is taken as the holotype of the species, although the description, being unequivocal, could equally well serve as the basis of the species.

Loesener's Z. endlichii was based on *Endlich* 696 from the Hacienda Correrere near Topolobampo, Sinaloa, and his *Z. seleri* on *Seler* 1708 from near Tehuantepec, Oaxaca. I have seen neither of the collections, but study of the descriptions convinces me, as it did *Standley* (1923), that the names belong in synonymy here.

The specimens from the low, arid, limestone sierra in southern Puebla and the Cuicatlán-Tomellín area of north-central Oaxaca have smaller, more pubescent leaf blades, on the average, than those of most other specimens.

2. ZIZIPHUS YUCATANENSIS *Standley*, Trop. Woods 32: 16. 1932, as "*Zizyphus*."

Trees to 8 m tall, usually shorter; upper branches rather slender, brownish-barked, the branchlets of the season grayish-puberulent to glabrate; internodes 0.8–2 (–4) cm long, commonly bearing leafy short-shoots laterally and commonly some leafless thorn-tipped branchlets 4–8 mm long; leaves alternate or commonly subopposite or usually in fascicles of 2–5 at the short shoots of the branchlets; blades obovate to rarely rotundly ovate, (2–) 2.5–3.5 (–4) cm long, (1–) 1.5–2 (–2.5) cm broad, firm to subcoriaceous, bright green, when young minutely puberulent, when mature glabrate, marginally entire, apically rounded and/or commonly emarginate, basally rounded to cuneate, with a midvein and 2 primaries from the base slightly prominent beneath and stramineous;

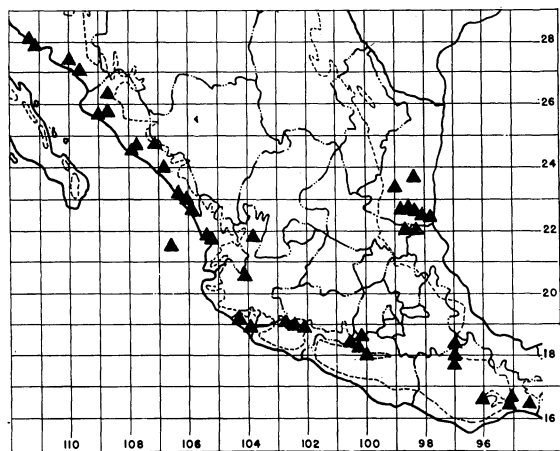


Fig. 1. Map showing distribution of *Ziziphus amole* in Mexico as revealed by herbarium records. The dashed line is the 2,000-ft contour, the figures at the right the N latitude and at the bottom the W longitude. The symbol off the Pacific coast of Mexico indicates the Tres Marias Islands.

secondary veins very inconspicuous; petioles 1.5–5 mm long; stipules firm, subulate, 1–1.5 mm long, caducous. Flowers in densely many-flowered spiciform thyrses as much as 4 cm long and 1 cm thick, interrupted by the dispersal of the individual cymes along the axis; peduncles 5–11 mm long, stout; cup ca. 2 mm in diam., sepals ca. 1 mm long, minutely densely puberulent outside, pale green; petals rotundly ovate, greenish, glabrous, long-clawed, a little shorter than the sepals. Drupes prolate-ellipsoidal, ca. 10–13 mm long, with a thin pulp and a thick-walled, prolate, completely 2-celled stone, each cell containing an erect, basally attached seed.

These plants are known only from the extreme northern coastal arid regions of Yucatan, and only by the 2 following collections: Yucatan, Progreso, *Dr. Roman S. Flores s. n.* in 1932 (F655097, type); Km. 23, Mérida-Progreso road, *Lundell & Lundell 7984*, May–July, 1938 (A, DS, F, LL, TEX, US). The latter was the subject of a note by Lundell (Contr. Univ. Mich. Herb. 6: 42–44. 1941).

3. *ZIZIPHUS MEXICANA* Rose, Contr. U. S. Nat. Herb. 1: 315. 1895, as "*Zizyphus*."

Trees 4–9 m tall with trunks 5–22 cm in diam. and large, dense tops; branchlets very slender with internodes 0.7–3 cm long and brown, strigose epidermis, and with thorn-tips; leaves opposite or subopposite, deciduous, blades oblong-elliptic to oblong-ovate, 3.5–8 cm long, 2–4 cm broad, rounded at both ends or slightly tapered basally, olive-green, firm, marginally appressed-serrate with ca. 20–30 minute teeth per side, each tooth with a minute, dark mucro, glabrous or with appressed strigose hairs on the large veins; venation dark-stramineous, the midveins and 2 primaries from the base slightly prominent beneath, the several secondaries diverging from the midvein at angles of 40–70°, camptodrome within the distal margin; petioles 4–12 (–16) mm long, strigose; stipules subulate, 1–2.5 mm long, stramineous, strigose, caducous. Flowers in pedunculate, dense (10–35-flowered) thyrses; peduncles 1–2.5 cm long, stout, strigose; pedicels 2–4 mm long, dark olive to purple, basally sparingly strigose or all glabrous; cup hemispheric, 2.5–3 mm in diam., glabrous, olive-purple; sepals 5, triangular, 1.5–2 mm long, acute, olive to stramineous; petals markedly clawed, about as long as sepals, membranous, stramineous, strongly reflexed; stamens a little longer than the petals; filaments very thin; disk thickened around the ovary, flat on top; ovary depressed-globose, nearly hidden by the disk, completely 2-celled, each cell with 1 erect ovule; style 1.5–2 mm long, stout, bifurcate a fifth to a third the length, the divisions slightly tapered. Drupe ca. 1–1.7 cm in diam., globose or obovate-globose, with a thin purplish pulp and a large, thick, 2-celled stone, each stone with an erect, brownish seed strongly

resembling an apple seed, though somewhat larger, but smaller than the chambers and easily extricated therefrom.

Only 8 collections have been seen. They are cited here, below. Presumably the species will also be found in Guerrero, which is one of the least well explored states of Mexico.

MEXICO: Jalisco: 6.5 miles northeast of Autlán, elev. 925 m, *McVaugh & Koelz 1033*, 24 Nov. 1959 (MICH). Colima: Armeria, *E. Palmer exs. 1278*, 15 Feb. 1891 (A, GH, US, type); Colima, *E. Palmer exs. 54*, July 1897 (MICH, US); Paso del Rio, *Emrick 223*, Nov. 1906 (F); 11 miles south-southwest of Colima on the Manzanillo road, elev. 400–500 m, *McVaugh & Koelz 1574*, 7–8 Dec. 1959 (MICH). Michoacán: Distr. Coahuacán, Loc. Huizontla, *Hinton et al. 16210*, 1941 (MICH, NY, UC, US); Loc. Aguila, *Hinton et al. 15871*, 29 Mar. 1941 (DS, MICH, NY, US). Oaxaca: Tomellín Canyon, *Pringle 10254*, 14 May 1906 (US).

4. *ZIZIPHUS PEDUNCULATA* (Brandg.) Standl. Contr. U. S. Nat. Herb. 23: 713. 1923, as "*Zizyphus*."

Condalia pedunculata Brandg. Univ. Calif. Publ. Bot. 3: 384. 1909.

Condalia seleri Loesener, Fedde Rep. Sp. Nov. 9: 355. 1911.

Condaliopsis (?) *seleri* (Loesener) Suesseng. Natürl. Pflanzenf. 20d: 135. 1953.

Shrubs or small round-topped trees; branches slightly flexuous, when 2 years old 2–4 mm thick, soon acquiring a smooth, fuscous bark; branches of several classes, the primary ones elongating several decimeters in a season and bearing numerous thorn-tipped branchlets ca. 1 cm long, which, because of the opposite branching, often resemble stipular spines; branches of the season 1–2 cm long, the epidermis dark brown, rough, with minute, antrorsely subappressed, silky hairs; internodes 1–2.5 (–3.5) cm long; leaves opposite or subopposite or many of them in fascicles of 2–6 at short shoots of the secondary branchlets; blades oblong, 10–25 mm long, 6–11 (–14) mm broad, apically rounded or emarginate, basally shortly rounded, bright green, firm but membranous, marginally with a number of small, inconspicuous teeth each marked by a minute, brownish, glandular mucro, glabrate (young ones beneath sparsely beset with minute, appressed, antrorse, silky hairs along the veins), midvein and 2 primaries from the base slightly prominent beneath; petioles 1.5–2 mm long, yellow-green, with antrorse, appressed, silky hairs; stipules subulate, ca. 1 mm long, brownish, with appressed, silky hairs, caducous, leaving cartilaginous, white cicatrixes. Flowers in dense, 3–7-flowered cymes (often the secondary floriferous branchlets being leafless or with only reduced leaves, in which case the whole branchlet becomes a thyse 2–3 cm long); peduncles ordinarily rather stout and glabrate, arcuate, 1–2 cm long;

pedicels 1.5–3 mm long, stout, brownish, glabrate; cup hemispheric, ca. 3 mm in diam., dark purplish-brown, glabrous; sepals shortly triangular, ca. 1.5 mm long, paler brownish purple, glabrous, widely spreading, deciduous; petals 1.5 mm long, membranous, pale purple, reflexed, the blade oblong and the claw pronounced; stamens ca. 1.5 mm long; ovary depressed-globose, quite free from the disk but not constricted basally, the receptacular attachment thus broad, completely 2-celled, each cell 1-ovulate; style ca. 1 mm long, purple, shortly but distinctly bifurcate at the stigmatic end, the branches acute. Fruit purplish brown, globose or very slightly prolate, ca. 1 cm long, with a thin pulp and a large stone with 2 cells, each with 1 seed; seeds brown, strongly resembling apple seeds.

Of this species, only the 3 collections cited below have been seen, indicating a restriction in distribution to extreme southern Puebla and north-central Oaxaca, in limestone mountains at moderate elevations.

MEXICO: Puebla, Barranca de Tlacuilosto, San Luis Tultitlanapa, *Purpus 3173*, June 1908 (F, GH, NY, UC, type). Oaxaca: Dept. Cuicatlán, Cuesta de Quiotepec, elev. 700 m, *Conzatti & Camino-Gómez 2414*, 21 June, 1909 (F); Tomelín Canyon, *Runyon 1349*, 17 Aug. 1929 (US).

Loesener's *Condalia seleri* was based on a *Seler* collection from near Tecomavaca, Oaxaca. I have not seen this collection, and am merely going by the description and following Standley (1923) in referring the name to synonymy here.

5. *ZIZIPHUS OBTUSIFOLIA* (Hook. ex T. & G.) Gray, Gen. Fl. Amer. Bor.-Orient. Illustr. 2: 170. 1849, as "*Zizyphus*."

For synonymy see the varietal designations.

Shrubs or small trees; primary branches 5–40 cm long, flexuous, arcuate, not thorn-tipped, arising from short-shoots of previous season, bearing some short shoots and from the lowest nodes of them thorn-tipped secondary branchlets 1–8 cm long which in turn bear short shoots and rarely from these some tertiary thorns 1–10 mm long; epidermis gray to white, pruinose; bark gray, thin, smooth; internodes (2–) 4–6 (–15) mm long; leaves deciduous, alternate or in fascicles of 2–5 at short shoots; blades ovate or oblong, basally rounded or rarely truncate, marginally entire or often with 2–10 glandular teeth per side, gray, firm but membranous, the lateral venation inconspicuous or occasionally the 2 lowermost laterals (primaries) somewhat paler colored and prominent; stipules linear-subulate, ca. 1.5 mm long, brownish, caducous; petioles present. Flowers in short thyrses; cup ca. 1.5–2 mm in diam., glabrous within, olive; sepals deltoid, ca. 1 mm long, olive, glabrous inside, caducous; petals about equalling sepals, spatulate, apically emarginate, yellowish or brownish, membranous, glabrous, reflexed, caducous; stamens

shorter than the sepals or petals; disk smooth and flat, thickened axially and closely surrounding but free from the ovary; ovary glabrous, olive, globose-conic, with a broad receptacular attachment, 2-celled, each cell with an ovule; style tapered, 0.5–1 mm long, purplish olive, usually bifid a fourth to three-fourths the length, but occasionally nearly entire and merely deeply grooved on 2 sides, caducous after fertilization, but in abortive flowers long-persistent. Fruit globose, reddish or brownish when immature but when fully mature and juicy blue-black with a whitish bloom, 7–10 mm long, with much pulp; stone globose or slightly prolate, relatively thin-walled, with 2 large cells each with 1 seed; seeds smaller than their cells and easily extricated, strongly resembling apple seeds.

The key to the 2 varieties of *Zizyphus obtusifolia* is included in the general key. The distributions are shown in the map (Fig. 2). The nomenclature and characters of the varieties are as follows.

5A. *ZIZIPHUS OBTUSIFOLIA* VAR. *OBTUSIFOLIA*.

Rhamnus ? *obtusifolia* Hook. ex T. & G. Fl. No. Amer. 1: 685. 1840.

Paliurus texanus Scheele, Linnaea 21: 594. 1848.

Zizyphus lycioides Gray, Pl. Lindh. 2 [Bost. Jour. Nat. Hist. 6] p. 168. 1850, as "*Zizyphus*."

Condalia obtusifolia (Hook. ex T. & G.) Weberb. Naturl. Pflanzenf. 3⁵ 404. 1895 (basionym not given); Trel. in Gray, Synopt. Fl. No. Amer. 1¹: 403. 1897.

Condalia lycioides (Gray) Weberb. Naturl. Pflanzenf. 3⁵: 404. 1895 (basionym not given); Trel. in Gray, Synopt. Fl. No. Amer. 1¹: 403. 1897.

?*Condalia lycioides* var. *microphylla* Loesener, Fedde Rep. Sp. Nov. 8: 296. 1910.

Condaliopsis obtusifolia (Hook. ex T. & G.) Suesseng. Naturl. Pflanzenf. 20d: 135. 1953.

Condaliopsis lycioides (Gray) Suesseng. Naturl. Pflanzenfam. 20d: 135. 1953.

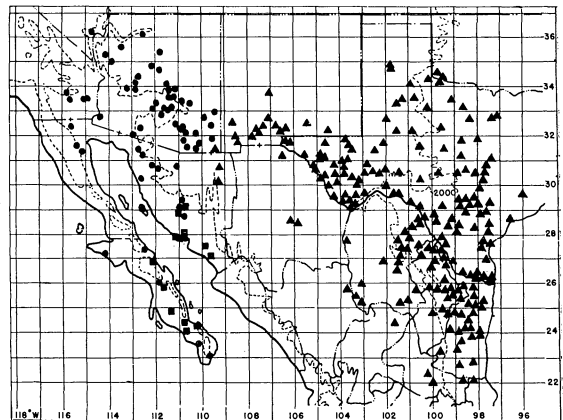


Fig. 2. Map showing distribution of *Zizyphus obtusifolia* in Mexico and the United States as revealed by herbarium records. Triangles, var. *obtusifolia*. Disks, var. *canescens*, pubescent phase. Squares, var. *canescens*, glabrous phase. The dashed line is the 2,000-ft contour, the figures at the right the N latitude and at the bottom the W longitude.

Shrubs 0.5–1 (–2.5) m tall; stem epidermis usually glabrous or somewhat sparsely pilose to rarely white-hispidulous; leaf-blades narrowly to broadly ovate to ovate-oblong to deltoid-ovate to lance-ovate, (5–) 10–20 (–50) mm long, (2–) 4–15 (–50) mm broad, apically often rounded and emarginate or rarely acute (minimum angle ca. 50°), olivaceous gray or greenish gray, above usually glabrous, beneath glabrous or sparsely pilose or toward the base slightly hispidulous; petioles (1–) 2–3 (–10) mm long, grayish, glabrous or usually somewhat pilose or hispidulous; stipules glabrous or very sparsely strigose dorsally. Flowers mostly appearing in summer in short, 1–4 (–6)-flowered thyrses 0.5–1 cm long; peduncles (0.5–) 1–2 mm long, glabrous or sparsely pilose; pedicels (1–) 2–3 (–5) mm long, glabrous or sparsely pilose; outside of cup glabrous to somewhat silky-strigose; outside of sepals glabrous to somewhat silky-strigose; fruits usually maturing in summer.

I have seen the following type specimens: Texas, Austin Co., San Felipe de Austin, *Drummond II 45* in 1835 (GH, K, type of *Rhamnus* ? *obtusifolia*); Coahuila, Mapimí to Matamoros, *Gregg* (GH, NY, type of *Ziziphus lycioides*).

Scheele's *Paliurus texanus* was based on a Lindheimer collection from the bottomlands of the Guadalupe River in Comal County, Texas. The name was correctly reduced to synonymy by Gray 2 years after its publication.

Loesener's *Condalia lycioides* var. *microphylla* was based on *Endlich 497a* from near Hacienda La Tortuga, Coahuila. I have not seen the collection. The description says that the leaves are small, about 1 cm long and 2 mm broad. This characterizes one of the small-leaved forms common in scattered parts of the Chihuahuan desert.

5b. *ZIZIPHUS OBTUSIFOLIA* VAR. *CANESCENS* (Gray) M. C. Johnst. *Brittonia* 14: 367. 1962.

Ziziphus lycioides var. *canescens* Gray in Rothrock's Rep't. Wheeler Exped. 6. Bot. 82. 1879, as "*Zizyphus*."

Condalia lycioides var. *canescens* (Gray) Trel. in A. Gray, *Synopt. Fl. No. Amer.* 1: 403. 1897.

Condalia divaricata A. Nels. Bot. Gaz. 47: 427. 1909. *Ziziphus divaricata* A. Nels. ex Davidon & Moxley, Fl. So. Calif. 226. 1923, as "*Zizyphus*."

Condalia rigida Wiggins, Cont. Dudley Herb. 4: 20, t. 1, f. 5–8. 1950.

Shrubs or small trees 1–3 (–4) m tall; stem epidermis with a short, dense tomentum of white-sericeous straightish or pilose hairs, or nearly glabrous; leaf-blades ovate to deltoid-ovate to lance-ovate to oblong, 3–20 (–25) mm long, 2–12 (–14) mm broad, apically rounded and emarginate or acute (minimum angle ca. 55°), pale greenish gray or yellowish gray, above microscopically sparsely to densely sericeous-pilose to glabrous, beneath sparsely to densely sericeous-pilose to glabrous; petioles 1–2 (–3.5) mm long, greenish white, pubescent as the stem epidermis; stipules

dorsally pubescent. Flowers mostly vernal, in (5–) 10–30-flowered thyrses 1–2 cm long; peduncles 2–4 mm long, pubescent as is the stem epidermis; pedicels 1–2 mm long, pubescent as is the peduncle; cup densely canescent-tomentose to glabrous outside; sepals densely canescent-tomentose to glabrous dorsally; fruits usually maturing in late spring and early summer.

Of this var. *canescens* there are 2 weakly distinguished sorts of plants, somewhat geographically segregated as shown in the map (Fig. 2). The sort with the more southerly distribution is made up of nearly glabrous plants, and has been named *Condalia rigida* Wiggins. The plants with intermediate pubescence are rather numerous.

I have seen the following type specimens:

Arizona: Greenlee Co., valley of the Gila River, 3080 ft elev., *Rothrock 331*, 1874 (F, GH, US, type of *Ziziphus lycioides* var. *canescens*). Nevada: Clark Co., Las Vegas, *Goodding 2300*, 5 May 1905 (GH, type of *Condalia divaricata*). Baja California: Arroyo Rancho Seco, ca. 24°10' N latitude, *Johansen 601*, 7 July 1930 (DS, type of *Condalia rigida*).

6. *ZIZIPHUS LLOYDII* (Standl.) M. C. Johnst. *Brittonia* 14: 367. 1962.

Condalia lloydii Standl. Cont. U. S. Nat. Herb. 23: 714. 1923.

Condaliopsis lloydii (Standl.) Suesseng. *Natürl. Pflanzenf.* 20d: 135. 1953.

Shrubs 1–5 m tall; primary branches 10–30 cm long, arcuate and flexuous, not or rarely thorn-tipped but ending in an indeterminate short shoot (which is capable of bearing terminally a new primary shoot the next season), and bearing numerous indeterminate short shoots and from the lowest axil of each of these a thorn-tipped secondary 0.5–4 cm long which, in turn, may bear 1 or 2 tertiary thorns 1–6 mm long; epidermis purplish-canescens, densely and minutely sericeous-villous and hispidulous; bark dark gray or nearly black, rather smooth; internodes (1–) 2–3 mm long; leaves alternate or mostly in fascicles of 2–6 on the short shoots; blades entire, oblong, 8–17 mm long, 3–7 mm broad, apically rounded or occasionally retuse, basally rounded, marginally serrulate-crenulate with the teeth close together and each with a minute, glandular, red tip, above grayish-green and minutely reddish-lentiginous with a close, dark, pinnate venation and sparingly sericeous-villous, beneath slightly paler grayish-green and sericeous villous with dark-maroon pinnate venation with a prominent midrib and 2 much less prominent basal primaries diverging at angles of 45–60°, and ca. 5–6 pairs of secondaries diverging at angles of 50–70° and camptodrome well within the margins; petioles 1–2 (–4) mm long, maroon-brown, densely canescent-villous, deeply channeled adaxially; stipules dark brown, subulate, ca. 1 mm long, shaggy-villous, caducous. Flowers appearing in the summer following rains,

in fascicles of 2-4 at the short shoots of previous seasons; pedicels 3.5-5.5 mm long, stout, nearly straight, purplish-canescens, hispidulous; cup ca. 2 mm in diam., purplish-canescens, hispidulous; sepals deltoid, ca. 1.5 mm long, firm, purplish-brown, glabrous inside, hispidulous outside; petals oblong and narrowed-unguiculate basally, ca. 1.2 mm long, membranous, reflexed at anthesis, caducous; stamens shorter than the petals; disk purplish, thickened axially around the ovary but free from it; ovary conic, with a broad receptacular attachment, purplish-brown, completely 2-celled (rarely 3-celled), each cell with 1 ovule; styles stout, ca. 1 mm long, purplish-brown, tapered, bifurcate (rarely trifurcate) a half to two-thirds the length, each lobe subulate. Fruit distinctly prolate, when immature and dry reddish-brown, when fully mature reddish-purple with a thin pulp and a large stone, 7-10 mm long, 5-8 mm thick; stone 2- (rarely 3-) celled; seeds smaller than their chambers and readily extricated from them, resembling apple seeds externally.

This species is known only from 8 collections, here cited:

MEXICO: Coahuila: 3 miles south of La Ventura, *I. M. Johnston 7630*, 12-13 Sept. 1938 (GH). Nuevo León: 5 miles south of the Coahuila boundary on the Saltillo-Matehuala highway, *Crutchfield & Johnston 5865a*, 1 Oct. 1960 (TEX); 39 miles south of San Roberto, *Crutchfield & Johnston 6041b*, 7 Nov. 1960 (TEX). San Luis Potosí: Charcas, *Lundell 5353*, July-Aug. 1934 (CAS, DS, F, GH, MICH, US); 3 miles east of Huizache junction and 3 miles west of El Huizache on the Ciudad del Maíz highway, *Crutchfield & Johnston 5657*, 20 Sep. 1960 (TEX). Zacatecas: Cedros, *Lloyd 71* (DS, F, UC, US, type); *Lloyd 131*, 1908 (GH); *Kirkwood 110*, June, 1908 (GH).

7. *ZIZIPHUS PARRYI* Torr. Bot. Mex. Bound. (Emory, Rept. U. S. Mex. Bound. Surv. 2. Botany) p. 46. 1859, as "*Zizyphus*."

For synonymy see the varietal designations below the description.

Shrubs; primary branches flexuous, elongating in the spring, 4-10 cm long, terminating in indeterminate short shoots (these capable of giving rise terminally to other elongate primaries the next spring), and bearing numerous thorn-tipped secondary branchlets 1.5-3 cm long which bear usually only one node and have short shoots; epidermis glabrous, pale greenish-yellow or purplish-stramineous; leaves deciduous, glabrous, alternate or in fascicles of 2-5 at short shoots; blades entire, membranous, olive-green, elliptic to obovate, broadest near the middle, apically rounded to pointed (minimum angle ca. 90°) or even rarely emarginate and mucronate, basally rounded or pointed (minimum angle 75°), marginally entire and not thickened, above and below with flush pinnate venation, with purplish midrib and 7-12 (-15) pairs of inconspicuous secondaries

diverging at angles of 60-80° and camptodrome very near the margin; petioles 0.3-0.5 mm thick, glabrous; stipules deltoid-acuminate to subulate, 1.8-2.5 mm long, basally oblique, brownish and membranous, each with a membranous, glabrous, white, hyaline auricle on the margin away from the petiole. Flowers vernal, appearing with or just before the leaves in fascicles of 2-5 (-7) at the short shoots; pedicels 2-8 mm long, 0.1-0.2 mm thick, glabrous, purplish-olive to stramineous, accrescent to 10-19 mm long in fruit; cup ca. 2-2.2 mm in diam., glabrous, purplish-green; sepals lance-deltoid, 2-3 mm long, purplish-stramineous to flavescent olive, glabrous, in transmitted light showing a midvein and 2 acrodrome laterals, caducous; petals narrowly oblong with a claw, 1.8-2 mm long, membranous, spreading to reflexed, caducous; stamens shorter than the petals; disk fleshy; especially thick axially, closely surrounding but essentially free from the ovary; ovary globose, slightly constricted basally, brownish, glabrous, completely 2-3-celled, each cell with an ovule; style stout, purplish, tapered, 1-2 mm long, grooved and in some specimens 2-3-lobed apically. Fruits maturing in the summer, pendulous, ovoid to ellipsoid, 1-2 (-2.5) cm long, 1-1.5 cm thick, brownish to purplish-brown, smooth, acute or distinctly beaked apically, rounded basally, with a thin pulp and a large tough stone (walls as much as 2.5 mm thick) which is completely 2-3-celled and 1-2-3-seeded; endosperm comparatively copious for this genus, as much as 0.4 mm thick; seeds fitting the cavities tightly, not extricable therefrom.

The key to the 2 varieties is included in the general key.

7a. *ZIZIPHUS PARRYI* VAR. *PARRYI*.

Condalia parryi (Torr.) Weberb. Naturl. Pflanzenf. 3^o: 404. 1895 (basonym not given); Trel. in Gray, Synopt. Fl. No. Amer. 1^o: 403. 1897.

Condaliopsis parryi (Torr.) Suesseng. Naturl. Pflanzenf. 20d: 135. 1953.

Shrubs 1-4 m tall with smooth grayish or brownish bark with narrow, longitudinal fissures; internodes (4-) 8-15 mm long; leaf-blades 10-25 (-30) mm long, 5-12 (-15) mm broad; petioles 2-6 mm long.

The variety is restricted to Riverside and San Diego counties, California, the type having been collected in San Diego Co. near San Felipe (*Parry s.n.* GH, NY, seen). The specimens are so numerous that no attempt will be made to cite them, other than the type. Although some of the specimens are from stations close to the border, the variety is unknown from Baja California.

The leafy short shoots of the axils and primary tips of this species are rather better developed than in the others except perhaps *Z. Lloydii*, being often as much as 10 mm long and with dozens of nodes (but only the apical 1-5 nodes bearing leaves or flowers at any one time). They differ

from those of other species, except *Z. lloydii* and some specimens of *Z. obtusifolia*, in remaining meristematic with the curious ability to give rise apically to elongate primary branches in the spring which at the cessation of elongation in the summer then produce apical short shoots which again remain meristematic (this is "curious" in the group *Condaliopsis* but scarcely so in most deciduous woody plants).

7b. *ZIZIPHUS PARRYI* VAR. *MICROPHYLLA* (I. M. Johnst.) M. C. Johnst. *Brittonia* 14: 368. 1962.

Condalia parryi var. *microphylla* I. M. Johnst. Univ. Calif. Publ. Bot. 7: 439. 1922.

Shrubs 1–2 m tall with dark, fuscous-brown, rough bark; internodes 2–6 (–8) mm long; leaf-blades obovate, 5–8 (–10) mm long, 2.5–4.5 mm broad; petioles 1–2 mm long; flower parts heavily pigmented, the lateral veins of the sepals purplish, easily visible.

Only 8 collections of this variety have been seen, and they are cited here: Baja California: Las Huevitas, *Brandegee s.n.* 19 May 1889 (A, UC, type); Cedros Island, E. *Palmer exs. 752*, 18–20 Mar. 1889 (F, GH, NY, UC, US, cited by Vasey and Rose, *Cont. U. S. Nat. Herb.* 1: 14. 1890); *Brandegee s.n.*, 1–2 Apr. 1897 (UC, US); *Rose 16130*, 11 Mar. 1911 (US); *Haines & Hale s.n.* 2 Mar. 1939 (UC); *Moran 3020*, 1 May 1948 (UC).

EXCLUDED TAXA

Z. acuminata Benth. *Bot. Voy. Sulph.* p. 78. 1844.

This was based on a specimen collected near Acapulco, *Barclay s.n.* (K, photo seen F, TEX) and is to be referred to *Colubrina glomerata* (Benth.) Hemsl. in the broad sense (Standley, 1923), i.e., *C. triflora* Brogn. ex. G. Don.

Z. umbellata "Cav." ex Poir. *Encycl. Suppl.* 3: 193. 1813. Poiret here referred to *Rhamnus umbellata* Cav. *Icon.* 6: 2. t. 504. 1801, erroneously listing it under the genus *Ziziphus*. It actually pertains to *Karwinskia* Zucc. and may be a synonym of *K. humboldtiana* (R. & S.) Zucc.

Z. volubilis (L.f.) Willd. *Berlin. Baumz.* 145. 1796. This was based on *Rhamnus volubilis* L.f. *Suppl.* 152. 1781, now considered a synonym of *Berchemia scandens* (Hill) K. Koch, *Dendr.* 1: 602. 1869.

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