

1919



THE GENUS *JUNIPERUS* (CUPRESSACEAE) IN MEXICO AND GUATEMALA: SYNONYMY, KEY, AND DISTRIBUTIONS OF THE TAXA

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INTRODUCTION

The junipers of continental North America extend southward into México and Guatemala, the southermost localities being in the mountains of western Guatemala. These species have been critically examined by only one botanist, Maximino Martínez (1944, 1946). The earliest reports of the presence of the genus in México may be those in the 1539 log of the Spanish navigator Ulloa (Eisen, 1901). The earliest report in botanical literature of *Juniperus* from México occurred almost three hundred years later. Sprengel (1826) published the name *J. mexicana* for a plant previously described as *Cupressus sabinoides* H.B.K. Kunth (Humboldt, Bonpland, and Kunth, 1817) had mistaken the juniper for a cypress, as he had done with another juniper which he called *C. thurifera* H.B.K.

Standley (1920) presented the first evaluation of the Mexican junipers in this century. Four species were recognized on the basis of an examination of the herbarium specimens at the United States National Museum (US). Botanists have used this work as a standard reference. Johnston (1943) noted the presence of four additional species in Mexico. In 1943, Standley and Steyermark published a previously undescribed species from Mexico and Guatemala. A total of nine species were known from México, and one from Guatemala by 1944.

Martínez (letters dated 1942 to 1946 from M. Martínez to C. V. Morton, United States National Museum) had begun work on the Mexican junipers by 1942. Much of his early work was concerned with nomenclatural problems of the Mexican species. Trips were made to the type localities of the previously described species to collect specimens. Martínez frequently corresponded with C. V. Morton to discuss nomenclatural problems and to have specimens compared to those from the United States. Foresters and others sent specimens to Martínez for study (letter dated September 25, 1973 from Rogers McVaugh, University of Michigan). Martínez examined over two thousand specimens and herbarium sheets in his studies.

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The taxonomic treatment of the Mexican junipers appeared in two later publications (Martínez, 1953, 1963), each was altered by Martínez as new localities were found. The classification itself remained unchanged.

Three papers concerning the Middle American junipers have appeared since 1946. Hall (1954) reviewed the nomenclature of *Juniperus ashei* Buchholz and reaffirmed the citation by Johnston (1943) that the species was in México. Martínez (1946) rejected Johnston's identification of the specimens and decided that there was no evidence of the species in México. Standley and Steyermark (1958) documented the presence of two species in Guatemala, which also occur in México. *J. saltillensis* was published as a new species in México by Hall (1971).

The number of species accepted to be present in México was 14; two species were known from Guatemala. Species listed here for México are 16, with 3 of the same species in Guatemala.

The work reported here was begun in 1971. Reinvestigation of the Mexican and Guatemalan taxa was undertaken to evaluate the similarities of those taxa and to begin studies for the comparison of the junipers in the adjacent areas of the United States of America. Our earlier work concerning the morphological analyses (Zanoni and Adams, 1975) and chemical analyses of the volatile leaf terpenoids (Zanoni and Adams, 1976) has already been published. A review of the synonymy of all taxa of the genus *Juniperus* section Sabina in North America will appear soon (Zanoni, 1976).

The distribution records reported here were derived from the examination of about 3000 specimens from many herbaria (A, ARIZ, BH, CAS, CS, DS, ENCB, F, FPF, GH, HAL, MEXU, MICH, MO, MSC, NA, NY, OKL, PH, POM, RSA, SMU, TENN, TEX, UC, US, and Instituto Nacional de Investigaciones Forestal, México). We have traveled over 30 000 miles in México and Guatemala and have observed all of the taxa in their natural habitats.

Common names of junipers in México and Guatemala include cedro, enebro, and sabino of Spanish origin. Several common names are of indigenous origin. The application of common names in México and Guatemala cuts across the lines of botanical species, for the most part. Common names listed here have been taken from our field experience, from labels of herbarium specimens, and from numerous literature sources (Bennett and Zingg, 1935; Berlin, Breedlove, and Raven, 1974; Laughlin, 1975; Little, 1953; Martínez, 1946, 1959; Miranda, 1950; Pennington, 1963; Standley and Steyermark, 1958; Sudworth, 1927). We have indicated by underscoring the English common names that are preferred.

JUNIPERUS L.

Aromatic (terpenoid resins) evergreen shrubs to trees, dioecious, occasionally monoecious in succeeding years [or often monoecious in *J. osteosperma* (Torr.) Little]. Rapidly growing branches (terminal whips) often slender with long, ternate whip leaves; leaves on lateral branches scale-like, 1–2 mm. long [or awl-shaped], opposite or ternate.

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Staminate cones oblong, 5–6 mm. long, of (6–) 8–14 opposite [or ternate] peltate scales each with 0–5 pollen sacs. Ovulate (female) cones globose or gibbous, formed by enlargement and fusion of 2 to 12 scales, soft and fleshy or fibrous, forming a berry-like fruit (galbulus). Ovules 1 (or 2) per ovuliferous scale, with hard seed coat; 1 to 13 seeds per cone. Seeds germinate within cone or when separated from cone by birds or mammals. About 60 species mostly in the Northern Hemisphere including about 22 in North America (Zanoni, 1976).

All North American species (except *J. horizontalis* Moench.) have the arborescent habit, although the shrubby habit may be more common in some species. Variation in foliage color resulting from glaucous leaves is common. Sharp, divergent needle-like juvenile leaves occur in all species, and may persist on mature trees especially if diseased or grazed. Normal ovulate cones have seeds included in the cone; the teratological condition of exerted seeds can be expected in any species. The glaucous bloom on the cone may cause the cone to appear pink or blue; the color of the cone without the bloom may differ. Color of the cone used in the following key is the color of the cone surface with the bloom removed, unless specified. Only specimens with mature ovulate (female) cones (usually in winter or spring) can be identified correctly. A 20x or 30x lens should be used to examine leaf margins. Technical terms of branches used in identification are illustrated in Fig. 1. Close observation of stem bark is important in identification.

KEY TO THE TAXA OF *JUNIPERUS* IN MEXICO AND GUATEMALA

- A. Mature female cones (8–)10–20 mm. diameter, light reddish-brown to dark reddish-brown, hard, somewhat fibrous; cones do not shrink and do not wrinkle on drying.
- B. Seeds (4–)6–13 per cone; terminal whip branches flaccid and pendulous; ultimate twigs distichous; angle of branching of ultimate twig 25–30 degrees; whip and scale leaf margins irregularly toothed, appear almost entire (using 30x lens).
 - C. Scale leaves on ultimate twigs acute and sharp, scale leaf tips divergent; mature female cone usually showing suture lines from fusion of cone-scales *J. flaccida* var. *poblana*
 - C. Scale leaves on ultimate twigs obtuse, scale leaf tips appressed; mature female cones usually smooth (or with horn-like protuberances from the enlarged cone-scale tips) *J. flaccida* var. *flaccida*

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- B. Seeds 1–4(–7) per cone; terminal whip branches ascending or erect (except in *J. deppeana* var. *deppeana* f. *sperryi*); ultimate twigs not distichous; angle of branching of ultimate twig 35–50 degrees; whip and scale leaf margins finely toothed (using 30x lens).
- D. Seeds 1–2 per cone; often bilobed, broadly triangular; scale leaves usually ternate, broadly ovate, acuminate, with obtuse tips; terminal whip branches ascending to erect; stem bark of long, interconnected strips; arborescent shrubs branching at or above base *J. californica*
- D. Seeds 1–4(–6) per cone, broadly triangular and smooth, or angular; scale leaves opposite on ultimate twigs with acute or obtuse tips; terminal whip branches ascending or erect (except flaccid and pendulous in *J. deppeana* var. *deppeana* f. *sperryi*).
- E. Terminal whip branches flaccid and pendulous; stem bark longitudinally furrowed into long, interconnected strips. *J. deppeana* var. *deppeana* f. *sperryi*
- E. Terminal whip branches ascending to erect; stem bark in quadrangular plates or in longitudinal strips (occasionally interconnected).
- F. Stem bark of longitudinal strips (occasionally interconnected). *J. deppeana* var. *patoniana*
- F. Stem bark of square or oblong quadrangular plates.
- G. Mature female cones larger 13–20 mm. diameter; seeds 1–4(–7) per cone; heavy bloom on cone surface causes cone to appear white; shrub or short tree (to 8 m.) *J. deppeana* var. *zacateicensis*
- G. Mature female cones 8–15 mm. diameter; light bloom on cone surface; arborescent shrub to tall tree (to 24 m.).
- H. Seeds (1–)2–4(–6) per cone, irregular and angular, 6–7 mm. long, 4–6 mm. wide; arborescent with weak central axis, often branching above base *J. deppeana* var. *deppeana*
- H. Seeds (1–)2–3(–6) per cone, ovoid or oblong, 7–10 mm. long, 6–8 mm. wide; trees (to 25 m.) with strong central axis *J. deppeana* var. *robusta*

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A. Mature female cones to 9(–10) mm. diameter; cone pulp soft and fleshy; cones often wrinkled when dried; cone color orange, red, reddish-brown, bronze, dark blue, or bluish-black.

I. Whip and scale leaves with entire leaf margins (using 30 \times lens).

J. Mature female cones 2(–3)-seeded, dark bluish-black; cones irregular and usually bilobed; seed tips divergent in cone; stem bark furrowed into narrow, longitudinal, interconnected strips, tightly appressed to stem *J. blancoi*

J. Mature female cones 1(–2)-seeded, dark bluish-black; cones globose to broadly ovate, usually not lobed; stem bark furrowed into broad, longitudinal, often interconnected strips, loosely attached, often peeling from stem. *J. scopulorum*

I. Whip and scale leaves with finely-toothed or denticulate leaf margins (using 30 \times lens).

K. Seeds (1–)2–17 per cone.

L. Mature female cones reddish-brown to brown, with a light coat of bloom; cone peduncles straight.

M. Mature female cones irregular and gibbous; seeds (2–) 4–9(–11) per cone; terminal whip branches strict; foliage very loosely spaced; scale leaves do not appear as a string-of-beads on the ultimate twig. *J. jaliscana*

M. Mature female cones globose; seeds 1–4 per cone; terminal whip branches erect to strict, recurved at tip; foliage tightly-spaced; scale leaves appear as a string-of-beads on the ultimate twig *J. durangensis*

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- L. Mature female cones dark blue to bluish-black, with light coat of bloom, globose; seeds (2-)3-7(-9) per cone; cone peduncles usually curved; terminal whip branches spreading to ascending, sometimes recurved at tip.
- N. Mature ultimate twigs 5-10 mm. long; angle of branching of ultimate twig 50-60 degrees; foliage very dense and tightly compacted; prostrate shrubs (less than 1 m.); alpine habitat *J. monticola* f. *compacta*
- N. Mature ultimate twigs 10-40 mm. long; angle of branching of ultimate twig 40-60 degrees; foliage loose, not tightly compacted; low shrub to tree (to 10 m.).
- O. Mature ultimate twigs 10-15(-20) mm. long; angle of branching of ultimate twig 40-50 degrees; foliage not tightly compacted; spreading, tortuous-stemmed shrub to tree (to 10 m.). *J. monticola* f. *monticola*
- O. Mature ultimate twigs 20-40 mm. long; angle of branching of ultimate twig 55-60 degrees; foliage not tightly compacted; shrubs (to 1.5 m.) *J. monticola* f. *orizabensis*
- K. Seeds 1-2 per cone.
- P. Mature female cones orange, reddish-orange, red, bronze, or reddish-brown, appearing pink or rose-color if covered with bloom.
- Q. Stem bark of quadrangular plates; cones reddish-brown; terminal whip branch tips straight, not curved; seeds subglobose or broadly ovoid *J. gamboana*

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- Q. Stem bark of longitudinal strips, often interconnected; cones orange to reddish-brown or bronze-color; seed ovoid.
- R. Mature female cones orange to red, with light bloom appearing pink or rose-colored; whip leaf ventral side white-glaucous *J. erythrocarpa*
- R. Mature female cones bronze to reddish-brown, with no bloom; whip leaf ventral side not white-glaucous *J. pinchotii*
- P. Mature female cone dark blue to dark bluish-black, with a light to heavy coat of bloom appearing light blue.
- S. Terminal whip branches straight, not recurved at tips; foliage slender; whip leaf glands not protruding like bead on dorsal surface of leaf.
- T. Ultimate twigs 1 mm. diameter, very slender; stem bark of fibrous-ragged; longitudinal strips; mature female cones globose, 5–8 mm. diameter; seeds 4–6 mm. long, 3–4 mm. wide; strong central axis, usually single-stemmed tree (to 10 m.), with a globose or broad-conic crown; foliage with faint odor of aromatic (terpenoid) compounds *J. comitana*
- T. Ultimate twigs 1–2 mm. diameter, slender; stem bark of longitudinal strips; mature female cones 5–7 mm. diameter; seeds globose to ovoid, 5–6 mm. long, 4–5 mm. wide; shrubs branched at base or short trees (to 10 m.) with horizontally-broadened crowns; foliage with strong odor of aromatic (terpenoid) compounds *J. monosperma* var. *gracilis*
- S. Terminal whip branches recurved at tips; foliage coarse; whip leaf gland protruding like bead on leaf.
- U. Scale leaf gland protruding like a bead, dark brownish-green on dark grayish-green mature leaf; angle of branching of ultimate twig 25–40 degrees; scale leaves on ultimate twig do not appear as a string-of-beads *J. ashei*

U. Scale leaf gland protruding like a bead, same color as light gray-green mature leaf; twig bark grayish brown, smooth; angle of branching of ultimate twig about 60 degrees; scale leaves on ultimate twig appear as a string-of-beads *J. saltillensis*

1. *Juniperus ashei* Buchh., cedro, *ashe juniper*, mountain cedar, rock cedar, Mexican cedar.

Juniperus ashei Buchholz, Bot. Gaz. 9:329. 1930. *Type*: United States: Arkansas: Stone County: Sylamore, W.W. Ashe 22520 (*Lectotype*: NCU!, selected by Hall, 1954).

J. occidentalis var. *Texana* Vasey, Rep. [U.S.] Commiss. Agric. 1875:185. 1876.
Type: Not designated by Vasey. *nomen nudum*.

J. occidentalis var? *conjugens* Engelmann, Trans. Acad. Sci. St. Louis 3:590. 1877. *Type*: United States; Texas: (locality unknown), Berlandier 671 (*Holotype*: MO; *Isotype*: US!).

J. sabinooides (H.B.K.) Nees sensu Sargent, Silva N. Amer. 10:91. 1897; *non J. sabinooides* (H.B.K.) Nees, Linnaea 19:706. 1847; *Sabina sabinooides* (H.B.K.) Small, Fl. Southeastern U.S. 33, 1326. 1903.

Large shrub to small tree to about 6 m. high, usually multi-stemmed at base as a shrub, with a globular or irregular crown; bark thin, light ashy-gray, long shreddy strips; branches spreading to erect, terminal whips, often recurved at tips, twig bark reddish-gray, peeling; angle of branching of ultimate twig 25–40 degrees; scale leaves opposite or ternate, triangular ovate, acute, appressed, 1–2 mm. long, margins finely toothed, older scale leaves often with oval resin gland protruding like bead on dorsal surface, brownish-red gland on gray-green leaves; female cones globose to ovoid, with soft, juicy resinous pulp, 7–8.5 mm. long, 6–7.5 mm. wide, dark bluish-black, with white bloom appearing light blue; seeds 1(–2) per cone, ovate, acuminate, 5–6 mm. long, 3–5 mm. wide, light brown to dark brown with shallow grooves; hilum ivory, one-third length of seed.

This species had been frequently called *J. mexicana* Sprengel by various authors (e.g. Hopkins, 1938). The name *J. mexicana* had been erroneously applied to *J. ashei* and many other sw. United States and Mexican species. *Distribution*: In rocky soil in canyons, ravines, arroyos, and eroded areas to 1800 m. elevation, in s. Missouri, n. Arkansas, e. Oklahoma, and the Edwards Plateau of Texas, U.S.A.; nw. Coahuila, México (Fig. 2).

Specimens Examined:

México: Coahuila: Hacienda Mariposa near Puerto Santana, Mpio. Muzquiz, Wynd &

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Mueller 284 (ARIZ, GH, MEXU, MO, MSC, NY); Puerto Santana in Sierra Santa Rosa, Mpio. Muzquiz, *Latorre* 143 (ENCB, TEX); Las Pilas, Mpio. Muzquiz, *Morales* in 1963 (ENCB, MEXU); Rancho Agua Dulce in Sierra de San Manuel, Mpio. Muzquiz, *Wynd & Mueller* 360 (ARIZ, GH, MO, NY); Potrero de la Mula, NW of Ocampo, *Johnston* 9195 (MEXU); 1 km. W of Rancho Lagunita, Mpio. Zaragoza, *Riskind & Patterson* 1893 (CS), *Riskind & Patterson* 1894 (CS); La Cuesta, S of Sierra del Carmen, 28°43'N x 102°30'W, *Adams* 1092 (CS).

2. *Juniperus blancoi* Mart., táscale, *Blanco juniper.*

Juniperus blancoi Martínez, Anal. Inst. Biol. México 17: 73, 74. 1946.

Type: México: Durango: Arroyo de Peñuelas, El Salto, C. E. Blanco A-500 (Holotype: MEXU!).

(Shrub to) tree (to 15 m.), main trunk branching several meters above the base, crown very irregular; trunk bark thin (to 5 mm.), brown, of tightly appressed, interconnected, longitudinal strips; terminal whip branches spreading to ascending, branch tips straight, bark dark gray-brown; angle of branching of ultimate twig 35–45 degrees; scale leaves mostly opposite, oval or subelliptic, acuminate with acute to obtuse, appressed tips, 1.5–2.0 mm. long, margin entire, dark yellowish-green to green, with a linear resin gland near the center of the leaf; female cones with soft, fleshy pulp, irregular to bilobed, enlarged transversally, dark bluish black, with a light coat of bloom, 5–7 (–9) mm. diameter, 3–6 mm. long, peduncle straight; seeds 2 (rarely 3, 4 or 5), irregular to subpyramidal, grooved, 2–5 mm. long, 3–4 mm. wide, brown; hilum about one-half length of seed.

This species is rare in occurrence in México. Observations by D. Reyes V. (Compañía Maderera de Durango, El Salto, Durango) indicated that it is locally common in the vicinity of El Salto, Durango. Martínez (1946) considered this species to be allied to *J. jaliscana* in his subsection Jaliscanae. Zanoni and Adams (1975, 1976) have shown that this is an unnatural alliance, and that *J. blancoi* is related to *J. scopulorum*. Distribution: At the bottoms of arroyos, along stream beds in the pine-oak-juniper forest of Durango, at 2600–2900 m. elevation, and at lower elevations in ne. Sonora; near El Salvador, state of México, México (Fig. 3).

Specimens Examined:

México: Durango: Arroyo de Peñuelas, Mpio. El Salto, Martinez 10527 (A, BH, DS, F, MEXU, MO, RSA, UC); Arroyo San Antonio, Mpio. El Salto, Zanoni 2766 (CS); Arroyo de las Adjuntas, Mpio. El Salto, Zanoni 2771 (CS).

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Sonora: Cañon de Bavispe, White 3112 (ARIZ, MICH); Rancho de la Nacha, White 4093 (ARIZ, MICH). México: 0.5 km. N of El Salvador on road to Carmona, Adams 1486 (CS).

3. *Juniperus californica* Carr., cedro, *California juniper*, Cedros Island juniper, Cedar Island juniper, desert white cedar, sweet-berried juniper, white cedar.
Juniperus californica Carrière, Rev. Hort. ser. IV, 3:352. 1854. Type: United States: California: (locality?), *M. Boursier* s.n. (*Holotype*: P); *Sabina californica* (Carr.) Antoine, Cupress. Gatt. 52. 1857.
- J. pyriformis* Lindley, Gard. Chron. (23 June 1955): 420. 1855. Type: United States: California: San Bernardino Mountains, *W. Lobb*.
- J. cerrosianus* Kellogg, Proc. Calif. Acad. Sci. 2:37. 1859. Type: México: Baja California: Cedros Island, *Veatch* s.n. (*Holotype*: A!); *J. cedrosiana* Kellogg, Hesperian 4:3,4. 1860. Type: México: Baja California: Cedros Island, *Veatch* s.n. (*Holotype*: probably same as for *J. cerrosianus*, see Zanoni and Adams, 1973).
- J. occidentalis* W. J. Hooker sensu Parlatore in DC, Prodromus 16(2): 489, 490. 1868.
- J. californica* var. *siskiyouensis* L. F. Henderson, from Oregon is probably *J. occidentalis*.

Tall shrubs (to 4 m., rarely tree to 10 m.) branching just above base, branches ascending or spreading, forming an open, rounded or lobular crown; stem usually deeply fluted, bark ashy gray, divided into large plates; terminal whip branches ascending to erect, branch tips straight, with smooth, scaly, ashy-brown bark; angle of branching of ultimate twig 45–60 (–70) degrees; scale leaves mostly ternate, (ultimate twig appears terete in cross-section) broadly ovate, acuminate with obtuse, appressed tips, 1.5–2 mm. long, margins finely toothed, with a resin gland on the center of the leaf, yellowish-green to green; female cones with dry, somewhat fibrous pulp, globose to pyriform, medium to dark reddish-brown, with bloom appearing light blue, 10–18 mm. diameter, the cone surface is membranous and peels off cones after maturity; seeds 1–2, broadly ovoid, light brown, few or no grooves; hilum about two-thirds length of seed, tan.

Distribution: On dry mountain slopes in the Sierra Juarez, Sierra San Pedro Martir, Sierra San Borja, and Sierra de Calamujue y San Luis, and in adjacent desert fringes at 270–1200 m. elevation in n. Baja California, also Isla de Cedros and Isla de Guadalupe, México; California, s. Nevada, and w. Arizona, U.S.A. (Fig. 7).

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Specimens: (see Zanoni and Adams, 1973, for citation of specimens from México).

4. *Juniperus comitana* Mart., cedro; cipres; sicop (Baja Verapaz, Guatemala); bac'il nuhkupat (Tzeltal at Tenejapa, Chiapas); *Comitan Juniper*.

Juniperus comitana Martínez, Anal. Inst. Biol. México 15:12, 13. 1944. *Type:* México: Chiapas: 12 km. S. of Comitan, Martínez 6700 (*Holotype*: MEXU!).

Tree (to 10 m.), single-stemmed, branching several meters above the base. crown rounded or broadly conic; bark about 5 mm. thick, light ashy-brown, of ragged, longitudinal strips; terminal whip branches ascending to erect, branch tips straight, reddish-brown with scaly bark; angle of branching of ultimate twig 35-45 degrees; scale leaves mostly opposite, ovate, with acuminate, appressed tips, 11.5-2 mm. long, margin finely toothed, green; foliage very slender (ultimate twig diameter less than 1 mm.), with very weak odor from unusually low content of aromatic (terpenoid) compounds.

fruit = bluish

Distribution: On limestone hills, in pine-oak forests, and in *Ficus-Acacia* forests in the mountains of Chiapas, México. On dry rocky hills in the pine-oak forests of Depto. Baja Verapaz, in the Sierra de los Cuchumatanes of Depto. Huehuetenango, and on dry, dolomitic slopes and bluffs of Depto. Zacapa, Guatemala, at 1300-2300 m. elevation (Fig. 2).

Specimens Examined:

Guatemala: Baja Verapaz: near San Jerónimo, Molina 12379 (F); hills near Santa Rosa, Standley 91253 (F). Huehuetenango: San Miguel Acatán, Skutch 1024 (GH); between Nentón and Candelaria, Cook 60 (US); between Nentón and Las Palmas, Steyermark 51617 (F,G,NY,US); barranca of Río Ixlam between San Idelfonso and Cuileco, Steyermark 50715 (F); Cerro Chiquihui above Carrizal, Steyermark 50798 (F, GH, MO, NY, US); on trail from Aguatán to Nebaj, Sharp 46107 (F, TENN); Aguacatan, Skutch 1921 (F, GH, NY, US). Zacapa: Loma el Picacho, Santa Rosalia in Sierra de las Minas, Steyermark 42703 (F, GH, NY).

Méjico: Chiapas: 12 miles E of La Trinitaria on road to Lagos de Monte Bello, Breedlove 14115 (DS, F); near Colonia Santa María, 15 miles SE of Comitan, Carlson 1910 (NY, UC); between Bajueu and Comitan, Cook 111 (US); Los Lagos, 3 miles NW of Rancho San José, 34 miles SE of Comitan, Carlson 1910 (F); Tepancuapan, Martínez 10529 (BH, DS, F, MO, NY, UC).

5. *Juniperus deppeana* Steud., cedro; cedro chino (Puebla); sabino; Táscate (Chihuahua and Durango); Tláscal or Tláxcal (Hidalgo); Huata, Agoriza (Sonora); aborí, aorí, awarí, aworíki, kawarí, koarí, petcalawa, waaka (Tarahumar of Chihuahua); ga'a-

(Pima of Chihuahua), *alligator juniper*, oak-bark juniper, checkered-bark juniper.

Arborescent shrubs to trees (to 20 m.) high, to 2 m. diameter, single-stemmed, may branch 1 or 2 m. above base; bark 1-20 cm. thick, quadrangular plates (or longitudinally furrowed in f. *sperryi*), ashy gray outside, deep chocolate brown inside; crown open and broadly conic, or dense and globular, or sparsely branched in dense forests; branches stiff spreading to erect (or drooping in f. *sperryi*) on rapidly growing trees, with peeling bark; angle of branching of ultimate twigs 30-45 degrees; scale leaves mostly opposite, twigs appear tetragonal in cross-section, 1-3 mm. long, obtuse to acute, margins finely toothed, yellowish-green to blue-green; ovulate cones ripen in second year, subglobose to broadly ellipsoid, dry fibrous pulp, 8-15 mm. diameter, reddish-tan to dark reddish-brown with light to heavy white bloom; seeds 1-4 (-6) per cone, 6-9 mm. long, 4-7 mm. wide broadly ovate to angular, smooth or grooved, light chocolate brown; hilum two-thirds to three-quarters length of seed, light tan. Cut-over or burned trees stump-sprout at root crown.

- 5a. *Juniperus deppeana* Steudel var. *deppeana*, Nom. Bot. ed. 2.835. 1841; *J. mexicana* Schlecht. & Chamisso, Linnaea 5:77. 1830. *Type*: México: Vera Cruz: Llanos de Perote, Schiede in 1828 (*Holotype*: location not known, probably lost or destroyed; *Lectotype*: here designated, MO!); *J. foetida* & *thurifera* Spach., Ann. Sci. Nat. ser. 2. 16:298. 1841. *Sabina mexicana* (Schlecht. & Chamisso) Antoine, Cupress. -Gatt. 38. 1857.

j. *gigantea* Roezl, Cat. Graines Conif. México 8. 1857. *Type*: México Tlaxcala: (locality?), Roezl (*Holotype*: location not known). *Sabina gigantea* (Roezl) Antoine, Cupress. -Gatt. 36. 1857.

Arborescent shrubs to short, stout trees (to 10 m.), with weak central axis, often branching just above base; female cones 8-15 mm. diameter, light coat of bloom; seeds (1-) 2-4 (-6) per cone, irregular and angular, 6-7 mm. long, 4-6 mm. wide.

We include *J. deppeana* var. *pachyphylaea* (Torrey) Martínez, in var. *deppeana* pending further studies in this species.

Distribution: In pine-oak, oak, pine-oak-fir, oak-juniper woodlands on the w. slopes of Sierra Madre Oriental from Coahuila s. to Puebla at 1737 m. -3000 m. elev., and ne. Sonora, México; Arizona, New México, and sw. Texas, U.S.A.

Representative Specimens:

México: Coahuila: Canyon de Sentenela in Sierra del Carmen, municipio Villa Acuña, Wynd and Mueller 535 (ARIZ, MSC, MO, NY); S of Saltillo in Sierra Madre, Palmer

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1296 (GH, MO, NA, NY). Hidalgo: 4 km. N of Pachuca at El Bordo, *Rzedowski* 24305 (ENCB, MICH, MSC). México: 20 km. NE of Texcoco on road to Calpulapan, *Cruz C.* 442 (DS, ENCB, MICH, MSC, TEX). Michoacan: Tlalpujuhua, *Martínez* 10510 (F, NY, UC). Nuevo Leon: approx. 15 miles SW of Galeana at Puerto Santa Ana, *Mueller* 930 (MICH). Puebla: Ciudad Serdan, *Ventura A.* 2130 (DS, ENCB, MICH, MO, NY). Queretaro: E of Vizarron on road to San Joaquin, *Puig* 3546 (ENCB). San Luis Potosi: 12 km S of Mineral de Catorce at Tierras Negras, *Rzedowski* 7293 (ENCB). Tamaulipas: Valle de la Gruta, 5 km. W of Rancho del Cielo and 8 km. NW of Gomez Farias, *Gilbert* 53 (TEX). Tlaxcala: at base of Mt. Tlacuapanga, *Sharp and Hernández X.* 44518 (MEXU, TENN). Vera Cruz: Llanos de Perote at Perote, *Zanoni* 2245 (CS).

- 5b. *Juniperus deppeana* var. *deppeana* f. *sperryi* (Correll) R. P. Adams, Brittonia 24:289. 1973. *J. deppeana* var. *sperryi* Correll, Wrightia 3:188. 1966. *Type:* United States: Jeff Davis County: Dry Canyon of Davis Mountains, about 8 mi. from Sproul Ranch Headquarters, *Sperry* T879 (*Type*: GH; *Isotype*: US!).

Stem bark longitudinally furrowed into interconnected strips; terminal whip branches and larger branches flaccid and drooping.

Distribution: Davis Mountains of Texas, U.S.A.; ne. Sonora, México in rocky soils and open, grassy slopes (Fig. 4).

Specimen Examined:

México: Sonora: 14.2 miles N of Coyote on road to Huachinera, *Zanoni* 2872 (CS).

- 5c. *Juniperus deppeana* var. *pachyphlaea* (Torrey) Martínez, Anal. Inst. Biol. México 17:53. 1946. *J. pachyphlaea* Torrey, U. S. Rep. Survey Miss. -Pacific 4 (5): 142. 1857. *Type:* United States: New México: Zuni Mountains, *Bigelow* in 1853 (*Holotype*: NY!); *J. pachyphloea* Torrey in Ives, Rep. Colo. River part 4, 28. 1861. *Sabina pachyphlaea* (Torrey) Antoine, Cupress. -Gatt. 39. 1857. *Sabina pachyphloea* (Torrey) A. A. Heller, Muhlenbergia 5:120. 1909. *Sabina pachyphloea* (Torrey) I. M. Lewis, Univ. Texas Bull. 22:43. 1915.

J. pachyderma Sitgreaves, Rep. Exped. Zuni Colo. Rivers. 35. 1854; *J. plochyderma* in Sitgreaves, Rep. Exped. Zuni Colo. River plate 16. 1854; (Sitgreaves used *J. pachyderma*; however Torrey did not use the name in the

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botanical descriptions. *J. plochyderma* is a printer's error); *Sabina plochyderma* Antoine, Cypress. -Gatt. 40. 1857.

This variety has not been studied recently. Investigations relating it to the other varieties of *J. deppeana* are needed. We include this variety under *J. deppeana* var. *deppeana* until further investigations in the species are made.

Distribution: Arizona and New México, U.S.A.; Sonora, México.

- 5d. *Juniperus deppeana* var. *patoniana* (Martínez) T. A. Zanoni, Biochem. Syst. & Ecology 4. 1976: *J. patoniana* Martínez, Anal. Inst. Biol. México 17:62, 63. 1946.
Type: México: Durango: El Salto, C. E. Blanco 6710 (*Holotype*: MEXU!).

J. patoniana f. *obscura* Martínez, Anal. Inst. Biol. México 17:68. 1946. Type:
México: Durango: El Salto: C. E. Blanco A-510 (*Holotype*: MEXU!); *J. deppeana* var. *obscura* (Martínez) Gaussen, Trav. Lab. Forest. Toulouse Tome II, Sect. I, Vol. 1, partie II 2, fasc. 10. 150, 152. 1968.

Trees, very sparsely branched, with very irregular crown, stem bark of longitudinal strips (occasionally interconnected); otherwise similar to *J. deppeana* var. *robusta*.

Distribution: As single, scattered trees in the pine-oak-juniper forests, usually with *Juniperus deppeana* var. *robusta*, at 2400-2800 m. elevation in the Sierra Madre Occidental of Durango, México (Fig. 4).

Specimens examined:

México: Durango: El Salto, *Blanco* A510 (MEXU); *Blanco* 6710 (GH, MEXU); Martínez 10532 (A, BH, DS, F, MO, UC); Puerto Buenos Aires, approx. 52 km. W of El Salto, Zanoni 2744 (CS); Arroyo San Antonio, 3.6 miles S of El Salto, Zanoni 2764 (CS); Las Tablas, *Blanco* 3001 (MEXU); La Garza, Santiago Papasquiaro, Martínez 10531 (A, BH, DS, F, MO, NY, UC); Sierra de la Candela, Tepehuanes, Estavez in Oct. 1943 (A, US); Zapiguri, Tepehuanes, Martínez 12005 (RSA).

- 5e. *Juniperus deppeana* var. *robusta* Martínez, Anal. Inst. Biol. México 17:47. 1946.
Type: México: Durango: Pueblo Nuevo, Estavez A502 (*Holotype*: MEXU!).

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Trees (to 25 m.), with strong central axis, bark of square to rectangular plates; female cones 8–15 mm. diameter, with light coat of bloom; seeds (1)2–3(–6) per cone, ovoid or oblong, 7–10 mm. long, 6–8 mm. wide.

Distribution: In the pine, pine-oak, oak, pine-oak-juniper-arctostaphylos forests, and occasionally in grasslands of the Sierra Madre Occidental at 1500–3200 m. elevation from Chihuahua s. to Jalisco, México (Fig. 4).

Representative specimens:

México: Chihuahua: W side of San Luis Range, 5 air miles SE of Monument 67 on Sonora-New Mexico border, *Tucker 2599* (ARIZ, UC); near Colonia García, *Townsend and Barber 185* (F, MO, NY, RSA, TEX, UC); Cerro de la Ventana, S of Basuchil, about 10 miles NW of Miñaca, *Mexia 2517* (A, CAS, GH, MICH, MO, PH, POM, UC); El Vergel, 100 km. SW of Parral, *Little 17900* (F, UC). Durango: Zapiguri, Tepehuanes, *Martínez 12003* (A, RSA); Sierra de la Candela, Tepehuanes, *Martínez 10514* (DS); 6 miles W of La Ciudad on Highway 40, *Breedlove 18871* (CAS, MICH); Hacienda Coyotes, municipio El Salto, *Zanoni, 2147* (CS). Jalisco: 5 km E of Rancho El Mortero, municipio Mezquitic, *Rzedowski 17701* (ENCB). Zacatecas: 0.1 mile NW of El Alamo, on Highway 45, *Zanoni 2159* (CS); 8 miles S of Chalchihuites, *Jones 1037* (ENCB, MICH).

5f. *Juniperus deppeana* var. *zacatecensis* Martínez, Anal. Inst. Biol. México 17:57, 58. 1946. *Type:* México: Zacatecas: 10 km. W of Sombrerete, *Martínez 4503* (Holotype: MEXU!); *J. zacatensis* (Martínez) Gaussen, Trav. Lab. Forest, Toulouse Tome II, Sect. I, Vol. 1, partie II 2, fasc. 10, 151, 1968.

Large shrubs to small tree (to 8 m.), stem bark of square to oblong plates; female cones 13–20 mm. diameter, with heavy bloom on cones, causing cone to appear white; seeds 1–4(–7) per cone.

Distribution: In oak-pine-juniper and pinon-juniper woodlands, and on grasslands on hills at 1980–2470 m. elevation, in w. Zacatecas and adjacent Durango, México (Fig. 4).

Representative Specimens:

México: Durango: at km. 104 S of Durango on Highway 45, *Littman and Pennington 9044* (NY). Zacatecas: pass through Sierra Papanton near border with Durango, *Gentry 8452* (MICH, US); W of Sombrerete, *Martínez 10519* (BH, DS, F, MO, NY, UC); just N of Chalchihuites on Highway 15 (to Jimenez del Teul) near Mina Dolores, *Zanoni*

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2173 (CS); 20 km. WSW of Valparaiso at Puerto de la Paja, *Rzedowski* 17554 (ENCB, TEX); Sierra de Guadalupe near Temazcal, municipio Nieves, *Rzedowski* 8748 (ENCB, MSC, TEX).

6. *Juniperus durangensis* Mart., cedro, tascate, *Durango juniper.*

Juniperus durangensis Martínez, Anal. Inst. Biol. México 17:94, 95. 1946. Type: México: Durango: Puerto de Santo Domingo, 30 km. from El Salto, *Martínez* 7015 (Holotype: MEXU!).

Shrub to small tree (to 5 m.), usually branching near base, trees have irregular crowns; bark thin ashy-brown, long fibrous strips; branches of shrubs ascending-erect to strict, spreading in trees, terminal whips recurved, bark smooth to peeling scales, reddish-brown; angle of branching of ultimate twig about 60 degrees; scale leaves mostly opposite on ultimate twigs, leaves on ultimate twig appear like a chain of beads, 1-2 mm. long, margins finely toothed, dark gray-green; female cones with soft pulp, gibbous, 6-7 mm. long, 4-6 mm. wide; seeds 1-3 (-4) per cone, subconic to oval, acuminate or obtuse, 3-4 mm. long, 2-3 mm. wide, dark reddish-brown with shallow grooves; hilum to one-half length of seed.

reddish Brown

Distribution: in openings in pine-oak or pine-oak-juniper-arctostaphylos forests at 1600-2900 m. elevation. In Sonora, Chihuahua, Durango, extreme w. and s. Zacatecas, n. Jalisco and Aguascalientes, México (Fig. 2).

Specimens Examined:

México: Aguascalientes: Sierra del Laurel near Calvillo, *Rzedowski* 14078 (ENCB); *McVaugh* 18394 (MICH). Chihuahua: Rancho Byerly in Sierra Charuco, *Gentry* 8144 (US); dry ledges of the Sierra Madre [near Ciudad Guerrero], *Pringle* 1363 (A, F, G, NA, NY, PH, UC); dry ledges of porphyry, in Sierra Madre [near Cusihuirijachic], *Pringle* 1672 (NY, UC). Durango: Bagres, municipio of Tepehuanes, *Martínez* 12004 (BH); Mexiquillo, municipio of Pueblo Nuevo, *Martínez* 10528 (DS, F, MO, NY, UC); 52 km. W of El Salto at Puerto Buenos Aires, *Zanoni* 2528 (CS); location unknown, *Rose* 3754 (US). Jalisco: Las Vidrieras, 10 km. NW of El Platanar, San Martin de Bolanos, *Rzedowski* 26193 (DS, ENCB, MICH, MSC); *Diaz Luna* 906 (ENCB). Sonora: 4 miles E of El Bilito, *White* 4788 (GH, MICH). Zacatecas: between Jalpa and Tlaltenango, *Diaz Luna* 2368 (ENCB); Sierra del Gato, Jimenez del Teul, *Martinez* A-506 (MEXU).

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7. *Juniperus erythrocarpa* Cory, agoriza (Sonora); tlascali, táscale (Chihuahua, Coahuila, Durango, Sonora); *Cory's juniper*.

Juniperus erythrocarpa Cory, Rhodora 38:186. 1936. *Type*: United States: Texas; Brewster County: Laguna in Chisos Mts., *Cory* 7642 (*Holotype*: A!).

J. erythrocarpa var. *coahuilensis* Martínez, Anal. Ints. Biol. México 17:115, 116. 1946. *Type*: México: Coahuila: Sierra de los Hechiceros, *Johnston and Muller* 1290 (*Holotype*: MEXU!; *Isotypes*: GH!, NA!, TENN!, TEX!); *J. coahuilensis* (Martínez) Gausen, Trav. Lab. Forest, Toulouse Tome II, Sect. I, Vol. 1, partie II 2, fasc. 10, 154, 1968.

J. texensis Van Melle, Phytologia 4:26. 1952. *Type*: United States: Brewster County: Big Bend National Park, *Brenckle* 51019 (*Holotype*: NY; *Isotype*: A).

Large shrub to small tree (to 8 m.), shrubs branched at base, with flattened-globular or irregular crown; bark thin, ashy-gray; long ragged strips, branches ascending to erect in shrubs, spreading in trees, bark scaly and ashy-gray; angle of branching of ultimate twig about 45-55 degrees; scale leaves opposite or ternate, appressed, ovate to broadly elliptic, obtuse to acuminate, 1.5-2 mm. long, margin finely toothed, yellowish-green; female cones with soft, juicy, resinous pulp, globose or ovate, 6-7 mm. long, yellowish-orange, orange to dark red, with white bloom appearing pink or rose; seeds 1 (rarely 2) per cone, ovate or pyriform, acuminate, 5 mm. long, 4 mm. wide, brown shallow or deep grooves; hilum about one-half length of seed light brown.

Distribution: In calcareous, often gravelly soils on rolling hills in the *Bouteloua* grasslands, and in adjacent oak-juniper savannas at 880-2200 m. elevation. S. of Mogollon Rim, of Arizona, s. to n. Sonora, s. New Mexico, Trans-Pecos of Texas, Chihuahua, Durango, Coahuila, e. Nuevo León, Tamaulipas, and n. Zacatecas (Fig. 5).

Representative Specimens:

México: Chihuahua: 30 miles W of Cuauhtemoc on Highway 16, *Stuessy* 1079 (ENCB, NY, TEX). Coahuila: mountains about Carneros Pass, *Pringle* 2305 (F, G, MO, MSC, NA, NY, PH, UC). Durango: near Torreon de las Canas on Zarca Mesa, *Gentry* 8651 (MEXU, MICH). Sonora: Cañon Pulpito, Mpio. Agua Prieta, *Muller* 3729 (F, GH, MICH, NA, TENN, UC). Zacatecas: Cedros, *Lloyd* 17 (F, US).

8. *Juniperus flaccida* Schlecht., cedro, cedro liso, cipres, enebro, sabino, tláscal, táscale, *drooping juniper*, Mexican drooping juniper.

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Small tree (to 12 m.) with trunk branching 1–2 m. above base (rarely shrubby); bark cinnamon reddish-brown or grayish reddish-brown, broad interlaced fibrous strips; branches spreading forming a globose or flattened globular crown; branchlets drooping and flaccid; angle of branching of ultimate twig 20–30 degrees; scale leaves 1.5–2 mm. long, opposite, narrowly ovate, tips acuminate appressed or divergent, margins subentire with few irregular teeth, sometimes with elliptic resin gland flat in dorsal leaf surface; female cone with soft fibrous resinous pulp, subglobose to several-flat sided, with umbo of cone-scales often present on mature cones, tan to reddish-brown with light coat of white bloom, 8–20 mm. diameter, dried cones hard due to resin cementing pulp; seeds (4–) 6–13 per cone, 5–6 mm. long, angular, ivory or brown.

8a. *Juniperus flaccida* Schlecht. var. *flaccida*. Linnaea 12:495. 1838.

Types: México: Hidalgo: Atotonilco el Chico, Schiede in 1830; México: Hidalgo: Regla, Ehrenberg s. n. (*Holotype*; location not known, probably lost or destroyed; *Lectotype*: here designated MO 2085919!; *Isolectotype*: US 12053431!); *J. foetida flaccida* (Schlecht.) Spach, Ann. Sci. Nat., ser. 2, 16:300. 1841; *Sabina flaccida* (Schlecht.) Antoine, Cupress. –Gatt. 37. 1857; *Sabina flaccida* (Schlecht.) A. A. Heller, Muhlenbergia 5:120. 1909; *Sabina flaccida* (Schlecht.) I. M. Lewis, Bull. Univ. Texas 22:43. 1915.

J. gracilis Endl., Syn. Conif. 31. 1847. *J. gracilis* Hort. in Roezl., Cat. Graines Conif. México. 8. 1857.

J. gigantea Roezl in part, Cat. Graines Conif. México. 8. 1857. *Type*: México: México: Tenancingo at 7–8000 feet, Roezl s. n. (*Holotype*; location not known); *Sabina gigantea* (Roezl) Antoine in part, Cupress. –Gatt. 36. 1857; *J. flaccida* var. *gigantea* (Roezl) Gaussen, Trav. Lab. Forest. Toulouse Tome II, Sect. I, Vol. 1, partie II 2, fasc. 10. 117. 1968.

Scale leaves on ultimate twigs with appressed, obtuse tips; mature female cones usually smooth (or with horn-like protuberances from the enlarged cone-scale tips).

Distribution: Usually on xeric slopes in open, grassy slopes or in pine, pine-oak, pine-oak-juniper, or in tropical-deciduous forests (Jalisco), on calcareous substrates at (900–) 1300–2900 m. elevation, in Big Bend National Park, Texas, U.S.A.; Chihuahua, Coahuila, Distrito Federal, Durango, Guanajuato, Guerrero, Hidalgo, Jalisco, México.

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Michoacan, Morelos, Nuevo León, Oaxaca, Puebla, Queretaro, San Luis Potosi, Sonora, Tamaulipas, and Zacatecas, México (Fig. 6).

Representative Specimens:

México: Chihuahua: Cañon del Rayo, Sierra del Diablos, *Stewart* 942 (GH, TEX). Coahuila: Cañon del Agua, Sierra de la Madera, Mpio. Cuatro Cienegas, *Muller* 3209 (GH, MICH, NA, TENN, UC). Distrito Federal: 1 Km. N of Topilejo, on road to San Mateo, *Rzedowski* 18265 (DS, MSC). Durango: Santiago Papasquiaro, *Palmer* 75 (A, F, GH, MO, UC). Guanajuato: Palmillas, 25 km. NE of San Luis de la Paz, *Little* 11089 (US). Guerrero: Cerro Alquitran, Mazatlán, *Kruse* 1591 (ENCB). Hidalgo: 10 km. NW of Orizabita, Mpio. Ixmiquilpan, *González Q.* 2103 (DS, ENCB, MEXU, MICH, MSC, SMU). Jalisco: Las Treinta Vueltas, 10 km. NW of El Platanar, Mpio. San Martin de Bolaños, *Rzedowski* 26212 (ENCB, MICH, MSC). México: 2 km. NE of Ixtapan de la Sal, *Rzedowski* 18242 (ENCB, MICH). Michoacan: on Rt. 15, Puerto del Gato, Curungueo, *Zanoni* 2194 (CS). Morelos: 3 km. E of Cuernavaca, on road to Tepoztlán, *Palacios* on 12 Sept. 1964 (ENCB). Nuevo León: Hacienda Ojo de Agua on Cerro Potosi, Mpio. Galeana, *Schneider* 996 (A, ARIZ, GH, MO). Oaxaca: El Vado, Mpio. Ejutla, on Oaxaca to Sola de Vega road, *Rzedowski* 21285 (DS, ENCB, MICH, TEX). Tamaulipas: 11 miles SW of Victoria, on road to El Huisachal, *Stanford, Lauber & Taylor* 2001 (DS, RSA). Queretaro: 80 km. NE of Queretaro on road to Pinal de Amoles, on Pilón, *McVaugh* 10349 (ENCB, GH, MICH, TEX). San Luis Potosi: vicinity of La Salitrera, Mpio. Zaragoza, *Rzedowski* 11396 (ENCB, MICH, MSC). Sonora: Rancho de la Nacha [S of Agua Prieta], Rio Bavispe régión, *White* 4093 (GH). Zacatecas: N of El Limón, at Zacatecas-Jalisco state line, *Zanoni* 2178 (CS).

8b. *Juniperus flaccida* var. *poblana* Martínez, Anal. Inst. Biol. México 17:31. 1946.

Type: México: Puebla: Amozoc at 2300 m., Martinez 507 (Holotype: MEXU!).

Cupressus thurifera H. B. K., Nova Gen. et Sp. Pl. 2:3. 1817. Type: México: Guerrero: prope Tasco et Tehuilopec, *Humboldt and Bonpland* 3956 (Holotype: P; as fragments and photograph!); *Chamaecyparis thurifera* Endl., Syn. Conif 62. 1847.

Scale leaves on ultimate twigs with sharp, acute, divergent tips; mature female cones usually show suture lines from fusion of cone-scales, appearing like a soccer ball.

Distribution: Usually on dry, calcareous slopes, in pure stands, or in mixed forests, at 1200-2300 m. elevation from Jalisco e. to Oaxaca (Fig. 6).

Representative Specimens:

México: Distrito Federal: Cerro Xochitepec, near Xochitepec, *Rzedowski* 22133 (DS, ENCB, MICH, MSC, TEX). Guerrero: between Taxco and Tehuilotepec, *Martínez 11000* (A, UC), *Martínez 10507* (F). Hidalgo: Santuario, Cardonal, *May Nah AM-35* (ENCB). Jalisco: 18 km. N of Ixtlahuacan del Rio, *Rzedowski 15265* (ENCB, TEX). México: Rancho Santo Tobias, near Villa Guerrero, Mpio. Coatepec Harinas, *Gilly 114* (MICH, TENN, TEX). Michoacan: NW of Aguililla, about 6–7 miles S of Aserradero Dos (MICH). Morelos: mountainside above Cuernavaca, Pringle Aguas, *McVaugh 22702* (MICH). Puebla: Tochimilco, *Nelson on 2–3 August 1893* (US). 13207 (CAS, F, MICH, SMU). Oaxaca: Las Sedas, *Pringle 4794* (A, ARIZ, G, MEXU, MO, MSC, PH, UC).

9. *Juniperus gamboana* Mart., cedro; cipres; cipres común; bac'il nuhkupat (Tzeltal at Tenejapa, Chiapas); K'uk", ton, nukul pat (Tzotzil at Zinacantán, Chiapas), *gamboa juniper.*

Juniperus gamboana Martínez, Anal. Inst. Biol. México 15:7, 8. 1944. *Type:* México: Chiapas: near Teopisca, *Martínez 6701* (*Holotype*: MEXU!).

Trees (to 12 m.), stem branching 1 or 2 m. above base, branches ascending to erect, crown rounded or very broadly conic; stem bark 5 mm. thick, dark ashy-gray-brown, divided in quadrangular plates; terminal whip branches ascending to erect, with straight tips, bark reddish-brown and scaly; angle of branching of ultimate twig 35–45 degrees; scale leaves mostly opposite, ovate to elliptic, 1.5–2 mm. long, with acute or obtuse, appressed tips, margin finely-toothed, yellow-green to green; female cones with soft pulp, globose, reddish-brown, with a light coat of bloom, 5–8 mm. diameter; seeds 1(or 2) per cone, ovoid, 4–6 mm. long, 3–4 mm. wide, several large grooves, brown; hilum about two/thirds length of seed.

Distribution: On limestone soils in pine-oak pine-oak-juniper forests in the sierras at 1670-2200 m. elevation in Chiapas, México; limestone hillsides near San Miguel Acatan at 1920-2134 m. elevation in the Sierra de los Cuchumatanes of Depto. Huehuetenango, Guatemala (Fig. 1).

Specimens Examined:

Guatemala: Huehuetenango: San Miguel Acatan, *Skutch 1024* (F, US); above Rio Ocheval toward San Miguel Acatan, *Sharp 451031* (F, TENN); slope W of San Miguel Acatan, *Sharp 451033* (F, MEXU, RSA, TENN). México: Chiapas: San Cristobal de las Casas, *Nelson 3187* (A, F, US); between San Cristobal and Comitán, *Carlson 2017* (MICH); 15 km. SE of San Cristobal near Nuevo León, *Rzedowski 23703 and 23704* (MICH).

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(DS, ENCB, MICH, MSC); 22 km. S of San Cristobal, *Martínez 10530* (A, BH, F, MEXU, NY); 22 km. S of San Cristobal, *Martínez 9000* (A, F); 13 miles SE of San Cristobal, *Peterson 72-118* (CS); summit of Highway between San Cristobal and Teopisca, *Breedlove 7122*; 4 miles N of Teopisca on Highway 190, *Laughlin 1921* (DS); near Teopisca, *Miranda 7207* (MEXU); near Teopisca, *Martínez 6701B*, (MEXU); 9 miles SE of Teopisca, *Zanoni 2272* (CS); 10 miles E of Teopisca, *King and Diboll 3022* (DS, MICH, NY, TEX UC, US); 20 km. E of Teopisca, *Rzedowski 23702* (BH, ENCB, F, MEXU); 16 km. NW of Comitán, near Lake Jusnajav, *Sharp 45446* (GH, MEXU, TENN); 18 miles NW of Comitán, *Breedlove and Raven 8323* (DS, ENCB, F); 10 miles NW of Comitán, *Sharp 45443* (GH, MO, TENN, UC); 7 miles W of Comitán, *Carlson 2017* (NY); Amatenago del Valle, *Ton 1832* (DS, ENCB, MICH); *Matuda 5820* (F, MEXU); *Matuda 5844* (MO); Cruz Quemada, *Langman 3802* (PH, US); 4 miles NW of Pinola, municipio Las Rosas, *Raven and Breedlove 20108* (DS, ENCB, F, MICH); 3 miles SW of Pinola Las Rosas on road to Soyatitan, municipio Venustiano Carranza, *Breedlove 11372* (DS, F, MICH); 1 mile NE of Highway, 2.3 miles NW of Comitán, *Stevens 1281* (CS); 3 miles NW of Comitan, *Marin M64-13* (RSA); S of Comitán, *Martínez s. n.* (BH); near San Gregorio, *Sharp 45990* (DS, TENN); Canjor, *Goldman 800* (US).

10. *Juniperus jaliscana* Mart., cedro, enebro; *Jalisco juniper*. *Juniperus jaliscana* Martínez, Anal. Inst. Biol. México 17:69. 1946. Type: México: Jalisco: Cuale, Gonzalez 7002 (Holotype: MEXU!).

Trees (to 10 m.) with straight stems, branches ascending to erect, forming a conic or round crown; stem bark 10–20 mm. thick of fibrous, interconnected strips, grayish-brown surface over cinnamon brown inner bark; terminal whip branches erect to strict, tips of branches very flexible and curved, but not recurved, bark reddish-brown and scaly; angle of branching of ultimate twig 50–60 degrees; scale leaves opposite (rarely ternate), ovate or ovoid, obtuse, appressed tips with resin gland on center of leaf, 0.7–1.0 mm. long, margins finely toothed, green; female cones with soft, fleshy pulp, irregular and gibbous, reddish-brown, with a light coat of bloom, 7–8 mm. diameter; peduncles straight; seeds (2–)4–9(–11) per cone, subovoid, angular, with resin grooves, 3–4 mm. long, 2 mm. wide; hilum about one-half length of seed.

This species apparently has only a local distribution, and may be considered rare in México.

Distribution: At El Puerto de las Víboras, Bosques de San Francisco, Pueblo Nuevo, Durango at 2670 m. in the pine-oak forest of the Sierra Madre Occidental (Martínez).

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1946); and in the pine-oak-juniper forest at 1335–1600 m. on the hills at Cuale, Jalisco, México (Fig. 4).

Specimens Examined:

México: Durango: Pueblo Nuevo, Martínez 12013 A (DS, RSA). Jalisco: S side of Cuale, ~~municipio~~ Talpa de Allende, Zanoni 2540 (CS); Gonzalez in January 1945 (MEXU); Gonzalez 7009 (MEXU); Martinez 10520 (A, BH, DS, F, MO, NY, UC).

11. *Juniperus monosperma* (Engelm.) Sarg., cedro, one-seed juniper.

Shrub or tree in protected sites (to 18 m.) and to 50 cm. diameter, stem branching at or below ground level, stem fluted and buttressed; stem bark thin, light gray, reddish to brown beneath, ridged fibrous flat strips; terminal whip branches ascending to erect, ashy-white peeling bark; foliage coarse and sharp-tipped; whip leaves, with gland three quarters length of lf., adaxial surface distinctly white glaucous; scale leaves 1–3 mm. long, ovate, acute to acuminate, green, margins finely toothed; female cone with soft juicy pulp, globose to ovoid, 4–8 mm. long, dark reddish-purple with heavy white bloom, appearing light blue; seeds 1 (rarely 2 or 3) per cone; pale chocolate brown, broadly ovate, acute to obtuse; hilum about one-third length of seed, light tan.

11a. *Juniperus monosperma* (Engelmann) Sargent var. *monosperma*, Silva N.

Amer. 10:38. 1896; *J. occidentalis* var. *B. monosperma* Engelmann, Trans. Acad. Sci. St. Louis 3:590. 1877. *Type*: United States: Colorado: Fremont County: Canon City, (collector?) (Holotype: MO); *Sabina monosperma* (Engelmann) Rydberg, Bull. Torrey Bot. Club 32:598. 1904; *J. mexicana* var. *monosperma* (Engelmann) Cory, Rhodora 38:183. 1936.

J. occidentalis var. (c) *gymnocarpa* Lemmon, Handb. West-Amer. Cone Bearers ed. 3, 80. 1895. *Type*: none designated; *J. monosperma* f. *gymnocarpa* (Lemmon) Rehder, J. Arnold Arboretum 7:239. 1926; *J. gymnocarpa* (Lemmon) Cory in part, Rhodora 38:184. 1936.

Ultimate twigs 6–8(–12) mm. long, 1.5–2 mm. wide, angle of branching of ultimate twigs about 50 degrees.

J. monosperma var. *monosperma* has been reported from s. Arizona (s. of the Mogollon Rim) and in n. México (Sonora, Chihuahua, Durango, Coahuila, Zacatecas, Nuevo Leon, San Luis Potosi, and Tamaulipas). Our field observations and chemotaxonomic

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investigations (Adams, 1972; Adams, 1976b; Zanoni and Adams, 1975a and 1976a) have shown that the junipers are *J. erythrocarpa*, *J. pinchotii*, and *J. monosperma* var. *gracilis*. We have not seen herbarium specimens nor observed live plants from México that are *J. monosperma* var. *monosperma*.

Distribution: In grasslands and open pine-oak forests at (1100-)1600-2100 m. elevation, often in dense, large populations, in s. central Colorado, into n. Arizona, New México, and w. and n. Texas, U.S.A.

Florin (1933) and Morton (1941) reviewed the occurrence of gymnocarpy (seeds exerted from the cone) in *Juniperus*. Our field observations indicate that gymnocarpy occurs on cones of any species of *Juniperus* in North America. Insect larvae infest the immature cones, causing abnormal development of seeds and cones, and the gymnocarpous condition. Usually, the seed will not contain a fully-developed endosperm and embryo. Cory (1936), in changing the status of *J. occidentalis* var. *gymnocarpa* Lemmon, included several species in his *J. gymnocarpa*. Lemmon (1895) stated that he observed the plants on the Sandia Mountains, near Albuquerque, New Mexico. These plants are referable to *J. monosperma*. Cory (1936) altered Lemmon's description to include plants from sw. Texas, New Mexico, Arizona, Utah, Nevada, Colorado, and México. Cory did not recognize the teratological nature of gymnocarpy in his specimens, and assumed it to be a valid characteristic. Subsequently he included inadvertently, plants that are now recognized as *J. erythrocarpa*, *J. pinchotii*, and possibly *J. osteosperma* in his *J. gymnocarpa*.

11b. *Juniperus monosperma* var. *gracilis* Mart., cedro, slender one-seed juniper.

Juniperus monosperma var. *gracilis* Martínez, Anal. Inst. Biol. México 17:111, 112, 1946. *Type:* México: San Luis Potosí: Hacienda de Angostura, Pringle 3771 (*Holotype*: not at MEXU; *Lectotype*: here designated, VT; *Isolectotypes*: ARIZ!, F!, GH!, MO!, NY!, UC!).

Ultimate twigs, 6-12 mm. long, 1-13 mm. diameter, usually very slender often with broader angle of branching of ultimate twig, about (50-)60-70 degrees, female cones oval and usually smaller.

Distribution: In grasslands, *Acacia* scrub, *Agave-Yucca*-*Opuntia*-*Juniperus* scrub, or pine woods, on gravelly or rocky limestone soils in the w. foothills of the Sierra Madre Oriental at 1050-2800 m. elevation. In e. Coahuila, s. Nuevo León, se. Tamaulipas, ne. Queretaro, and n. Hidalgo, México (Fig. 5).

Representative Specimens:

México: Coahuila: 2.5 miles W of Mineral Padilla, NE of Ocampo, Graber 147 (TEX).

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Hidalgo: 5 km. ESE of Cardonal, *González Q.* 3307 (ARIZ, DS, ENCB, MICH, MSC). Nuevo León: 15 miles SW of Pueblo Galeana in San Francisco Canyon, *Mueller* 290 (A, F, MICH, NY, TEX, US). San Luis Potosí: Tablas, *Rzedowski* 5836 (ENCB, TEX); Hacienda Angostura, *Pringle* 3771 (ARIZ, F, GH, MO, NY, UC). Tamaulipas: 4 km. S of Miquihuana, *González Q.* 3806 (DS, ENCB, MICH).

12. *Juniperus monticola* Mart., cedro; sabino; sabino de castillo (Pico de Orizaba, Vera Cruz); tláscal (Hidalgo); mountain juniper.

Low prostrate shrub to tree (to 10 m.), stems prostrate and tortuous to erect (in trees), crowns broad and flattened to broadly conic (in trees); stem bark 5–10 mm. thick, gray to grayish-brown, of fibrous, longitudinal strips; terminal whip branches spreading and tortuous to ascending, tips occasionally curved, bark reddish-brown to grayish-brown; angle of branching of ultimate twig 40–60 degrees, ultimate twigs subdistichous to distichous; scale leaves usually opposite, often thick and appearing as a string-of-beads on the ultimate twig, rounded or obtuse, appressed tips, 1.0–2.0 mm. long, margins finely denticulate, grayish-green to green, resin gland sometimes obvious on surface of leaf; female cones with soft, fleshy pulp, globose or gibbous, dark bluish-black, with a light coat of bloom, 5–9(–10) mm. diameter; peduncles usually curved; seeds (2–)3–7(–9) per cone, usually angular and grooved; hilum about 0.5 to 0.6 length of seed.

- 12a. *Juniperus monticola* Martínez f. *monticola*, Anal. Inst. Biol. México 17:79. 1946; *J. tetragona* Schlecht., Linnaea 12:495. 1838. *Type*: México: Hidalgo: Mineral del Monte, Eherenberg s. n. (*Holotype*: not found, probably lost or destroyed; *Lectotype*: here designated, MO!); *Sabina tetragona* (Schlecht.) Antoine, Cupress. —Gatt. 40. 1857.

Spreading shrub with tortuous branches to tree (to 10 m.); foliage not tightly compacted; angle of branching of ultimate twig 40–50 degrees; mature ultimate twigs 10–15(–20) mm. long.

Distribution: Mostly subalpine forests of oak-juniper, pine, or *Abies*, as understory shrub at 2400 m. elevation or higher, or at or above treeline on Nevado de Colima, Jalisco, in rocky crevices to 4300 m. elevation, México (Fig. 3).

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Representative Specimens:

México: Distrito Federal: La Cima station, Serjana de Ajusco, *Iltis, Koeppen, & Iltis* on 12–14 July, 1960 (TEX). Guerrero: Cerro Teotepec, Mpio. Tlacotepec, *Rzedowski* 18574 (MICH, TEX). Hidalgo: Real del Monte, *Martínez* 10523 (F, RSA), *Martínez* (BH, DS, MO). Jalisco: Nevado de Colima, *Gregory & Eiten* 300 (MICH, MO, SMU). México: Monte de las Cruces, *Martínez* 10523A (DS), *Martínez* 10524 (UC). Michoacan: Mt. Tancitaro, *Leavenworth & Hoogstral* 11634 (F, MO). Morelos: km. 42 on México-Cuernavaca road, *Reko & Halbinger* 65 (A).

12b. *Juniperus monticola* f. *compacta* Martínez, Anal. Inst. Biol. México 17:87. 1946; *Cupressus sabinooides* H.B.K., Nova Gen. et Sp. Pl. 2:3, 4. 1817. Type: México: Vera Cruz: Cofre de Perote, *Humboldt and Bonpland* s.n. (*Holotype*; P!); *J. mexicana* Sprengel, Syst. Veg. 3:909. 1826; *J. sabinooides* (H.B.K.) Nees, Linnaea 19:706. 1847; *J. sabinooides* Humboldt [erroneously attributed] in Lindley and Gordon, J. Hort. Soc. 5:202. 1850.

Shrubs prostrate with twisted branches forming mats (to 1 m. high); foliage very densely compacted; angle of branching of ultimate twig 50–60 degrees; mature ultimate twigs 5–10 mm. long.

Distribution: At edge of pine forest treeline (about 3000 m. elevation); or above treeline (alpine) in mountain grasslands of *Calamagrostis* and *Festuca*, usually in rocky crevices, or on rocky outcrops at 3000–4300 (–4500) m. elevation. On Sierra Mojada, Coahuila; Cerro Pelado and Ajusco, Distrito Federal; Nevado de Colima, Jalisco; Popocatepetl, Iztaccihuatl, Tlaloc, and Nevado de Toluca. México: Cerro Potosí, Nuevo León; Malinche, Tlaxcala; and Cofre de Perote, Vera Cruz, México (Fig. 3).

Representative Specimens:

México: Coahuila: Sierra Mojada, *M.E.J. [M. E. Jones]* 491 (MO, POM, RSA, US). Distrito Federal: Ajusco, *Beaman* 2807 (GH, MSC). Jalisco: Nevado de Colima, *Brizuela* on 27 Oct. 1967 (ENCB). México: above La Joya shelter, on Cerro Amaculecatl, *Iltis, Koeppen, Iltis* 1030 (MICH, MSC, TEX, UC). Nuevo León: Cerro Potosí, *Schneider* 963 (A, ARIZ, F, MICH, MO, NA). Tlaxcala: Malinche, *Beaman* 2248 (MICH). Vera Cruz: Cofre de Perote, *Martínez* 10524 (BH, F) and 10524b (MO, UC).

12c. *Juniperus monticola* f. *orizabensis* Martínez, Anal. Inst. Biol. México 17:91. 1946. Type: México: Vera Cruz: Pico de Orizaba, *I. de B.* 162 (*Holotype*; location not known; *Lectotype*: here designated, *Martínez* 8001, MEXU!).

Shrubs (to 1.5 m.) with twisted branches; foliage not tightly compacted; angle of branching of ultimate twig 55-60 degrees; mature ultimate twigs 20-40 mm. long.

Distribution: Alpine habitats at treeline and above treeline, in rocky crevices on Pico de Orizaba, Sierra Nevada, and Cofre de Perote, Vera Cruz; Peña Nevada, Tamaulipas at 3700-4500 m. elevation; also in oak forest near Mineral Catorce, San Luis Potosi at 2850 m. elevation, México (Fig. 3).

Specimens Examined:

México: San Luis Potosi: Puerto de Cedros, 3 km. E of Mineral de Catorce, Rzedowski 7270 (ENCB). Tamaulipas: Peña Nevada summit, Stanford, Lauber, & Taylor 2571 (DS, RSA). Vera Cruz: Cofre de Perote, Balls 4619 (A, US); Pico de Orizaba, Beaman 1756 (GH, MSC), Goforth 1 (CS), Stone 141 (PH), Beaman 2282 (GH, MSC, US), Martínez 10526 (MO, RSA, UC), Toucer in Sept. 1906 (F), Smith 488 (MO), Balls 4394 (A, UC, US), Liebmamn 14768 (F, UC), Purpus 3011 (F, MO, UC); Sierra Negra, [SW of Pico de Orizaba], Beaman 2519 (GH, MSC, UC).

13. *Juniperus pinchotii* Sudw., *Pinchot juniper*; redberry juniper.

Juniperus pinchotii Sudworth, Forest. & Irrig. 10:204. 1905. *Type:* United States: Texas: Randall County: Paloduro Canyon, Clothier in May, 1905 (*Holotype*: U.S. 1583659!); *Sabina pinchotii* (Sudworth) I. M. Lewis, Univ. Texas Bull. 22:44. 1915; *J. monosperma* var. *pinchottii* (Sudwoeth) Van Melle, Phytologia 4:29. 1952.

Large shrub to small shrubby tree (to 6 m.), usually multi-branched at base forming a broad shrub; bark thin, ashy-gray, long interconnected strips; branches stiff, erect to ascending, bark of long narrow scales; whip leaves with elongate, often ruptured glands, angle branching of ultimate twig, about 40-50(-60) degrees; scale leaves opposite or ternate, appressed, triangular-ovate, acute 1.5-2.5 mm. long, margins finely toothed, gland not protruding, yellowish-green; female cone with soft juicy resinous pulp, globose to ovoid, 6-8(-10) mm. long, bronze to dark reddish-brown with no bloom; seeds 1 (rarely 2) per cone, broadly ovate, acute, small ridges, brown; hilum scar about one-half length of seed. Stumps sprout after burning or cutting. Terminal shoots rapidly elongate after cutting or burning producing slender whips with sparse lateral growth.

J. erythrocarpa was frequently combined under *J. pinchotii*, however evidence (Adams, 1973, 1975; Zanoni and Adams, 1975, 1976) has indicated that the old usage of *J. pinchotii* includes two taxa—*J. erythrocarpa* and *J. pinchotii*.

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Distribution: In gravelly soils on rolling hills and in arroyos and canyons, on limestone or gypsum soils, often forming pure stands, or in pine-oak juniper forests (in Coahuila) at 1000-2000 m. elevation. In w. Oklahoma, w. central Texas, Trans-Pecos of Texas, se. New Mexico, U.S.A.; scattered localities in Coahuila, México (Fig. 5).

Specimen Examined:

México: Coahuila: at pass near Rancho Papa Lota, about 75 km. SSE of Boquillas, Adams 105 (CS); 6.5 miles from Rt. 57 on road to Los Lirios, Zanoni 2582 (CS).

14. *Juniperus saltillensis* M. T. Hall, *Saltillo juniper*.

Juniperus saltillensis M. T. Hall, Fieldiana, Bot. 34:45. 1971. *Type:* México: Coahuila: 18 mi. S of Saltillo on México Highway 57, Hall 66305-1 (*Holotype*: F!).

Broad shrub to small tree to about 7 m. high, trunk branching at or just above base; bark thick, light ashy-gray, longitudinally divided into narrow strips; branches erect or strict, terminal whips recurved at tips, bark gray smooth not peeling; angle of branching of ultimate twigs about 60 degrees; scale leaves mostly opposite on ultimate twig, triangular-ovate, tips appressed, obtuse to rounded, 0.5-1.5 mm. long, margins finely denticulate, usually with resin gland protruding like a bead on the dorsal surface, gland same color as older light grayish-green leaves; ovulate cone with soft juicy resinous pulp, slightly ellipsoid to globose, dark bluish-black with heavy white bloom appearing bright light blue, 4.5-8 mm. diameter; seeds mostly 1(-2, rarely 3) per cone, ovoid, obtuse, dark brown, 4-5 mm. long; hilum light brown to dark brown, one-third length of seed.

Distribution: At the edge of the *Bouteloua* grasslands and border of pine woodlands, and izotal at 1550-2900 m. elevation in the w. foothills and adjacent grasslands of Chihuahua, Coahuila, Zacatecas, and Nuevo León, México (Fig. 2). We have not been able to find *J. saltillensis* at Santa Eulalia, Chihuahua [now known as Aquiles Serdan] where Pringle collected specimens in 1886.

Specimens Examined:

México: Chihuahua: Santa Eulalia Mountains, Pringle 710 (A, F, MICH, MO, NA, NY, RSA, UC); 3 km. E of Rancho El Murciélagos, Sierra Grande, 29° 52' N x 104° 50' W, Johnston, Wendt & Chiang 11287 (LL). Coahuila: near Sierra del Pino on Highway 22 from Muzquiz to Boquillas, Adams 98 (CS); near Saltillo, Gregg 106 (G, MO);

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approx. 16 mi. E of Saltillo on Highway 57. *Spetzman* 1197 (NA); near El Chorro pass, approx. 12 mi. SE of Saltillo on Highway 57. *Zanoni* 2480 (CS); San Antonio, near Saltillo. *Gregg* 398 (MO); 11 miles S of Artega; *Kenoyer and Crum* 2749 (MICH); Parras, *Kenoyer and Crum* 3188 (MICH); Sierra de Parras. *Purpus* 1104 (F, G, MO, NY, POM); Sierra de Parras, *Johnston, Wendt, & Chiang* 11019 (LL); 9 km. S of Parras on Sierras Negras. *Stanford, Rutherford and Northcraft* 150 (DS, G, MO, NY, UC); 3.5 miles S of Agua Nueva, near Carneros Pass on Highway 54. *Zanoni* 2576 (CS). Nuevo León: near Tokio, E of Est. San Roberto, *Zanoni* 2462 (CS); 14 km. W of Tokio on San Roberto Galena Highway, *Johnston, Wendt, & Chiang* 11053 (LL); 11.8 miles E of Est. San Roberto on Highway 60. *Zanoni* 2791 (CS). Zacatecas: 4 miles SE of Mazapil. *Taylor* 5805 (OKLA); 20 miles SW of Concepcion del Oro near Picacho de las Bocas, *Shreve* 9374 (ARIZ, G, NA, UC); Picacho de Rocamontes, at the Zacatecas-Coahuila stateline, *Johnston, Wendt, & Chiang* 10493 (LL); 4 km. E of Salaverna, *Johnston, Wendt, & Chiang* 10474 (LL).

15. *Juniperus scopulorum* Sargent, sabino (Sonora); *Rocky Mountain juniper*, red-cedar, river juniper.

Juniperus scopulorum Sargent, Gard. & Forest 10:420. 1897. *Type*: not designated by Sargent. *Lectotype*: Wyoming: Yellowstone National Park: Mammoth Hot Springs. C. S. Sargent on July 8, 1896 (A!), *nomen provisorium*; *J. scopulorum* Sargent, Silva N. Amer. 14:93. 1902; *J. virginiana* var. *scopulorum* (Sargent) Lemmon, Handb. West-Amer. Cone-Bearers ed. 4, 114. 1900. *Sabina scopulorum* (Sargent) Rydberg, Bull. Torrey Bot. Club 32:598. 1904. *Sabina scopulorum* (Sargent) Lewis, Univ. Texas Bull. 22:1915.

J. excelsa sensu Pursh, Fl. Amer. Sept. 2:647. 1814. *Type*: United States: "on the banks of the waters of the Rocky-mountains", [Missouri River, South Dakota] M. Lewis in 1805 (*Holotype*: Amer. Philosophical Society, at PH!); *J. foetida* E. *excelsa* (Bieberstein) Spach in part, Ann. Sci. Nat. ser. 2, 16:297. 1841; *non J. excelsa* Bieberstein, Fl. Taur.-Cauc. 2:245. 1808.

J. occidentalis var. *a pleiosperma* Engelmann, Trans. Acad. Sci. St. Louis 3:590. 1877. (based on *J. excelsa sensu* Pursh and *J. andina* Nuttall).

J. scopulorum var. *patens* Fassett, Bull. Torrey Bot. Club 72:46. 1945. *Type*: United States: Wyoming: Big Horn Country: between the Big Horn River and the Big Horn Mountains, E. of Lovell, Fassett 22062 (*Holotype*: WIS); X. *J. fassettii* Boivin, Naturaliste Canad. 93:372. 1966.

J. scopulorum var. *columnaris* Fassett, Bull. Torrey Bot. Club 72:482. 1945. *Type*:

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United States: North Dakota: Slope County: bottom of deep gully, edge of pine region, Amidon, O. A. Stevens 504 (*Holotype*: NDA). *J. scopulorum* f. *columnaris* (Fassett) Rehder, Bibliog. Cult. Trees & Shrubs 63, 1949.

Single-stemmed trees (to 12 m.) or shrubby tree branched near base, forming a broadly conic or globose crown; bark thin, reddish-brown, furrowed into strips or quadrangular plates; branches spreading-ascending or drooping and flaccid, bark smooth or peeling; angle of branching or ultimate twig 35–5 degrees; scale leaves opposite, not imbricate, appressed acuminate tips, ovate to ovate elliptic, 1.5–2 mm. long, margins entire, glaucous pale gray-green to dark green; female cones mature in 2 years, with soft juicy resinous pulp, globose (or occasionally bilobed), dark bluish-black with heavy bloom appearing light blue, (4–)5.5–6.5(–9) mm. diameter; seeds per cone, light brown deep resin pits, hilum about one-third to one-half length of seed.

Distribution: British Columbia, Alberta, and Washington, s. to Sonora, Chihuahua, and nw. Coahuila, in rocky areas in canyons and breaks, and along stream edges, in pure stands and with pine (and oak) from sea level (in British Columbia) to 2700 m. elevation (Fig. 2).

Specimens Examined:

México: Chihuahua: Soldier canyon in Sierra Madre, M. E. Jones on 16 Sept. 1903 (PH, POM, RSA); gorge of Rio Gavilan, 1 mi. SE of Gavilancito, J. T. Marshall, Jr. 38 (ARIZ, RSA, UC); near Colonia Garcia, Townsend and Barber 370 (A. F., GH, MO). Coahuila: Cañon El Bonito, Rancho El Bonito, Serranías del Burro, Mpio. Zaragoza, Riskind & Patterson 1933 (CS); Riskind & Patterson 1940 (CS); Riskind & Patterson 1952 (CS). Sonora: Huchuerachi, Hartman 309 (PH); Sierra de los Ajos, J. T. Marshall, Jr. 78 (ARIZ, TEX); Maicoba, Pennington 101 (TEX).

16. *Juniperus standleyi* Steyermark, cipres; cipres enano; chancol, huitó, huitun, si-kop (Huehuetenango, Guatemala), *Standley juniper*.

Juniperus standleyi Steyermark, Field Mus. Nat. Hist., Bot. Ser. 23: 3, 1943. *Type:* Guatemala: San Marcos: Volcán Tacana, Steyermark 36137 (*Holotype*: F!; *Isotype*: F!). MO,

Prostrate shrub, shrub to tree (0.3–15 m.), branches spreading-ascending; main stem often contorted, crown irregularly shaped; stem bark of longitudinal,

interconnected strips; terminal whips broadly-spreading to ascending, tip of whip branches usually straight, reddish-brown; angle of branching of ultimate twig 40–50 degrees; scale leaves opposite or ternate, ovate to broadly ovate, with rounded or obtuse appressed tips, 1.5–2.0 mm. long, margin finely toothed, yellowish to dark green, resin gland at base of scale leaf; female cones with soft, fleshy pulp, ovoid-conic or irregular, dark blue, with a light coat of bloom, 7–9 mm. diameter, on short, curved peduncles; seeds 3–5(–6) per cone, 4–5 mm. long, 2.5–3.7 mm. wide, subconic, grooved, dark brown; hilum about two-thirds length of seed.

Distribution: Above timberline near the summit of Volcán Tacaná in Chiapas, México and Depto. San Marcos, Guatemala; in pine and pine-juniper forests on moist slopes and sheltered ravines, often on limestone, in the Sierra de los Cuchumatanes, Depto. Huehuetenango, Guatemala, at elevations of 3000 m. or higher (Fig. 3).

Specimens Examined:

México: Chiapas: Volcán Tacaná, Mac Dougall 15 Jan. 1938 (MEXU, NY); Martínez 12009 (MO); Matuda 2341 (F, GH, MICH, MO, NA, NY); Matuda 2359 (F); Matuda 2861 (F, GH, MEXU, MICH, MO, NA, NY). Guatemala: Huehuetenango: 25 km. N of Huehuetenango on road to Santa Eulalia, Hawksworth and Wiens 1225 (PPF); about 28 mi. from Huehuetenango on Cerro Chémal, Hawkes, Hjerting and Lester 1771 (F); between Paquix and San Miguel on road to San Juan Ixoy, Molina R. 21225 (F, NY); Molina R., Burger, and Wallenta 16566 (F, NY); Molina R., Burger, and Wallenta 16471 (F); Molina R., Burger, Wallenta 16487 (F, NY); Sharp 451024 (MEXU, TENN, UC); between Tojquia and Caxin bluff, Steyermark 50180 (F, NY); km. 311 on Ruta Nacional 9 N between Paquix and Chémal, Beaman 3021 (MSC, TEX, UC); near Chémal, Standley 81718 (F); Williams, Molina R. and Williams 22022 (F, NY); between Paquix and Todos Santos, Melhus and Goodman 3572 (F, OKL); near Todos Santos, Caec, et Ed. Seler 2628 (GH); between Chiantla and Todos Santos, Cook 42 (US); Cook 48 (US); near Tunimá, Steyermark 48406 (F, GH, NY); between first cumbre and La Pradera in Sierra de los Cuchumatanes, Standley 81146 (F); Standley 81151; Standley 81164; Sierra de los Cuchumatanes, Skutch 1236 (F, GH, NY); Lehmann 1594. San Marcos: Volcán Tacaná, Beaman 3212 (GH, MSC); Steyermark 36137 (F).

SUMMARY

The non-cultivated taxa of the genus *Juniperus* (Cupressaceae) which grow in México

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and Guatemala are described. A key to the individual taxa is included. Common names, ecological and geographical distributions, distribution maps, and taxonomic synonymy are also included. Sixteen species are listed for México; three of the same species are also in Guatemala.

RESUMEN

Los taxa silvestres del género *Juniperus* (Cupressaceae) que crecen en México y Guatemala son descritos y comentados. La clave para los taxa individuales es incluida. Nombres vulgares, distribuciones ecológicas y geográficas, mapas y sinonimia taxonómica están también incluidas. Diecisésis especies crecen en México, tres especies en Guatemala.

ACKNOWLEDGEMENTS

We thank the curators of the herbaria who loaned specimens for examination: J. Rzedowski, Instituto Politecnico Nacional, México; A. Gómez-Pompa, Universidad Nacional Autónoma de México; R. McVaugh, University of Michigan; Mrs. L. Saracino, Colorado State University Library; D. Reyes V., Compañía Maderera de Durango, El Salto; and Sra. Luz María Villareal de Puga, Universidad de Guadalajara.

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JUNIPERUS sect. **SABINA**

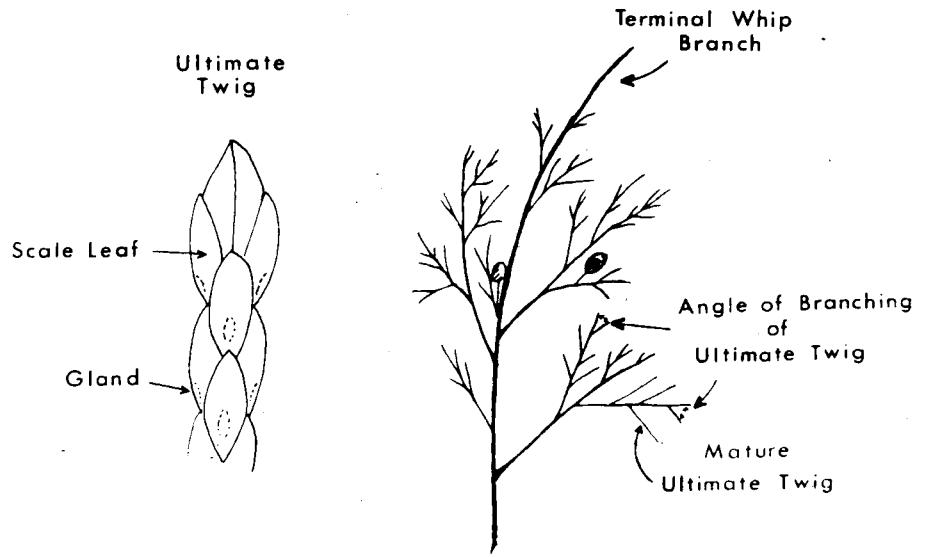


Fig. 1. Technical terms used in the identification of taxa of *Juniperus* section *Sabina*.

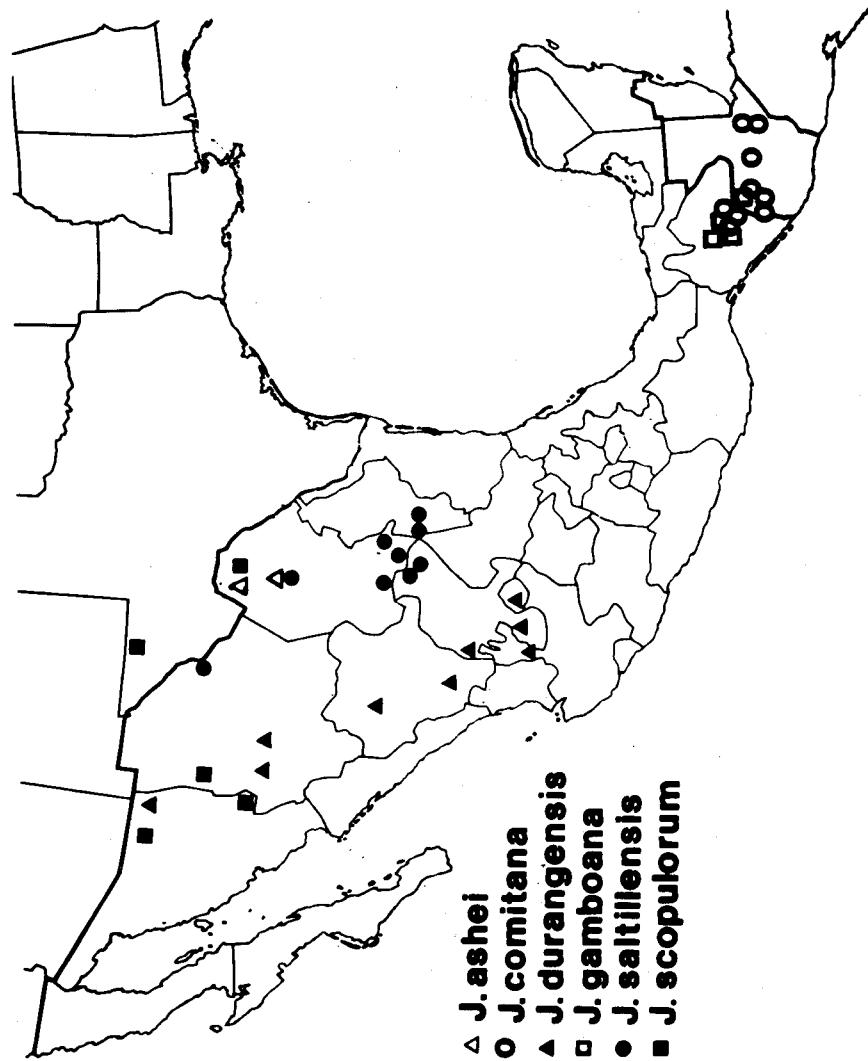


Fig. 2. Distribution of taxa of *Juniperus* in México and Guatemala.

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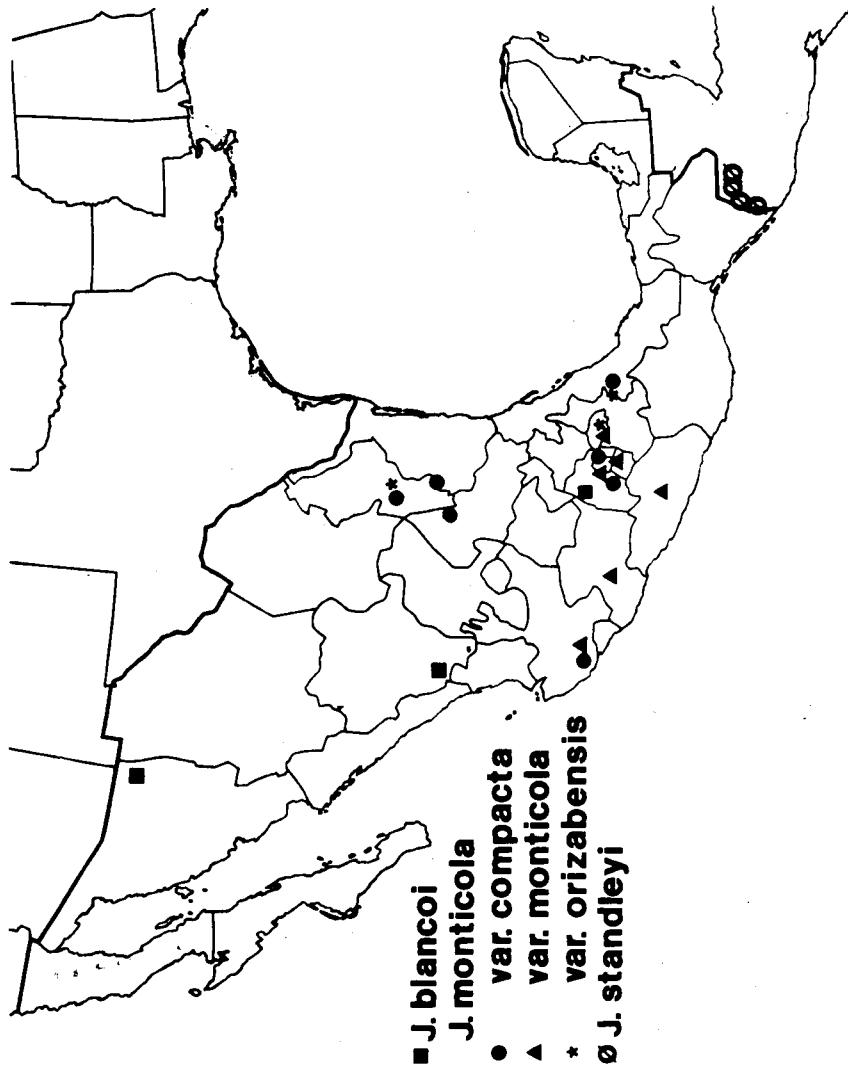


Fig. 3. Distribution of taxa of *Juniperus* in México and Guatemala.

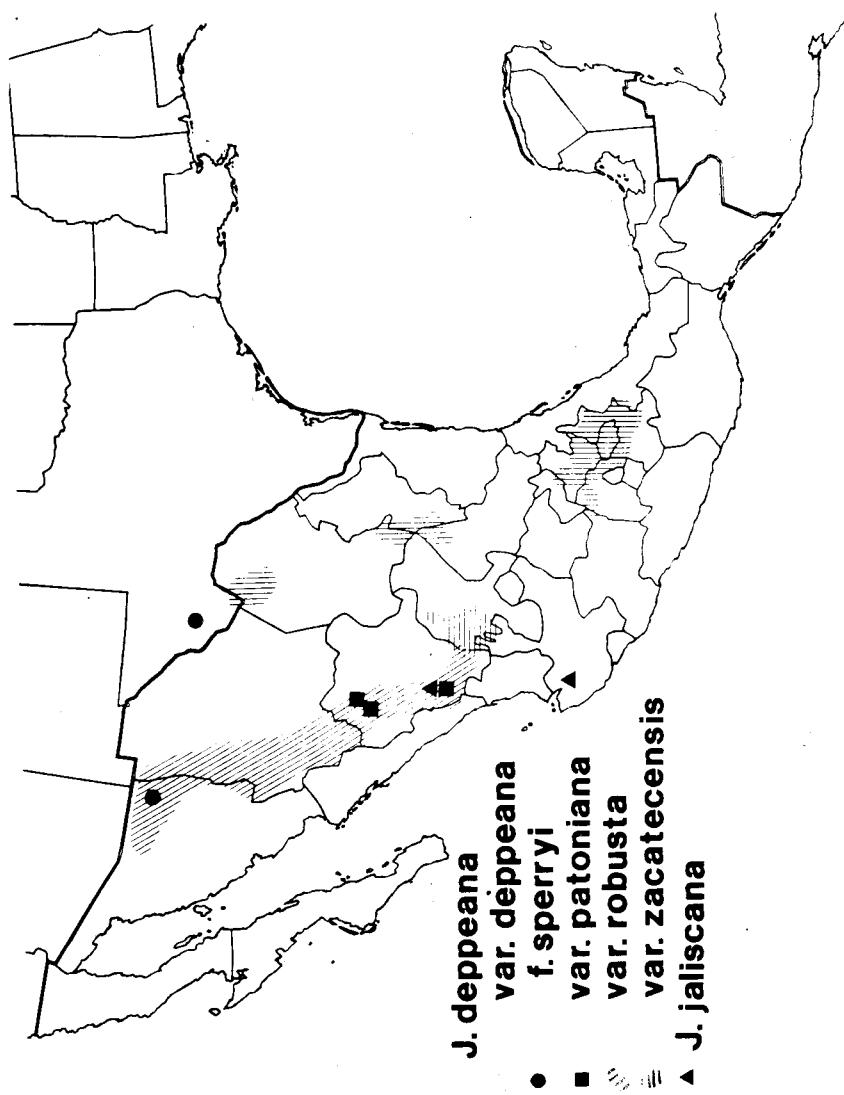


Fig. 4. Distribution of taxa of *Juniperus* in Mexico.

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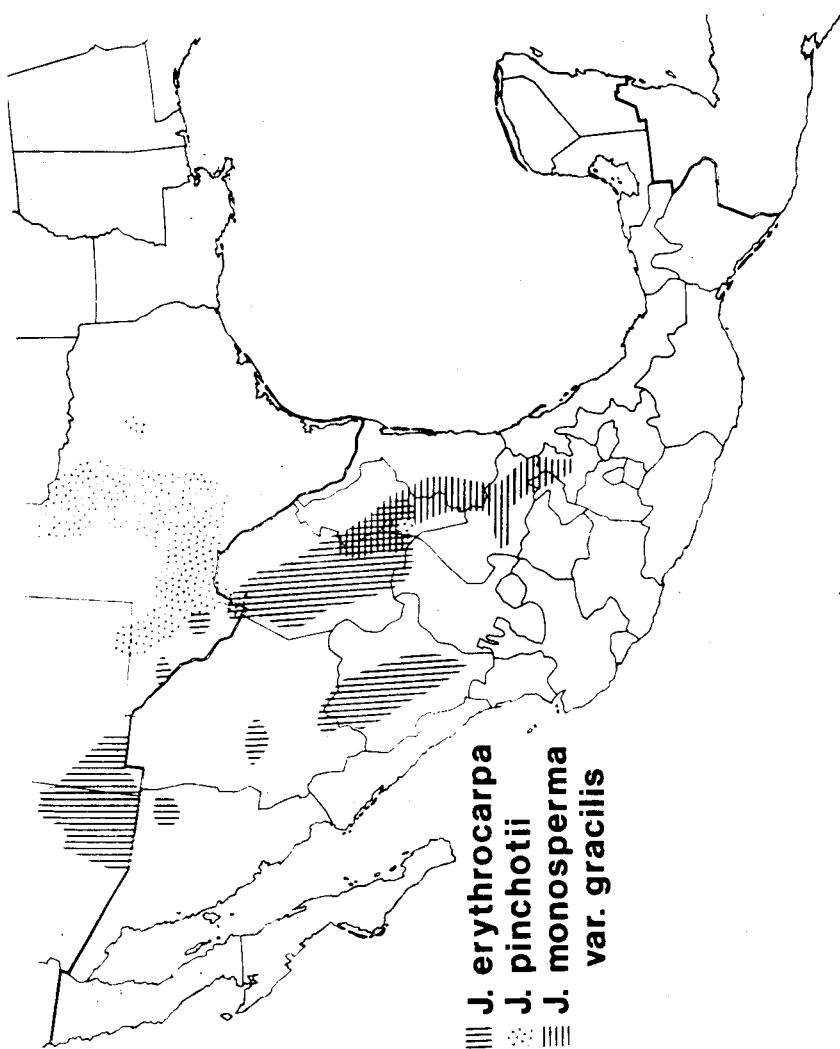


Fig. 5. Distribution of several *Juniperus* in Mexico and Guatemala.

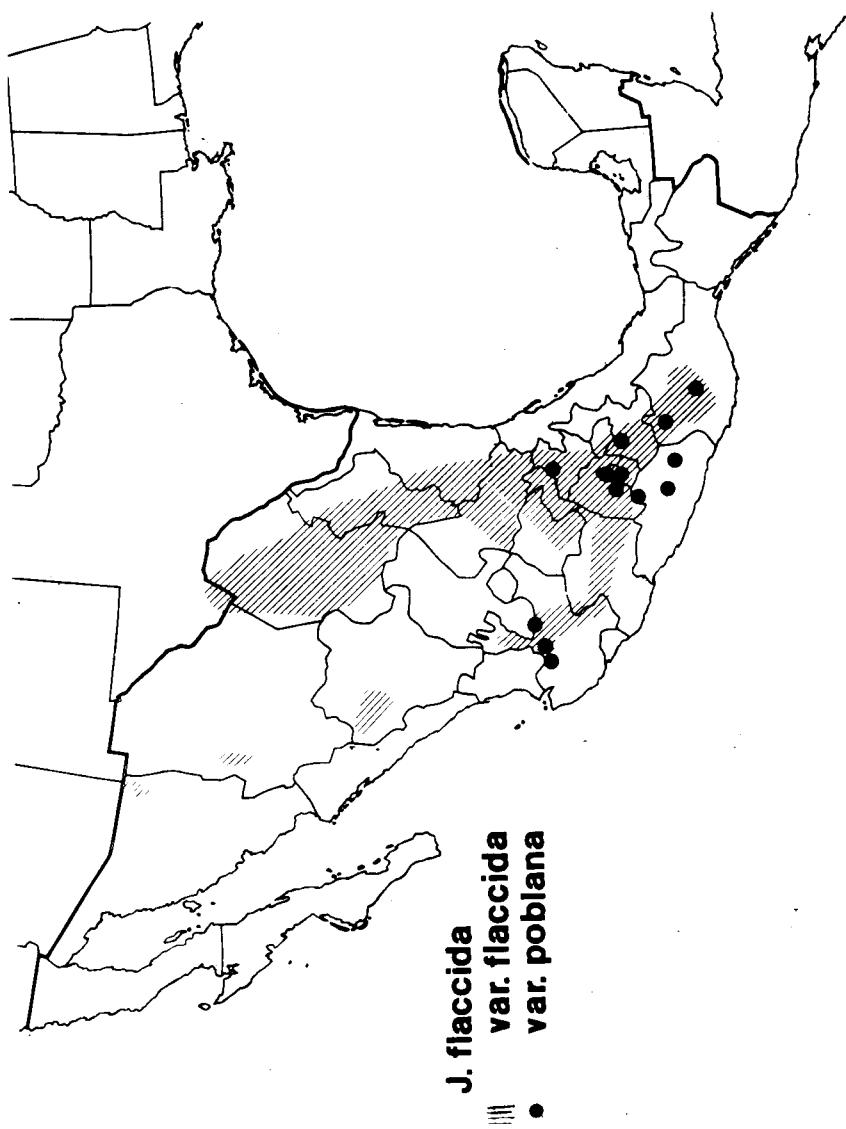


Fig. 6. Distribution of *Juniperus flaccida* vars. *flaccida* and *poblana*.

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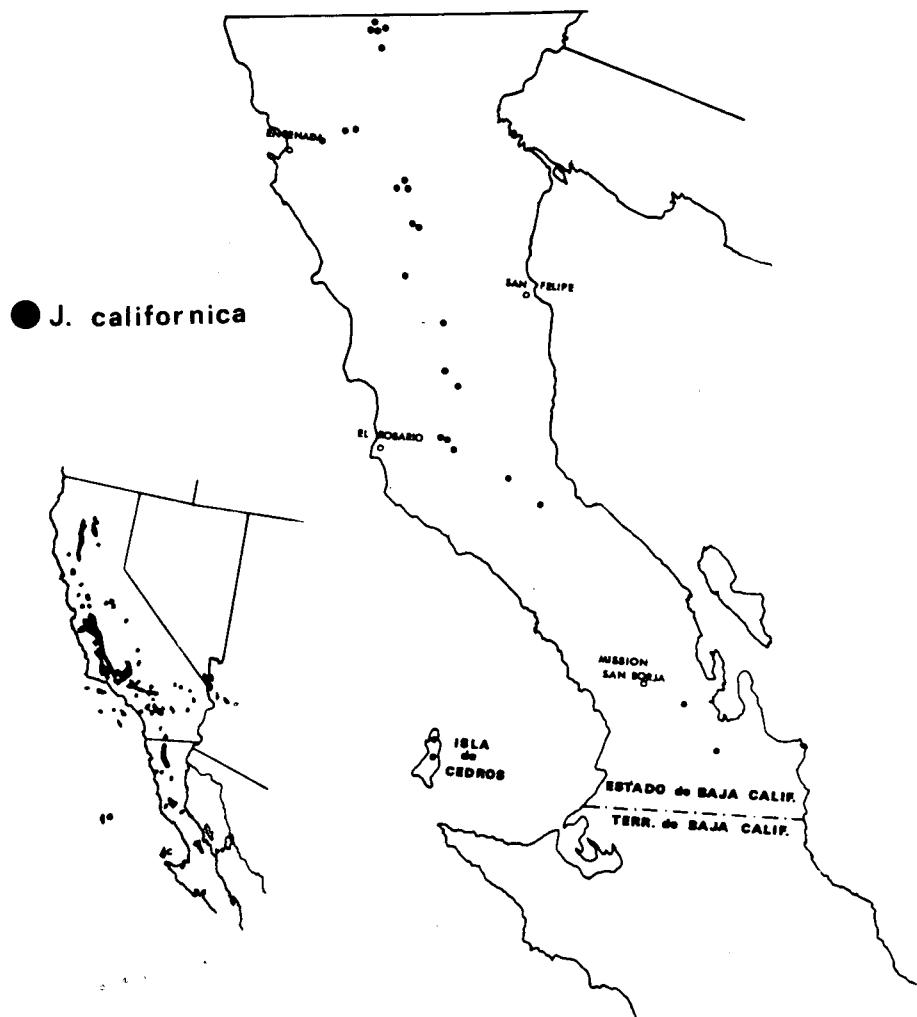


Fig. 7. Distribution of *Juniperus californica* in Baja California, México. Inset—distribution in North America, including Isla de Cedros (C) and Isla de Guadalupe (G), adapted from Little (1971).