

**JUNIPERUS OF CANADA AND THE UNITED STATES:
TAXONOMY, KEY AND DISTRIBUTION**

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ABSTRACT

The taxonomy of *Juniperus* of Canada and the United States is reviewed and keys to the taxa are presented as well as distribution maps. *Phytologia* 90(3): 255-314 (December, 2008).

KEY WORDS: *Juniperus*, Cupressaceae, taxonomy, keys, distribution, Canada, United States.

The genus *Juniperus* consists of approximately 70 species and 27 varieties (Adams, 2008). All the taxa grow in the northern hemisphere, except *J. procera* Hochst. ex Endl. which grows along the rift mountains in east Africa, thence into the southern hemisphere (Adams, Demeke and Abulfatih 1993), and some of the Mediterranean *Juniperus* species such as *J. oxycedrus* L., *J. phoenicea* L., and *J. thurifera* L. that grow in the mountains of the northernmost part of Africa (Morocco, Algeria).

Juniperus of Canada and the United States was treated in the Flora of North America (Adams, 1993) and more recently in the monograph of *Juniperus* (Adams, 2008). This paper is presented to update recent changes in nomenclature that have resulted from new information obtained from DNA sequencing.

Juniperus Linnaeus, Sp. pl. 1038. 1753. – Juniper, Cedar (the classical Latin name).

Perennial, evergreens, dioecious (or sometimes monoecious), prostrate to tall shrubs or trees; crowns strict (in young *J. virginiana*) to rounded or flat-topped (*J. virginiana* var. *silicicola*); branches variously oriented but not planar; bark reddish brown to gray, fibrous and exfoliating in strips, or rarely exfoliating in rectangular plates (*J.*

depeana). Twigs variously oriented, not flattened (not planar). Roots fibrous, often exposed along cracks in rocks. Leaves persisting 3-5 years, of four types: (1) subulate (acicular or awn-shaped); (2) decurrent-blade deciduous (with an abscission layer between the blade and sheath, sections *Caryocedrus* Endlicher and *Oxycedrus* Spach); (3) whip-leaves, (decurrent without an abscission layer between the blade and sheath, section *Sabina* Spach); and (4) scale leaves (section *Sabina* Spach). Whip-leaves are found on juvenile foliage and/or at the tips of rapidly growing shoots (but occasionally an entire mature tree will have only whip-leaves, and one species, endemic to Cuba, *J. saxicola*, has only whip-leaves). Scale leaves closely appressed, decussate or ternate, often both decussate and ternate on the same branch. Foliage from light to dark green, or often blue or silver-glaucous, turning reddish, to purple in some species in the winter. Leaf margins entire to denticulate (at 20—40 X). Stomatal bands on the adaxial surface of the leaves range from none (apparent) to one or two. All leaves have a single gland but it may not be visible, the glands vary from elongate to hemispherical (*J. ashei*), several species have ruptured glands that exude a white crystalline deposit. Seed cones maturing in 1 or 2 years, persisting for several months to a year after maturity depending on bird predation pressure. Seed cones axillary or terminal, sessile to short peduncled. Pollen cones oblong, 3-5 mm, light tan to brown. Seed cones globose and “berry-like”; 3-20 mm in dia., scales all fused, fleshy to fibrous to obscurely woody, indehiscent, blue-black, blue, rose, copper-red, brown, brownish-blue, purplish-brown, usually with a blue or glaucous hue. Seeds wingless, 1-13 per cone, light tan to brown, with two hilum scars covering from $\frac{1}{4}$ to $\frac{3}{4}$ of the seed. Cotyledons several to numerous.

The genus is the source of numerous cultivars that are widely used for landscaping around the world. Mutants or “sports” are very common and are likely due to single gene mutations. Rare mutations affecting the plant habit and foliage are present in all species. Many of the “sports” have been given formal names or else incorrectly ascribed to hybridization or introgression. Due to the widespread exaggerations of the degree of hybridization, this topic is discussed after each treatment. Gymnocarpy (bare seeds protruding from the cone) is occasionally found in most junipers, particularly in the SW United States. This condition is due to insect larvae (see Zanoni, 1978).

Finally, it should be noted that due to the aforementioned morphological mutations, aberrant specimens may be almost impossible to identify without chemical or molecular data.

At present, 16 species, 8 varieties, and 2 formas of *Juniperus* in Canada and the United States are recognized.

Key to *Juniperus* of Canada and the United States

- 1. Leaves all acicular (subulate, jointed at the base) and spreading; seed cones sessile, axillary; decumbent or rarely upright shrubs (in the western hemisphere).....**J. communis**
- 1. Leaves decurrent (not jointed at the base), both whip- and scale-like; seed cones terminal; trees or decumbent to upright shrubs.
 - 2. Whip- and scale-leaf margins entire (20 X) or with irregular teeth (40 X) and then with scale leaves with acuminate to mucronate tips and tan-brown to brownish purple seed cones.
 - 3. Whip- and scale-leaf margins with irregular teeth (40 X), scale leaves acuminate; seed cones (4-) 6-10 (-13) seeded, and tan-brown to brownish-purple; branches pendulous.....**J. flaccida**
 - 3. Whip- and scale-leaf margins smooth (entire) (40 X), scale leaves obtuse to acute to apiculate; seed cones 1-2(3) seeded, blue-black to brownish-blue when mature; branches not drooping (but ultimate branchlets are often flaccid).
 - 4. Prostrate to decumbent shrub; scale-leaves apiculate; both whip- and scale-leaves growing along the branchlets; peduncles generally curved.....**J. horizontalis**
 - 4. Tree with 1(2-3) stems and rounded, flattened, pyramidal, or strict crowns; scale-leaves obtuse to acute; whip-leaves growing only at branchlet tips (on mature trees); peduncles generally straight.
 - 5. Scale leaves not overlapping, or, if so, not by more than 1/5 the length, obtuse to acute; seed cones globose to reniform.....5a.
 - 5a. Twigs (3-5 mm dia.) with smooth bark, twigs (6-15 mm dia.) with bark exfoliating in plates, reddish-copper beneath; seed cones maturing in 2 yrs, most seed cones normal, rarely with exserted seeds.....**J. scopulorum**

- 5a. Twigs (3-5 mm dia.) with persistent dead whip-leaves, twigs (6-15 mm dia.) reddish-brown beneath; seed cones maturing in 1 yr. (14-16 mos.), often the seed cones with exserted (naked) seeds; Pacific northwest near the seaside in Georgia Straits and Puget Sound.....***J. maritima***
5. Scale leaves overlapping (more than 1/4 length) acute; twigs (3-5 mm dia.) with persistent dead whip-leaves, twigs (6-15 mm dia.) with bark not exfoliating in plates, or, if so, brownish beneath; seed cones maturing in 1 yr.....***J. virginiana***
2. Whip- and scale-leaf margins denticulate (20 X).
6. Seed cones with (3-) 4 - 5 (-6) seed, fibrous to obscurely woody, trunk bark exfoliating in square or quadrangular plates (except. in f. *sperryi* with bark that exfoliates in strips).....***J. deppeana***
6. Seed cones 1 - 2 (-3) seeded, fleshy to fibrous (when mature and fresh)
7. Scale leaves with a raised hemispherical gland, whip-leaves with raised hemispherical gland (var. *ashei*) or oval, raised gland (var. *ovata*), dark brownish-green on dark grayish-green mature leaf; angle of branching of ultimate twig 25-40 degrees, bark on branches with patches of white fungus.....***J. ashei***
7. Scale leaves without a raised hemispherical gland
8. Mature seed cones orange, reddish-orange, red, bronze, or reddish-brown, appearing pink or rose-color if covered with bloom.
9. Mature seed cones orange to red, with light bloom appearing pink or rose-colored; whip-leaf ventral side white-glaucous, glands on whip leaves visible, raised, elongated and divided (often 3 glands); often single stemmed shrub-trees with stocky, clumpy foliage.....9a.
- 9a. Shorter whip-leaf glands, half or less as long as the associated sheath.....***J. arizonica***
- 9a. Longer whip-leaf glands, more than half as long as the associated sheath.....***J. coahuilensis***

- 9. Mature seed cones copper to reddish-brown, with no bloom; whip leaf ventral side not white-glaucous, glands on whip-leaves visible, raised, oval, not divided; shrubs with elongated terminal whips ***J. pinchotii***
- 8. Mature seed cone dark blue, dark bluish-black to bluish-brown, with a light to heavy coat of bloom appearing light blue.
- 10. Glands on scale leaves visible (conspicuous) and ruptured.
- 11. Seed cones 7-10 mm long; maturing in 2 yrs., 2(3) seeded; bark on twigs (5-10 mm diam.) reddish and exfoliating in scales or flakes; single stemmed tree to 20 (-30)m, dioecious or monoecious..... 11a.
 - 11a. Trunk bark red-brown; seeds cones avg. 7.7 mm (5-9); approx. 95% of the plants dioecious, leaf glands usually not ruptured, if ruptured with clear to light yellow exudate..... ***J. grandis***
 - 11a. Trunk bark brown; seeds cones avg. 8.5 mm (7-10); approx. 50% of the plants dioecious, leaf glands ruptured with yellow exudate turning dark brown to black..... ***J. occidentalis***
- 11. Seed cones 6-10 mm long, maturing in 1 yr., 1 (-2) seeded, bark on trigs brown to ash, not exfoliating in scales or flakes, shrubs to small trees, mostly dioecious.
- 12. Seed cones with a fibrous to woody pericarp, (7-) 9-10 (-13) mm. diam., bluish-brown under glaucous, 1 (-2) seeded; dioecious (1.9% monoecious), branchlets approx. as wide as scale-leaf length; scale leaves closely appressed and generally flattened, branchlets terete ***J. californica***
- 12. Seed cones with a soft, juicy pericarp, 6-8 mm diam., reddish-blue to brownish-blue, globose to ovoid, scale-leaf glands barely visible not conspicuous, few (less than 1/5) of the whip-leaf glands with a white crystalline exudate (visible without a lens), ultimate twigs 1.3-1.5 mm wide..... ***J. monosperma***
- 10. Glands on scale leaves not conspicuous (embedded in the leaf, therefore not visible), plants monoecious, ultimate twigs 1.3-1.5 mm wide, seed cones bluish brown, very glaucous, 8-9 mm diam., 1-seeded ***J. osteosperma***

Juniperus arizonica R. P. Adams Phytologia 88(3): 306 (2006), Arizona juniper. Type: United States, Arizona, Yavapai, Co.: 72 km south of Flagstaff, 1160 m., *R. P. Adams 2132*, BAYLU

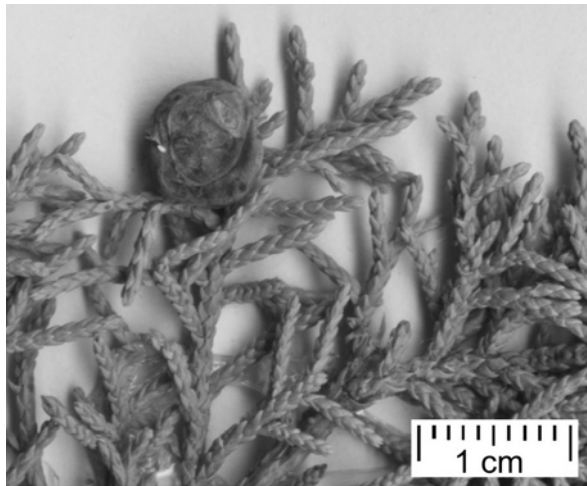
Juniperus coahuilensis (M. Martinez) Gaussen ex R.P. Adams var. *arizonica* R.P. Adams, Biochem. Syst. Ecol. 22 (7): 708 (1994).

J. erythrocarpa Cory (in part: New Mexico, Arizona)

J. pinchotii var. *erythrocarpa* (Cory) J. Silba

Diocious. **Trees** large shrub to small tree, 3-8 m, often with a single stem to 1 m, when shrubs branched at the base, with flattened-globular or irregular crowns. **Trunk bark** brown, thin, exfoliating in long ragged strips. **Branches** ascending to erect in shrubs, but spreading in trees. Branch bark scaly, ashy-gray. Stumps sprouting after burning or cutting. **Leaves** decurrent (whip) and scale. Whip- and scale-leaf margins denticulate (20 X), white glaucous on adaxial leaf surface. At least $\frac{1}{4}$ or more of the whip-leaf glands with a white crystalline exudate.

Seed cones rose to pinkish but yellow-orange, orange or dark red beneath the white-blue glaucous, soft and juicy, globose to ovate, 6-7 mm, 1(-2) seeded, the hilum scar pale brown, approx. $\frac{1}{2}$ as long as seed. **Seeds** 4-5 mm long. **Pollen shed** late fall to early winter.



Juniperus arizonica leaves and seed cone.

Habitat *Bouteloua* grasslands and adjacent rocky slopes; 980-1600 (-2200) m. **Uses** fence posts. Sprouts from cut stumps and is thus a pest in grasslands. **Dist.:** Arizona, South of the Mogollon Rim; and in southwestern New Mexico and northeastern Sonora, Mexico (Fig. 1). **Status:** abundant and weedy in areas. **Taxonomy:** Adams et al. (2006) recently reviewed the taxonomy and on the basis of combined nrDNA, trn-C-trn sequences data, plus RAPDs and terpenoids concluded that *J. coahuilensis* var. *arizonica* merited recognition as *J. arizonica*.

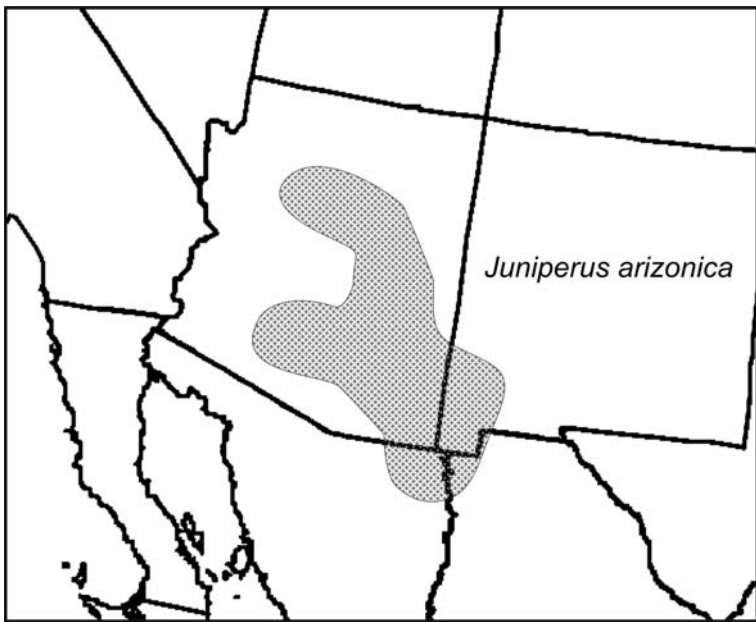


Figure 1. Distribution of *J. arizonica*.

***Juniperus ashei* Buch.**

Key to *J. ashei* varieties:

1. Whip-leaf glands hemispherical, scale-leaf glands hemispherical; female cones (8) 9 (10) mm in diameter; seeds 16-27 mm², 1 (avg. 1.01, rarely 2,) per cone. ***J. ashei* var. *ashei***
1. Whip leaf glands oval to elliptical; scale-leaf glands hemispherical, female cones (5) 6 (8) mm in diameter; seeds 13-16 mm², 2 (avg. 1.7), per cone.....***J. ashei* var. *ovata***

Juniperus ashei J. Buchholz. Bot. Gaz. (Crawfordsville) 90(3):329 (1930). Mountain cedar, rock cedar, post cedar, Mexican Junipers, Ashe juniper. Lectotype: NCU!

Cupressus sabinoides Kunth in Humboldt et al., Nov. Gen. Sp. Pl. 2: 3 (1817)

J. sabinoides (Kunth) Nees, Linnaea 19: 706 (1847), *non* Griseb. (1846)

J. sabinoides Sarg., Silva N. Amer. 10: 91 (1896), *non* Griseb. (1846)

J. sabinoides (H.B.K.) sensu Sargent *non* Nees

J. occidentalis Hook. var. *texana* Vasey, (Cat. Forest Trees U.S. 37) Rep. U.S. Dept. Agric. 1875: 185 (1876)

J. occidentalis Hook. var. *conjugens* Engelm., Trans. St. Louis Acad. Sci. 3: 590 (1878)

J. tetragona Moench var. *oligosperma* Engelm., Trans. St. Louis Acad. Sci. 3: 590 (1878)

Sabina sabinoides Small, Fl. S.E. United States: 33 (1903)

J. mexicana Sprengel in part, see Zanoni, 1978

Diocious. Trees with broad, bushy rounded or irregularly open crown, to 15 m, with a single trunk branching at 1-3 m or occasionally branching at the base. **Trunk bark** exfoliating in thin brown strips. **Branches** brown but usually with a grey-white fungus. **Leaves** both whip- and scale-like. Whip-leaves with a raised, hemispherical glands (not prominent on scale leaves). Whip- and scale-leaf margins denticulate (20 X). **Seed cones** ovoid to subglobose, maturing in one year, dark blue and glaucous, 6-9 mm in diam., 1(2-3) seeded. **Seeds** 4-6 mm long. **Chromosome number** 2n = 22 (Irving, 1980). **Pollen**

shed Dec. -Feb. **Habitat** Limestone glades and bluffs, 150-600 m. **Uses** source of Texas cedar wood oil (Adams, 1987), fence posts. **Dist.:** Ark., Okla., Tex.; N. Mexico. Maps: Adams, 2004 (amended Little, 1971, 21-E, W). **Status:** abundant on limestone in central/ west Texas, range is expanding, regarded as a weed in Texas. **Taxonomy:** see Adams (2007).

The type for *J. ashei* Buch. consisted of one male and three female specimens (Hall, 1954). To resolve this problem, Hall (1954) selected a female specimen (acc. number 22520, dated Sept. 16, 1923, UNC) and designated it as the lectotype. All of the material cited by Buchholz (1930) was collected on limestone bluffs, above the White River, near Sylamore, Arkansas. It is clear in Buchholz (1930) that his illustration is of *J. ashei* var. *ashei* with the hemispherical glands on the whip-leaves.

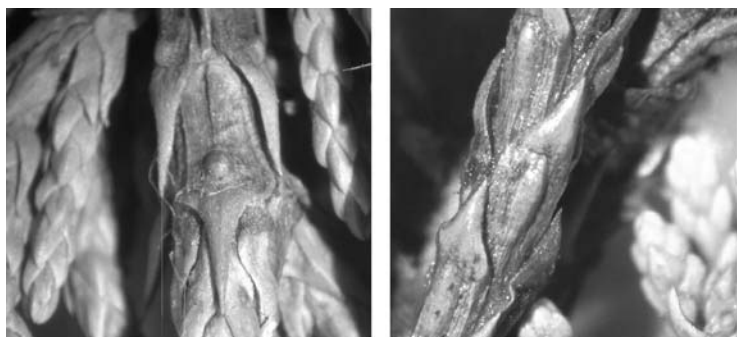
Juniperus ashei var. *ovata* R. P. Adams, Phytologia 89(1): 17 (2007), TYPE: U. S. A., Texas, Crockett Co., 5 km w. Ozona, 6 Dec. 1994, R. P. Adams 7463 (HOLOTYPE: BAYLU, PARATYPES: R. P. Adams 7664, 7465, 7466, 7467 (BAYLU).

This variety is similar to var. *ashei*, but instead of having hemispherical glands, the glands are oval to elongated on the whip-leaves. The var. *ovata* also has smaller cones, and more seeds per cone than var. *ashei*.

Other specimens examined: MEXICO, Coahuila, Adams 1066-1076. U.S.A., Texas, Crockett Co., Ozona, Adams 7424-42 (BAYLU), Coryell Co., TX, Adams 7463-82 (BAYLU).

The whip-leaf glands are illustrated in figure 2. Notice hemispherical glands on var. *ashei* (below) and the raised, oval to elongated glands on var. *ovata* (below). It should be noted that a few nearly hemispherical glands are present on whip-leaves of var. *ovata*. This is informative, as these characters can be used to distinguish var. *ovata* from var. *ashei*, yet exclude other nearby juniper species such as *J. monosperma*, *J. pinchotii* and *J. coahuilensis*. The distribution of the two varieties is shown in fig. 3. The area of possible sympatry in west

Texas and around New Braunfels is not well known and additional field collections are needed to define better their distributions in these areas.



1 mm *J. ashei* var. *ashei* 1 mm *J. ashei* var. *ovata*

Figure 2. Comparison of whip-leaf glands for *J. ashei* var. *ashei* and var. *ovata*.

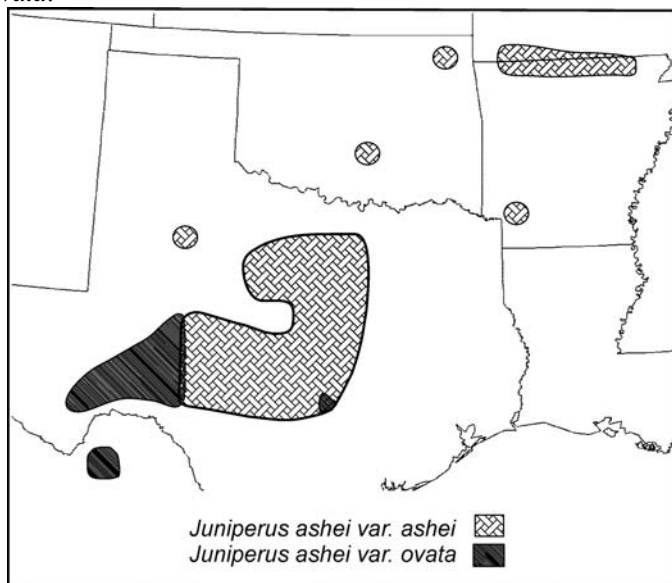


Figure 3. Distribution of *J. ashei* var. *ashei* and var. *ovata*.

Juniperus californica Carriere, Rev. Hort. Ser. 4, 3: 352 (1854).
California juniper. Holotype: P!

J. pyriformis Lindley A. Murray bis ex Lindl., Gard. Chron.
1855:420 (1855)

Sabina californica (Carriere) Antoine, Cupress.-Gatt.: 52 (1857)

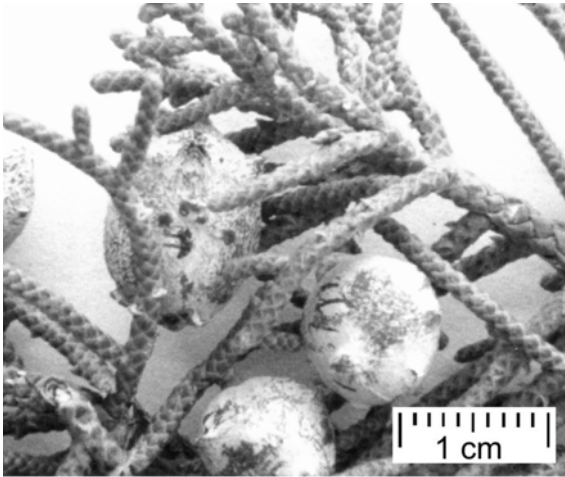
J. cedrosiana Kellogg, Hesperian 4:3 (1860)

J. cerrosianus Kellogg, Proc. Calif. Acad. Sci. 2:37 (1863)

J. californica Carriere f. *lutheyana* J. T. Howell & Twisselm., Four
Seasons 2(4): 16 (1968)

J. occidentalis sensu Parl. non W. J. Hooker

Dioecious (rarely monoecious, 1.9%). Shrubs multi- (seldom one) stemmed shrub-tree, 2-8 m, with round crown. **Trunk bark** on twigs (5-10 mm diam.) brown or gray, not exfoliating in scales or flakes. **Branches**, ultimate branchlets approx. as wide as scale-leaf length; scale leaves closely appressed and generally flattened, branchlets terete.



Juniperus californica leaves and seed cones.

Leaves both whip and scale. Leaf glands conspicuous. Whip- and scale-leaf margins denticulate (20 X). **Seed cones** bluish-brown, white glaucous, reddish-brown beneath glaucous, (7-) 9-10 (-13) mm. Maturing in 1 yr. **Seeds** 1(2-3) per cone (avg. 1.3), 5-7 mm long.

Pollen shed Jan. - March. **Habitat** Dry, rocky slopes and flats; 750-1600 m. **Uses** none known, possibly fence posts. **Dist.:** AZ, CA, NV; Baja California, Mexico (Fig. 4). **Status:** common and expanding its range.

Two chemical (volatile leaf oils) races were described by Vasek and Scora (1967) and reconfirmed by Adams, von Rudloff and Hogge (1983). These two chemo-types were not found using the volatile wood oils (Adams, 1987). To date, no morphological character appears to be correlated with the chemical races. It is noteworthy that analyses of the leaf volatile oils of all the other 40 taxa of *Juniperus* in the western hemisphere has failed to reveal any other species with chemical races.

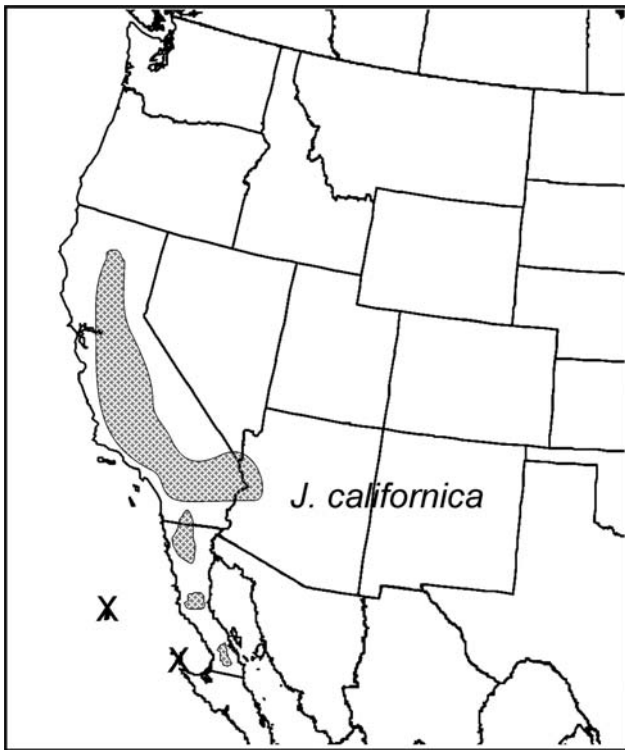


Figure 4. Distribution of *J. californica*. Xs denote outlying populations.

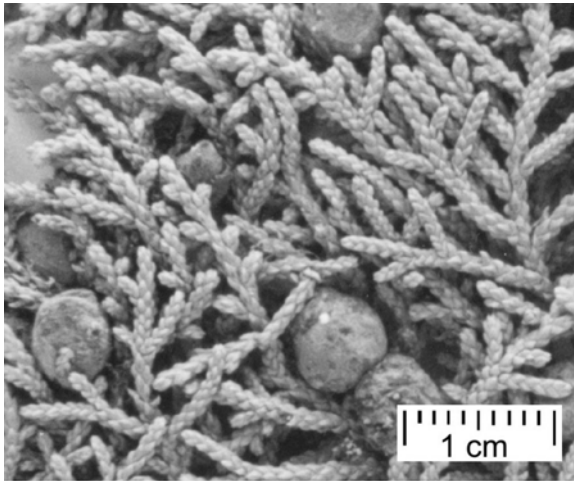
Juniperus coahuilensis (Martinez) Gausсен ex R. P. Adams
Phytologia 74: 450 (1993). Rose fruited juniper. Type: A!

J. erythrocarpa Cory. Rhodora 38:186 (1936)

J. erythrocarpa var. *coahuilensis* Martinez

J. pinchotii var. *erythrocarpa* (Cory) J. Silba

Dioecious. **Trees** large shrub to small tree, 3-8 m, often with a single stem to 1 m, when shrubs, branched at the base, with flattened-globular or irregular crowns. **Trunk bark** brown, thin, exfoliating in long ragged strips. **Branches** ascending to erect in shrubs, spreading in trees. Branch bark scaly, ashy-gray. Stumps sprouting after burning or cutting. **Leaves** both whip and scale. Whip- and scale-leaf margins denticulate (20 X), white-glaucous on adaxial leaf surface. At least ¼ or more of the whip-leaf glands with a white crystalline exudate. **Seed cones** rose to pinkish but yellow-orange, orange or dark red beneath the white-blue glaucous layer, soft and juicy, globose to ovate, 6-7 mm,



Juniperus coahuilensis leaves and seed cones.

1(-2) seeded, the hilum scar pale brown, approx. ½ as long as seed. **Seeds** 4-5 mm long. **Pollen shed** late fall - early winter. **Habitat** *Bouteloua* grasslands and adjacent rocky slopes. **Uses** fence posts. Sprouts from cut stumps and is thus a pest in grasslands. **Dist.:** 980-

1600 (-2200) m, trans-Pecos Texas, common in northern Mexico around the margins of the Chihuahuan Desert (Fig. 5). **Status:** abundant and increasing. Hybridization between *J. coahuilensis* and *J. monosperma* appears likely in Arizona (see *J. monosperma* above). Hybridization between *J. coahuilensis* and *J. pinchotii* occurs in the Big Bend Natl. Park, Brewster Co., Tex. (Adams and Kistler, 1991) and possibly near Saltillo, Mexico. Previous reports of hybridization with *J. ashei* (Hall et al., 1961) have been negated.

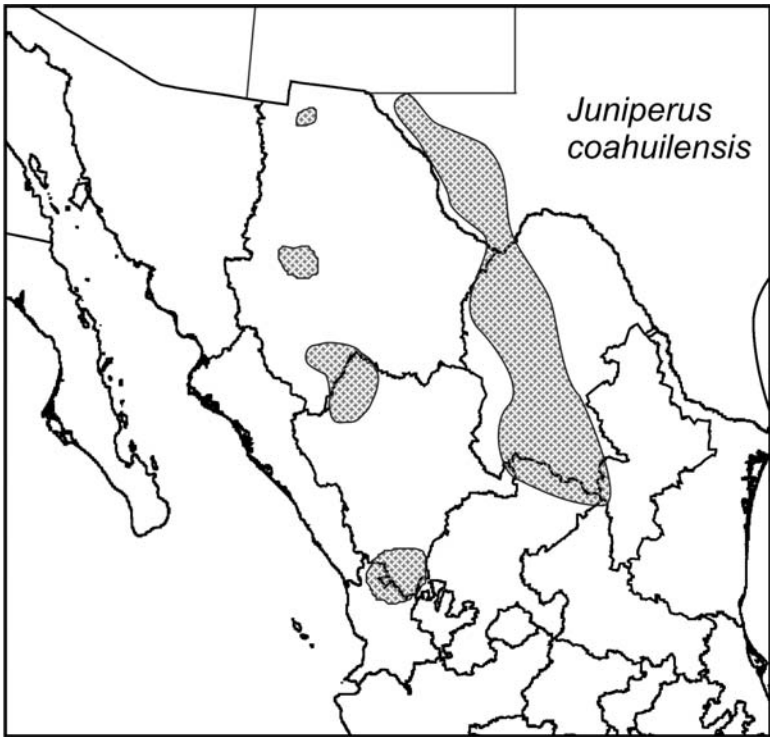


Figure 5. Distribution of *J. coahuilensis*.

Juniperus communis L., common juniper.

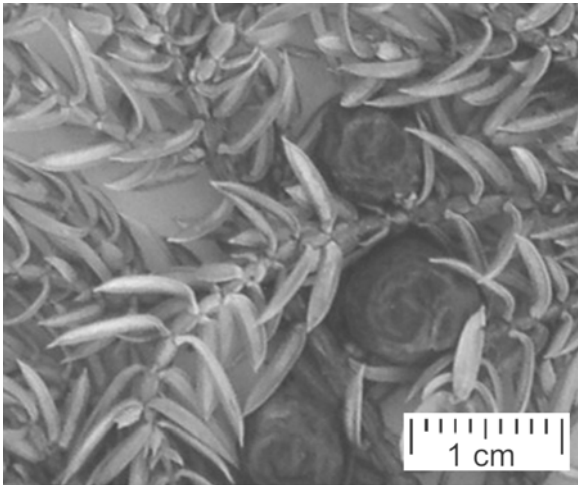
The taxonomy of *J. communis* in North America has recently been reviewed and revised based on morphology, RAPDs and nrDNA SNPs (Adams, 2008) and five varieties were recognized.

Key to *J. communis* varieties in North America:

- 1. Glaucons stomatal band twice (or more) as wide as each green leaf margin, spreading; mat-like shrub (or occasionally upright); leaves upright, sometimes almost imbricate, closely set, curved, 5 - 10 (12) mm long.....3.
- 1. Glaucons stomatal band about as wide to 1.5 x as wide as each green leaf margin; prostrate or low shrub with ascending branchlet tips (or occasionally a spreading shrub), leaves upturned, rarely spreading, linear to curved, 10-20+ mm long.....2.
- 2. Seed cones 6 – 9 mm diam., smaller than leaf length, North America.....var. **depressa**
- 2. Seed cones 10 – 13 mm diam., larger than leaf length, known only from southeastern Canada.....var. **megistocarpa**
- 3. Mature seed cones 8-9 mm diam., greater than leaf length, Endemic to Queen Charlotte Islands, grows in sphagnum bogs var. **charlottensis**
- 3. Coastal range of w. Canada and U. S., grows on serpentine, lava and other rock substrates, mature seed cones about a long as leaves.....4
- 4. Mature seed cones, elongated-subglobose stomatal band 3 to 4 times as wide as each green leaf margin.....var. **jackii**
- 4. Mature seed cones globose, stomatal band 2 times as wide as each green leaf margin.....var. **saxatilis**

Juniperus communis var. *charlottensis* R. P. Adams, Phytologia 90(2): 187 (2008). Queen Charlotte Island juniper. Type: Canada, Queen Charlotte Island, 9 km s of Masset, on hwy 16, in muskeg bog, 53° 55.511'N, 132° 06.471'W, 61m, 8-July-2007, R. P. Adams 10306 (holotype BAYLU!).

Dioecious. **Low shrubs** with upturned branchlets. **Trunk bark** brown, exfoliating in wide strips or plates. **Branches** spreading and upturned. **Leaves** acicular, imbricate to open, curved, boat shaped, tips apiculate to mucronate, 5 - 7 mm x 1.6 mm. Glauous stomatal band twice as wide as each green leaf margin. **Seed cones** 8-9 mm, larger than leaf length, dark blue when mature (2-3yrs). **Seeds** 1(2) per cone. **Pollen shed** spring. **Habitat** sphagnum bogs. **Uses** none known. **Dist.:** endemic to Queen Charlotte Island, Canada (Fig. 6). **Status:** At present, the habitat (sphagnum bogs) seems conserved, so it does not appear to be threatened nor endangered.



Juniperus communis var. *charlottensis* leaves and seed cones.

Juniperus communis var. *depressa* Pursh, Fl. Amer. Sept. 2: 646 (1814). Depressed juniper. Type: not located, (Coll. F. T. Pursh?), said to be from New York, and particularly in the province of Maine.

J. canadensis Lodd. ex Burgsd., Anleit. Sich. Erfzieh. Holzart. 2:124 (1787)

J. depressa Raf. ex M'Murtrie, Florula Louisville, 219 (1819)

J. depressa (Pursh) Raf., Med. Fl. 2:13 (1830)

J. communis L. var. *canadensis* (Lodd. ex Burgsd.) Loudon, Arbor. Frut. Brit. 4:249 (1838)

J. intermedia Schur. Verh. Mitth. Siebenburg. Vereins Naturwiss. Hermannstadt 2:169 (1851)

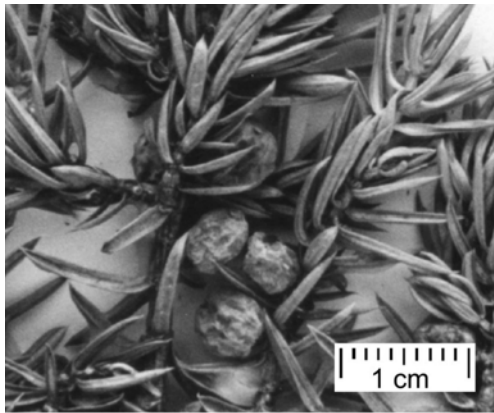
Sabina multiova Goodwyn, Amer. Botanist 37(4): 152 (1931)

J. communis L. subsp. *depressa* (Pursh) Franco in Bol. Soc. Broteriana Ser. 2, 36:117 (1962)

J. communis subsp. *depressa* (Pursh) E. Murray

Dioecious. Prostrate or low shrubs with ascending branchlet tips (or occasionally a spreading shrub to 3 m). **Trunk bark** brown, exfoliating in wide strips or plates. **Branches** erect to ascending. **Leaves** acicular, upturned, rarely spreading, linear, acuminate, tips acute to mucronate, to 15.0 x 1.6 mm. Glaucous stomatal band approx. as wide as each green leaf margin. **Seed cones** 6-9 mm, smaller than leaf length, dark blue when mature (2-3yrs).

Chromosome number $2n=22$ (Hall, Mukherjee and Crowley, 1979). **Seeds** 3 per cone. **Pollen shed** spring. **Habitat** Rocky soil, rocky slopes and summits, sea level to 2800 m due to latitudinal range. **Uses** none known. **Dist.:** common in mountains in United States and Canada (Fig. 6).



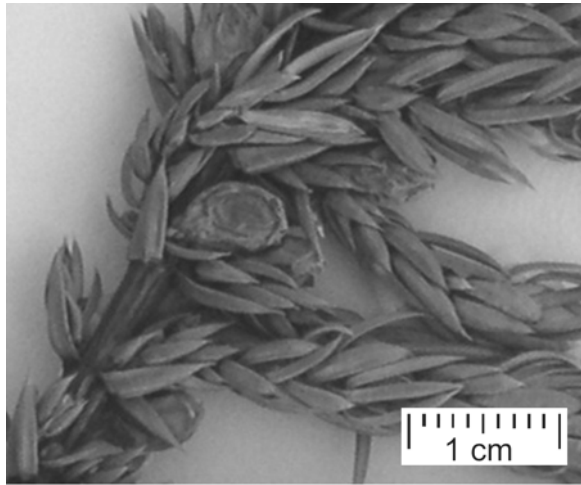
Juniperus communis var. *depressa* leaves and seed cones.

Status: common and expanding into disturbed areas. Not threatened.

Juniperus communis* var. *jackii Rehder, Mitt. Deutsch. Dendrol. Ges. 1907 (16): 70 (1907) Type locality: Siskiyou Mtns., on the road from Waldo, Oregon to Crescent City, CA, 3000 ft., 25 Aug., 1904, *J. G. Jack and Alfred Rehder*. Named after J. G. Jack.

Diocious. Prostrate shrubs to small shrubs. **Trunk bark** brown, exfoliating in wide strips or plates. **Branches** spreading. **Leaves** acicular, curved, tips apiculate to mucronate, 5 - 7 mm x 1.6 mm. Glaucous stomatal band 3 - 4 times as wide as each green leaf margin. **Seed cones** 6-7 mm, elongated-subglobose, dark blue when mature (2-3yrs). **Seeds** 1(2) per cone. **Pollen shed** spring. **Habitat** Serpentine rock and lava talus slopes. **Uses** none known. **Dist.:** Serpentine rock in nw CA, and lava talus slopes in Cascade Mtns., OR (Fig. 6).

Status: At present, the habitat (serpentine and lava talus slopes) seems conserved, so it does not appear to be threatened nor endangered.

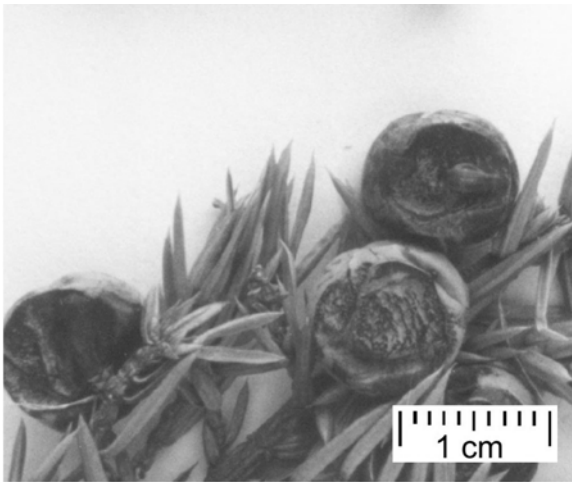


The type locality is on serpentine, but var. *jackii* also grows on high elevation lava (Mt. Hood, OR). *Juniperus communis* having short, curved leaves with a stomatal band about twice as wide as the green leaf margin, is found from n California to Alaska. Recent analysis of nrDNA SNPs (Adams, 2008) shows that the Siskiyou Mtns. and Mt. Hood populations are somewhat different from the other populations. In addition, the Queen Charlotte Islands plants that grow in a sphagnum bog show considerable differentiation.

Juniperus communis* var. *megistocarpa Fernald & H. St. John, Proc. Bos. Soc. Nat. Hist. 36: 58 (1921). Large fruited common juniper. Type: Canada, Quebec, Madeleine Islands, Alright Island, Narrows, *M. L. Fernald* (with *B. H. Long*) 6729 (holotype GH!).

Dioecious. Prostrate shrubs. Trunk bark cinnamon, exfoliating in wide strips or plates. **Branches** mostly prostrate on the ground. **Leaves** acicular, boat-shaped, curved, 7 – 10 mm, stomatal band 1.5 x as wide as green leaf margins. **Seed cones** very glaucous, purple-blue, mature in 2 yrs., 9-13 mm, larger than leaf length, dark blue when mature (2-3yrs). **Seeds** 1 – 3 per cone. **Pollen shed** spring? **Habitat** sand dunes, serpentine and limestone barrens; 0-500 m. **Uses** none known. **Dist.:** Newfoundland, N.S.: Sable Isl., Que.: Magdalene Isl. (Fig. 7). **Status:** this is a very restricted taxon and can easily become threatened.

This is the most distinct variety of *J. communis*, especially in its seed cones, habitat, and DNA fingerprints, yet it appears to be of only recent (Pleistocene) origin (Adams et al., 2003).



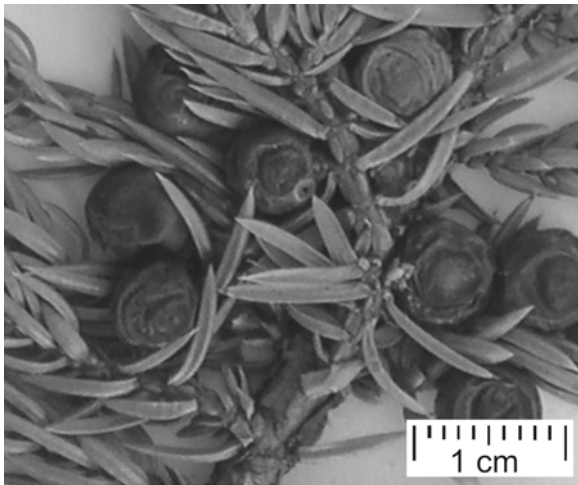
Juniperus communis var. *megistocarpa* leaves and seed cones.

Juniperus communis* var. *saxatilis Pall., Fl. Ross. 1 (2): 12 (1789).
Rocky juniper Type: none, Lectotype K, Illustration in Pallas, Fl. Rossica 1(2): 12, t. 54 (1789), designated by Farjon (2005).

- J. sibirica* Burgsd., Anleit. Sich. Erzieh. Holzart. 2:124 (1787)
J. nana Willd., Berl. Baumz.: 159, *nom. nud.* (1796)
J. communis L. var. *montana* Aiton, Hort. Kew 3:413 (1789)
J. communis L. var. *alpina* Suter, Fl. Helvet. 2:292 (1802)
J. oblonga M.-Bieb., Fl. Taur.-Cauc. 2:426 (1808)
J. communis L. var. *nana* (Willd.) Baumg. Enum. Stirp. Transsilv. 2:308 (1816)
J. alpina S. F. Gray, Nat. Air. Brit. Pl. 2: 226 (1821)
J. communis L. var. *oblonga* (M.-Bieb.) Parl. in Candolle, Prodr. 16 (2): 479 (1868), *non* Loudon (1838)
J. communis L. var. *caucasica* Endl., Syn. Conif.: 16 (1847)
J. nana Willd. var. *alpina* (Aiton) Endl., Syn. Conif.: 14 (1847)
J. pygmaea K. Koch, Linnaea 22:302 (1849)
J. montana (Aiton) Lindl. & Gordon, J. Hort. Soc. London 5:200 (1850)
J. caesia Regel. Gartenflora 6:346 (1857), *non* Carriere (1855)
J. communis L. subsp. *alpina* (Suter) Celak., Prodr. Fl. Bohmen: 17 (1867)
J. communis L. subsp. *nana* (Willd.) Syme in Sowerby, Engl. Bot., ed. 3, 8:275, t. 1383 (1868)
J. communis subsp. *alpina* (Smith) Celakovsky (1869)
J. sibirica Burgsd. var. *montana* (Aiton) Beck, Blatt. Verein. Landesk. Niederosterreichs 1890: 78 (1890)
J. rebunensis Kudo & Suzaki, Med. Pl. Hokaido, No. 6, t.6 (1920)
J. communis L. subsp. *oblonga* (M.-Bieb.) Galushko, Mat. Izuchenya Stavrop. Kraya 2-3:165 (1950)
J. communis L. subsp. *saxatilis* (Pall.) E. Murray, Kalmia 12:21 (1982)
J. communis L. subsp. *pygmaea* (K. Koch) Imkhan., Novosti SIsT. Vyssh. Rast. 27: 10 (1990)

Dioecious. **Shrubs** procumbent, to 70 cm. **Trunk bark** thin, cinnamon, exfoliating in wide strips. **Branches** procumbent, densely

arranged, 3-angled, thick, ca. 2 mm in diam. **Leaves** acicular, in whorls of 3, ascending, lanceolate or linear, usually subfalcate, 4-10 x 1-2 mm, slightly concave adaxially with a single white stomatal band broader than green marginal bands, keeled abaxially, base jointed, not decurrent. **Seed cones** brownish black when ripe, glaucous, globose or subglobose, 4-7 mm in diam. **Seeds** 1-3 per cone, 3-4 mm, dark blue when mature (2-3yrs). **Pollen shed** late spring. **Habitat** rocky areas. **Uses** seed cones ('berries') used to flavor gin. **Dist.:** nw US, w Canada (Fig. 6), also in the e. hemisphere (Europe and Asia). **Status:** this taxon is widespread so it seems robust.



Juniperus communis var. *saxatilis* leaves and seed cones from Redfish Lake, Idaho, USA, cf *Adams 10890*.

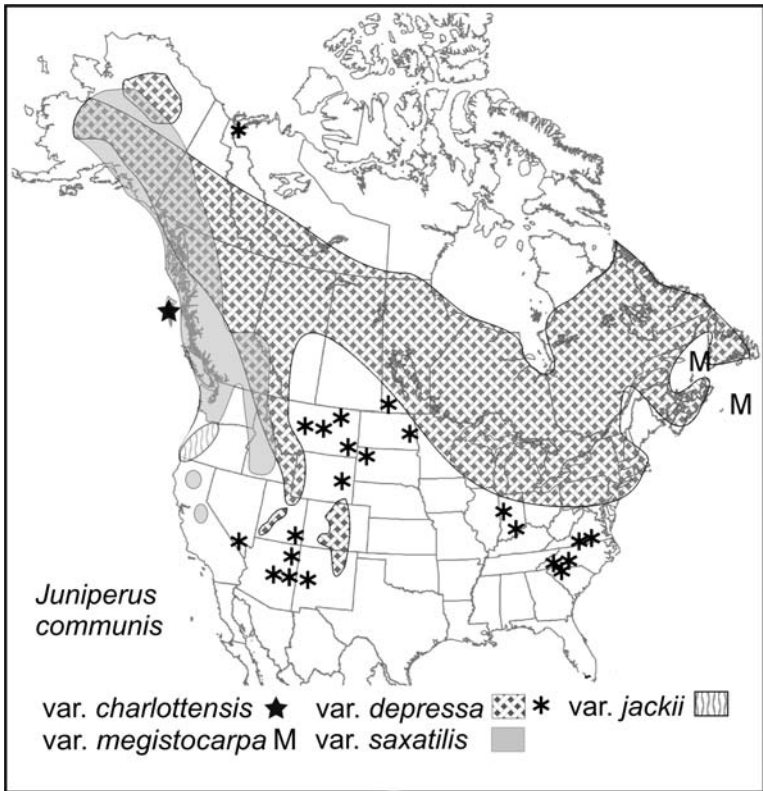


Figure 6. Distribution of *J. communis* in North America.

Juniperus deppeana Steudel, alligator bark juniper

Adams et al. (2007) show (Fig. 7) that there is some differentiation between populations of var. *deppeana* from Arizona and New Mexico and those from the Chisos and Davis Mtns. of Trans-Pecos Texas, but not sufficient to warrant formal recognition.

Juniperus deppeana grows in montane areas in the southwestern United States and Mexico (Fig. 8).

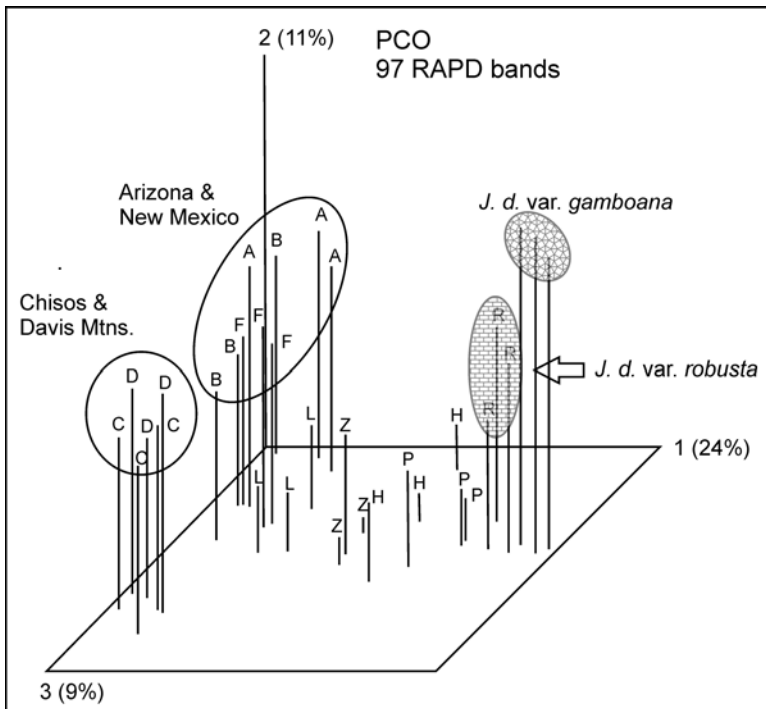


Figure 7. PCO of *J. deppeana* varieties, from Adams et al. (2007). The first principal coordinate separates var. *gamboana* and var. *robusta* from the other *J. deppeana* varieties. Notice some separation between the Arizona - New Mexico and Chisos - Davis Mtns. populations.

Adams, Zanoni and Hogge (1984), using leaf terpenoids examined the varieties of *J. deppeana*. They found that samples from Arizona (BA, SA) to be rather distinct from the other *J. deppeana* varieties. However, additional research using DNA sequencing and fingerprinting (Adams et al., 2007), confirmed that there is only one variety in the southwestern United States (*J. d. var. deppeana*).

Key to varieties and forms:

1. Stem bark longitudinally furrowed into long, interconnected strips, terminal whip branches often flaccid and somewhat pendulous f. *sperryi*
1. Stem bark in quadrangular plates, terminal whip branches ascending to erect
2. Terminal whips long (15-30 cm) and pendulous, all (or nearly all) leaves on adult plants juvenile (decurent, whip-type).....f. *elongata*
2. Terminal whips short (5-10 cm) and not pendulous, all leaves on adult plants scale-like (except on new growth where whip-leaves occur).....var. *deppeana*

Juniperus deppeana Steudel var. *deppeana*, Nom. Bot. ed. 2, 1:835 (1840). Alligator bark juniper, Cedro, cedro chins (Puebla), sabino, Tascate (Chihuahua and Durango), Tlascal or Tlaxcal (Hidalgo), Huata, Agoziza (Sonora).. Type: Mexico, Vera Cruz: Llanos de Perote, Schiede in 1828 (Type material unknown or destroyed). Lectotype: MO, designated by Zanoni Adams, Bot. Soc. Mex. 38: 83 (1979).

J. thurifera Spach, Ann. Sci. Nat. Bot., ser. 2, 16: 298 (1841), non L. (1753)

J. mexicana Schiede ex Schltdl. & Cham., Linnaea 5: 77 (1830), non Spreng. (1826)

J. foetida Spach, Hist. Nat. Veg. Phan. 11: 314 (1841)

Sabina mexicana (Schltdl. & Cham.) Antonine, Cupress.-Gatt.: 38 (1857)

J. gigantea Roezl, Cat. Grain. Conif. Mexic. 8 (1857)

Sabina gigantea (Roezl) Antoine, Cupress.-Gatt.: 36 (1857)

Juniperus deppeana Steud. var. *pachyphlaea* (Torr.) Martinez. Anales Inst. Biol. Univ. Nac. Mex. 17(1): 53 (1946). Type: Zuni Mts., NM, USA, Bigelow in 1853, NY!.

J. pachyphlaea Torr., US Rep. Expl. Survey Miss. Pacific 4(5):

142 (1857)

Sabina pachyphlaea (Torr.) Antoine, Cupress.-Gatt.: 39 (1857)

S. plochyderma Antoine, Cupress.-Gatt.: 40 (1857).[nom nud.]

Dioecious. **Trees** 10-15 (-30) m, with rounded crown. **Trunk bark** exfoliating in rectangular plates. **Branches** erect, often gray-green or light green, branchlets (1 cm) exfoliating to reveal copper color.

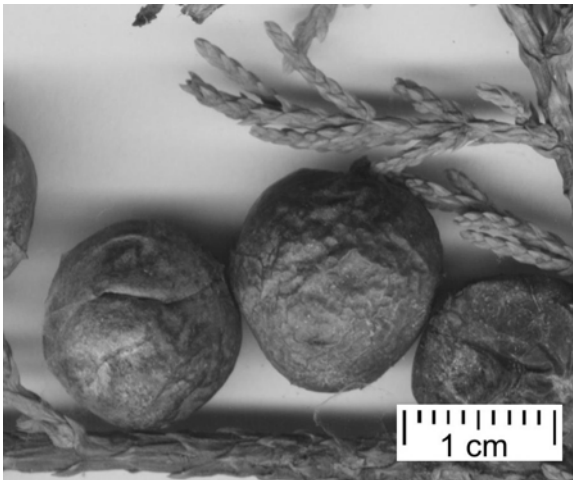
Leaves both decurrent (whip) and scale. Decurrent and scale leaf margins denticulate (20 X), whip and scale

leaves usually with ruptured glands (clear, yellow or white exudate). **Seed cones** globose, 8-15 mm across, fibrous to obscurely woody, maturing in the second year, reddish-tan to dark reddish-brown with glaucous bloom. **Seeds** 2-4 per cone, 6-9 mm long. **Pollen shed** late winter - early spring. **Habitat** rocky soils, slopes and mountains; 2000-2900 m. **Uses** fence posts.

Sprouts from cut stumps and is thus a pest in grasslands. **Dist.:** AZ, NM, TX, northern Mexico (Fig. 8). **Status:** common, not threatened.



checked or 'alligator' bark of *J. deppeana*.



Juniperus deppeana leaves and seed cones.

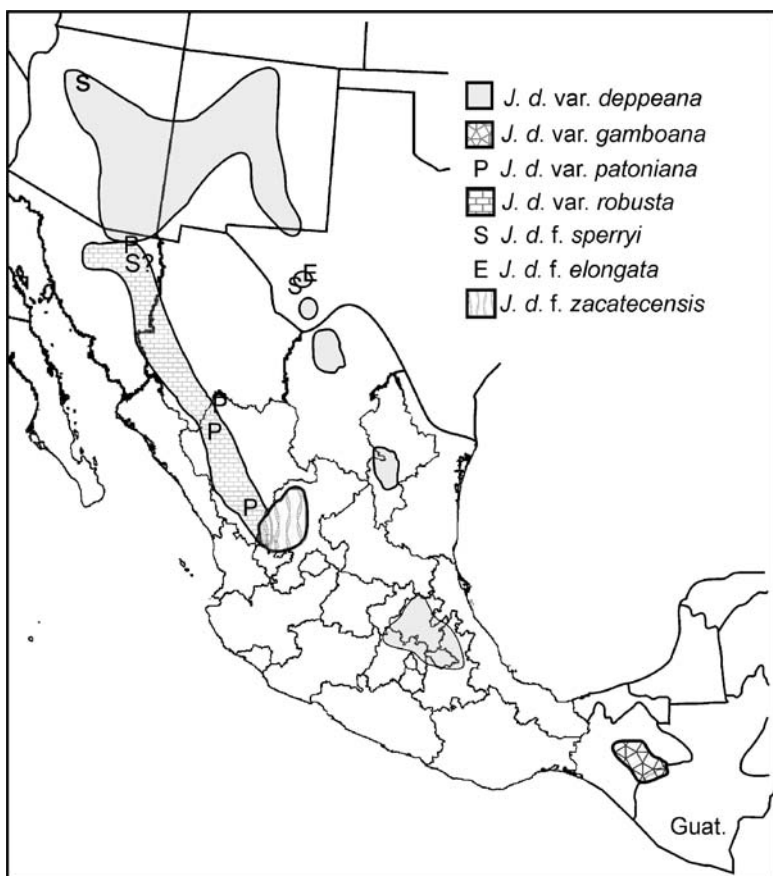


Figure 8. Distribution map of *J. depeana*. The population of *J. d. var. patoniana* (P) in n. Sonora, Mexico has previously been called *J. d. f. sperryi*, but appears better identified as var. *patoniana*.

Juniperus deppeana* f. *sperryi (Correll) R. P. Adams. Brittonia 25:289 (1973). Sperry's juniper. Type: GH: Isotype: US!. United States: Jeff Davis County: Dry Canyon of Davis Mountains, about 8 mi. from Sproul Ranch Headquarters. *Sperry* T879.

J. deppeana var. *sperryi* Correll, Wrightia 3:188 (1966)

J. deppeana subsp. *sperryi* (Correll) E. Murray, Kalmia 13:8 (1983)

Diocious. **Trees** 10-15 m, with rounded crown. **Trunk bark** stem bark longitudinally furrowed into interconnected strips (Fig. 9). **Branches** terminal whip branches and larger branches somewhat flaccid. **Leaves** both decurrent (whip) and scale. Decurrent and scale-leaf margins denticulate (20 X). **Seed cones** globose, 8-15 mm, fibrous to obscurely woody, maturing in the second year, reddish-tan when immature, then reddish-blue with very light bloom (glaucous) when mature. **Seeds** 5-6 per cone or 1(2) in Sonora (see discussion below), 6-9 mm long. **Pollen shed** spring? **Habitat** rocky soils, slopes and mountains. **Uses** none known. **Dist.:** Davis Mts., Texas, Prescott NF, AZ, n. Sonora, Mexico.



Fig. 9. *J. deppeana* f. *sperryi* bark.

Status: Type tree is from the Sproul Ranch, Davis Mts (Fig. 10). Trees with furrowed bark and pendulous foliage are in n. Sonora and have only 1(2) seeds per cone. These are referred to var. *patoniana*, but additional research is needed in this area. David Thornburg (pers. comm.) has recently found *J. deppeana* trees in northern Arizona that have furrowed bark. They do not seem to form a natural population, but occur as scattered individual trees among otherwise normal (quadrangular) barked trees. This suggests that only a few genes may be expressed to give the furrowed bark. Sampling and analyses of such trees is presently being undertaken by the author.



Juniperus deppeana f. *sperryi* leaves and seed cones.



Fig. 10. *Juniperus deppeana* f. *sperryi* with the author (1968) at the type tree on the H. E. Sproul Ranch, near Ft. Davis, Texas

Juniperus deppeana* f. *elongata R. P. Adams. Phytologia 87(2) 101 (2005). TYPE: Jeff Davis Co., Texas, USA, on Tex 118, 4.2 km west of w. entrance to Lawrence E. Wood Madera Ck. park, 1845 m, Lat. 30° 43.437' N, Long. 104° 08.255' W, 11 March 2005, R. P. Adams 10627 (HOLOTYPE: BAYLU, ISOTYPE: SRSC).

Additional specimen examined: Jeff Davis Co. Texas, USA, Brown Mtn., 2190 m (summit), R. P. Adams 10629 (BAYLU).

Dioecious. Trees 4-5 m, with rounded crown. **Trunk bark** stem bark exfoliating in rectangular plates. **Branches** terminal whip branches elongated and very flaccid (Fig. 11). **Leaves** both decurrent (whip) and scale. Decurrent and scale-leaf margins denticulate (20 X). **Seed cones** globose, 8-15 mm across, fibrous to obscurely woody, maturing in the second year, reddish-tan when immature, then reddish-blue with very light bloom (glaucous) when mature. **Seeds** 5-6 per cone or 1(2) in Sonora (see discussion below), 6-9 mm long. **Pollen shed** spring? **Habitat** rocky soils, slopes and mountains. **Uses** none known. **Dist.:** Davis Mts., Texas (Fig. 8). **Status:** two trees known. Additional trees are likely to be found.

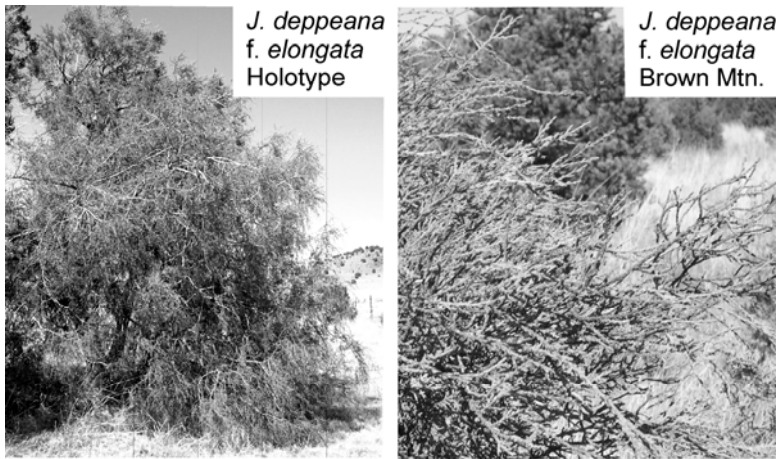


Fig. 11. Habit of *J. deppeana* f. *elongata* showing the long terminal whips and pendulous nature of the foliage.

Juniperus flaccida Schltld. Linnaea 12: 495 (1838). Weeping juniper.
Lectotype MO, 2085919.

J. gracilis Endl., Syn. Conif.: 31 (1847)

J. gigantea Roezl in part

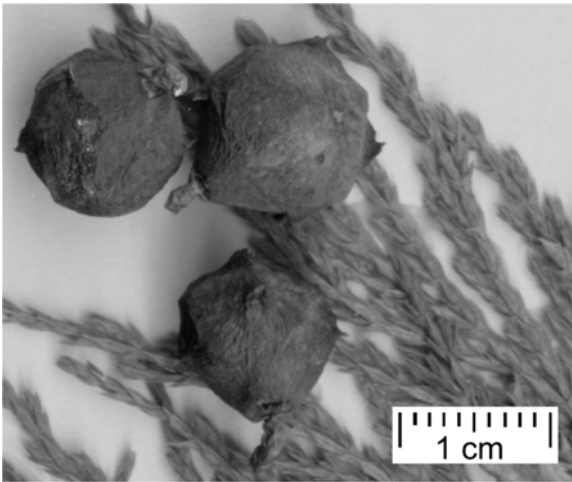
J. flaccida var. *gigantea* (Roezl) Gaussen

J. foetida flaccida (Schlecht.) Spach

Sabina flaccida (Schlecht.) Antoine

S. flaccida (Schlecht.) A. A. Heller

Dioecious. **Trees** to 12 m, trunk branching at 1-2 m. **Trunk bark** cinnamon reddish brown or gray reddish brown, exfoliating in broad interlaced fibrous strips. **Branches** spreading and forming a globular crown. Ultimate branchlets drooping, flaccid. **Leaves** both decurrent (whip) and scale. Scale-leaves often appearing somewhat decurrent, 1.5-2 mm, opposite, narrowly ovate, acuminate. Whip- and scale-leaf margins appearing entire at 20 X but with irregular teeth at 40 X. **Seed cones** spherical (4-) 6-10 (-13) seeded, tan-brown to brownish-purple with white glaucous, 9-20 mm in diam., maturing in 2 yr.? **Seeds** 5-6 mm long. **Pollen shed** late winter-early spring. **Habitat** rocky soils and slopes. **Uses** none known. **Dist.:** Mexico, Big Bend Natl. Park., Texas, USA (12). **Status:** widespread in Mexico and reproducing.



Juniperus flaccida leaves and seed cones.

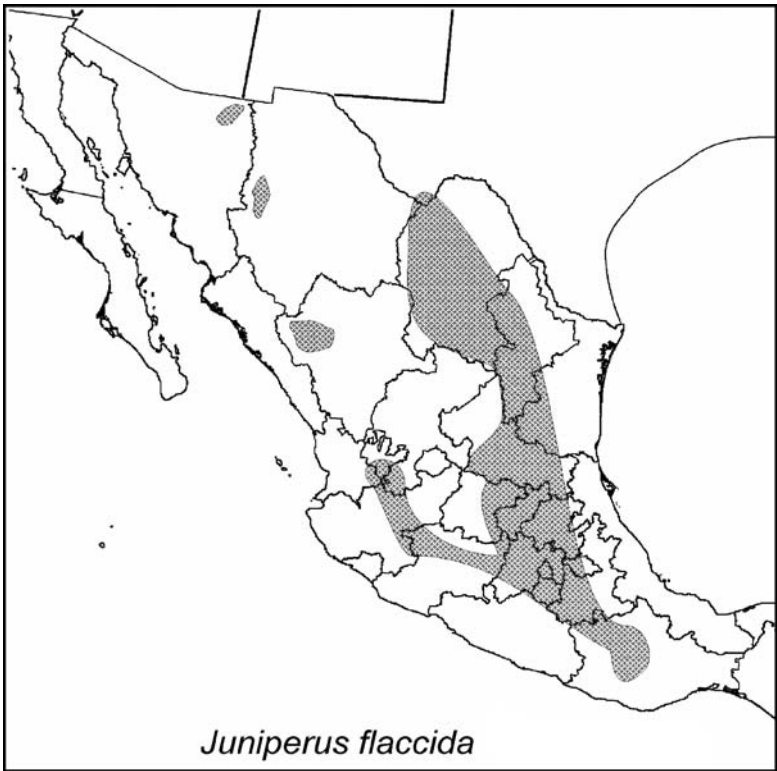


Figure 12. Distribution of *J. flaccida*. The only population in the United States is in the Chisos Mtns., Big Bend National Park, Texas.

Juniperus grandis R. P. Adams. Phytologia 88(3): 306 (2006), Big western juniper, grand juniper. Type: United States, California, San Bernardino Mtns., CA, Vasek 610929 (HOLOTYPE: RSA).

Juniperus occidentalis W. J. Hooker subsp. *australis* Vasek, Brittonia 18: 352 (1966),

Juniperus occidentalis var. *australis* (Vasek) A. & N. Holmgren., Intermountain Fl. 1: 239 (1972).

Dioecious, approx. 5% trees **Monoecious** (Vasek, 1966). **Trees** to 30 m. **Trunk bark** brown. **Branches** erect to pendulous. **Leaves** decurrent (whip) and scale-like, scale and whip-leaves with visible glands. **Seed cones** blue to blue-black, with resinous pulp, maturing in 2 yrs., 5 – 9 mm long (avg. 7.6). **Seeds** 1-2(3) per cone (avg. 1.5). **Pollen shed** spring. **Habitat** Sierra Nevada on dry rocky slopes; 1000-3000 m. Calif. **Uses** fence posts. **Dist.**: Sierra Nevada of California (Fig. 13). **Status**: occurs in protected areas, it is not threatened.

Taxonomy: Adams et al. (2006), using both DNA sequence and fingerprinting data, clearly showed that *J. occidentalis* var. *australis* to be more closely related to *J. osteosperma* than *J. occidentalis*. Based on these data, the var. *australis* was recognized as a distinct species, *J. grandis*.



Juniperus grandis leaves and seed cones.



Figure 13. Distribution of *J. grandis* (= *J. occidentalis* var. *australis*).

Juniperus horizontalis Moench, Methodus Plantas 699 (1794).

Creeping juniper, prostrate juniper. Type: no longer extant. (Zanoni, 1978).

J. sabina Michx., Fl. Bor. Amer. 2: 246 (1803), *non* L. (1753)

J. prostrata Pers., Syn. Pl 2(2): 632 (1807)

J. sabina Michx. var. *procumbens* Pursh, Fl. Amer. Sept. 2: 647 (1814)

J. repens Nuttall, Gen. N. Amer. Pl. 2: 245 (1818)

J. sabina Michx. var. *humilis* Hook., Fl. Bor. Amer. 2(10):166 (1838)

J. hudsonica Forbes, Pinetum Woburn.: 208 (1839)

J. virginiana L. var. *prostrata* (Pers.) Torr., Fl. New York 2: 235 (1843)

Sabina prostrata (Pers.) Antoine, Cupress.-Gatt.: 57 (1857)

J. foetida multicaulis Spach in part

J. horizontalis forma *alpina* (Loud.) Rehder

J. horizontalis forma *lobata* O.W. Knight

J. horizontalis var. *douglasii* Hort.

J. horizontalis var. *variegata* Beissn.

J. sabina B. *humilis* Carr. in part

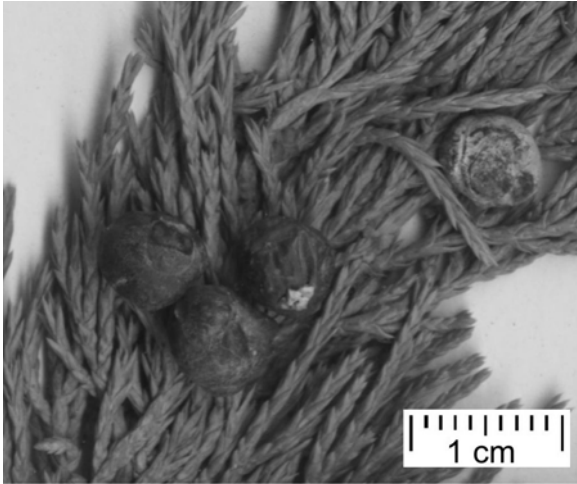
J. sabina β *procumbens* Pursh

S. horizontalis (Moench) Rydb., Bull. Torrey Bot. Club 39: 100 (1912)

S. vulgaris Antoine in part

Dioecious. **Prostrate to decumbent shrub.** **Trunk bark** brown, exfoliating in plates. **Branches** procumbent, forming large mats often several meters across. **Leaves** decurrent (whip) and scale-like. Foliage green but turning reddish-purple in winter. Leaf margins entire (20 X and 40 X). scale-leaf tips apiculate, mostly overlapping, both whip and scale leaves growing along the branchlets. **Seed cones** 1-2(3) seeded, blue-black to blue-brownish when ripe, borne on generally curved peduncles, mostly maturing in 2 yrs., 5-7 mm. **Seeds** 4-5 mm. **Chromosome number** $2n=22$ (Hall, Mukherjee and Crowley, 1979). **Pollen shed** spring. **Habitat** sand dunes, sandy and gravelly soils, prairies, slopes and along stream banks; sea level to 1000 m. **Uses** none known. **Dist.:** Canada: all provinces. AK, MT, WY, ND, SD, NB, MN, IA, WS, IL, MI, NY, VT, MA, ME (Fig. 14). **Status:** this taxon is common and reproducing. Not threatened.

Juniperus horizontalis hybridizes with both *J. virginiana* and *J. scopulorum* (Adams, 1983; Fassett, 1945a,b; Palma-Otal, et al, 1983). The *J. horizontalis* x *J. scopulorum* hybrid has been named *J. scopulorum* var. *patens* Fassett (= X *J. fassettii* B. Boivin).



Juniperus horizontalis leaves and seed cones.

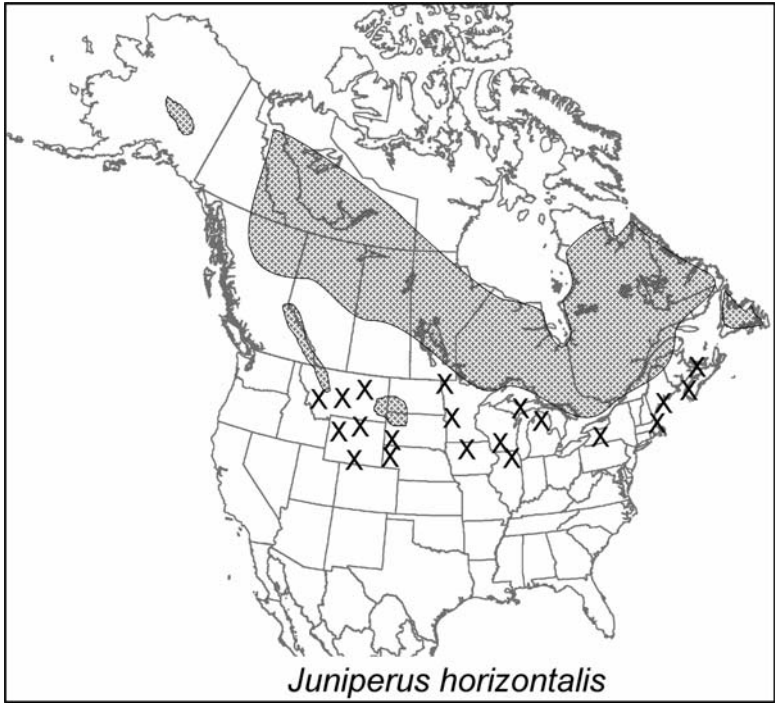
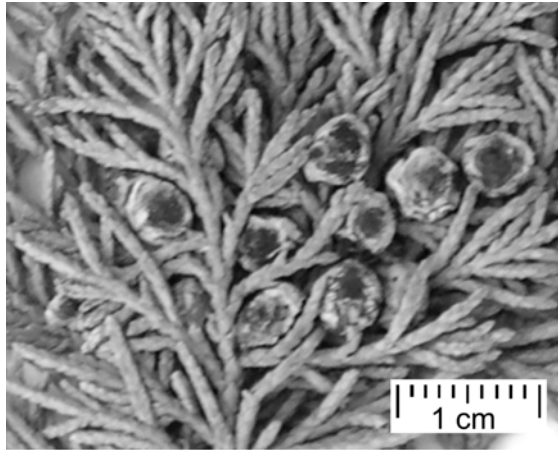


Figure 14. Distribution of *J. horizontalis*. Xs denote outlying populations.

Juniperus maritima R. P. Adams Phytologia 89(3): 278 (2007).

Type: Canada, BC, Vancouver Island, Brentwood Bay, Lat 48° 34.794' N; Long 123° 20.211' W, elev. 5 m., 29 May 2006, R. P. Adams 11056 (HOLOTYPE: BAYLU; ISOTYPE: V).

This species is similar to *J. scopulorum* but differs in having seed cones mature in 1 year (14-16 months), seeds are usually exerted from the cone, and the scale-leaf tips are obtuse (see below). It differs from *J. virginiana*



Juniperus maritima leaves and seed cones.

in having larger seed cones (6-8 mm) that are often reniform, seeds often exerted from the cone, scale-leaves overlap less than 1/5 the length, and branchlets are smooth and reddish-brown.

Character	<i>J. maritima</i>	<i>J. scopulorum</i>	<i>J. virginiana</i>
seed cones mature	1 yr (14-16 mos.)	2 years	1 year
seed cone diam.	6-8 mm	6-9 mm	3-6(7) mm
seed cone shape	globose to reniform	globose to reniform	ovoid
seeds per cone	(1) 2	(1) 2 (3)	1-2 (3)
exserted seeds	ubiquitous	rare	rare
scale-leaf overlap	< 1/5 length	< 1/5 length	> 1/4 length
scale-leaf tips	obtuse	acute to obtuse	acute
branchlets (6-15mm, diam.)	smooth, reddish-brown	smooth, bright reddish-brown	brown with persistent old leaves

Junipers maritima is known only from the Puget Sound and Strait of Georgia areas (Fig. 15). It is usually found in rocky areas, often within meters of the water. However, a population exists on coastal sand dunes near Cranberry Lake, Whidbey Island, WA. No other population has been found on sand, so that site may be atypical.

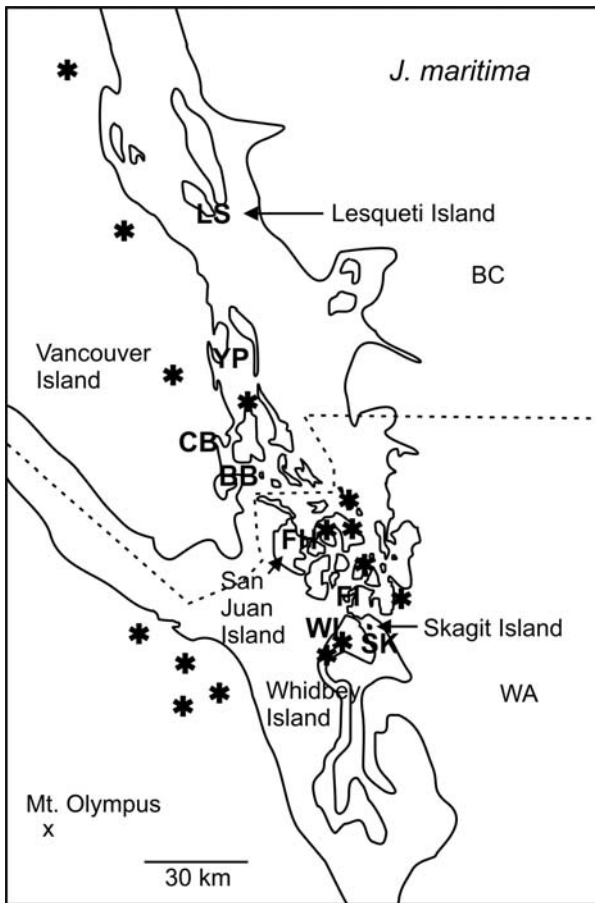


Figure 15. Distribution of *Juniperus maritima* based on Adams field collections (acronyms) and herbarium specimens (stars) from ONP, V, WS, and WTU (from Adams, 2007).

Juniperus monosperma (Engelm.) Sargent. Silva N. Amer. 10: 89 (1896). One-seeded juniper, cherry-stone juniper. Type: USA, Colorado, Fremont Co., Canon City, limestone hills, G. Englemann, s. n., Lectotype: MO 3377643 selected by T. Zanoni, Feb. 1992, designated by Farjon (2005).

J. occidentalis Hook. var. *monosperma* Engelm., Trans. St. Louis Acad. Sci. 3: 590 (1878)

J. californica Carriere var. *monosperma* (Engelm.) Lemmon, Handb. W. Amer. Conebearers, ed. 2: 17 (1892)

J. occidentalis Hook. var. *gymnocarpa* Lemmon, Handb. W. Amer.

Cone-bearers, ed. 3: 80 (1895)

Sabina monosperma (Engelm.) Rydberg, Bull. Torrey Bot. Club 32: 598 (1905)

J. occidentalis Hook. f. *gymnocarpa* (Lemmon) Rehder, J. Arnold Arbor. 7: 239 (1926)

J. mexicana Schiede ex Schlttdl. & Cham. var. *monosperma* (Engelm.) Cory, Rhodora 38: 183 (1936)

J. gymnocarpa (Lemmon) Cory, Rhodora 38: 184 (1936)

Diocious. **Shrub** or small tree, 2-7 (-12) m, usually with stems branching near the ground. **Trunk bark** thin, gray to brown, exfoliating in thin strips revealing cinnamon color. **Branches** ascending to erect, with an ashy-white peeling bark. **Leaves** both decurrent (whip) and scale-like. Ultimate branchlets approx. 2/3 as wide as scale leaf length, square or six-sided but not terete. Whip- and scale-leaf margins denticulate (20 X). Scale leaves acute to acuminate. Whip-leaf gland 3/4 as long as the leaf, adaxial (inner) leaf surface glaucous. Scale-leaves 1-3 mm, ovate, acute to acuminate, green. Scale-leaf tips free with the abaxial surface raised. Few (less than 1/5) whip-leaf glands ruptured and with a white crystalline exudate (visible without a lens). **Seed cones** 6-8 mm, soft and juicy pulp, globose to ovoid, reddish-blue to brownish-blue, white glaucous, 1(2-3) seeded, the hilum scar approx. 1/3 as long as seed. **Seeds** 4-5 mm long. **Pollen shed** late winter—early spring. **Habitat** common shrub in dry rocky soils and slopes; 1000-2300 m. **Uses** not rot resistant, so not commonly used for fence posts. **Dist.:** Ariz., Colo., N. Mex., Okla., Tex. (Fig. 16). Often reported from Mexico, but these plants should be referred to *J. angosturana* or *J. coahuilensis*. True *J. monosperma* has not been seen

in Mexico by the author. **Status:** This species is the dominant plant on millions of hectares in New Mexico, USA. It is reproducing and is considered a pest (weed) in pastures.

Hybridization between *J. monosperma* and *J. pinchotii* (Hall and Carr, 1968) has been negated using numerous chemical and morphological characters (Adams, 1969; 1975). Hybridization is unlikely in that pollination activity for *J. monosperma* is in late winter - early spring whereas that for *J. pinchotii* is in the fall. Hybridization with *J. coahuilensis*, a sibling species, does appear likely and is currently under investigation. The distribution of *J. monosperma* is shown in figure 16.

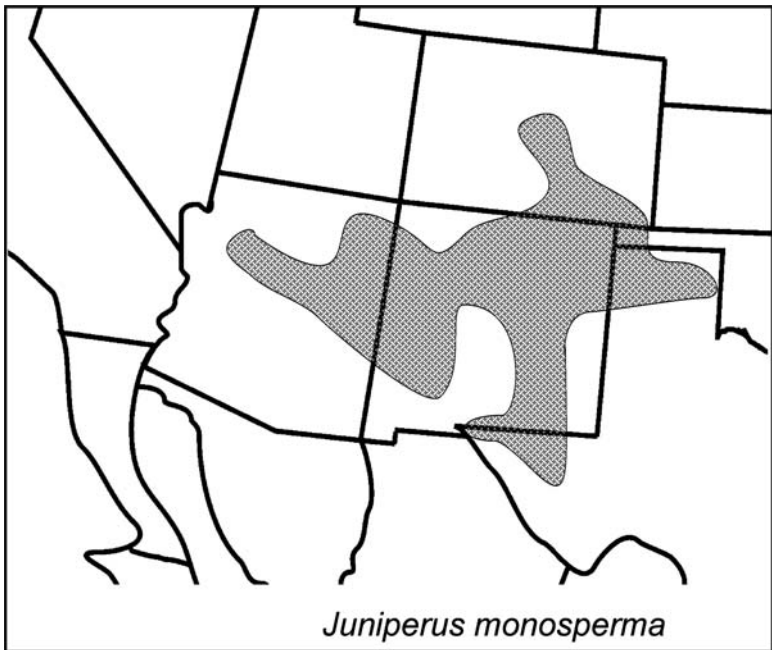
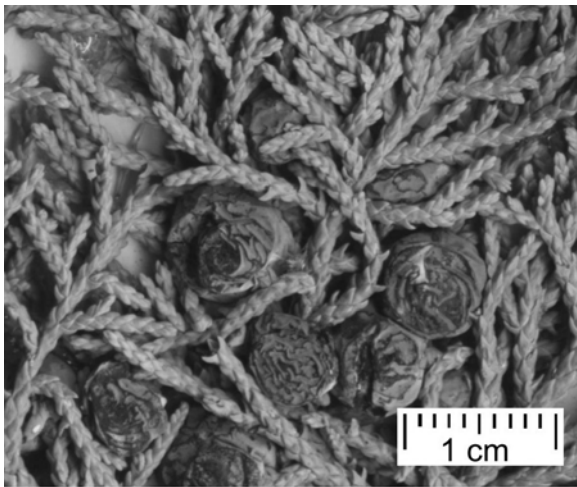


Figure 16. Distribution of *J. monosperma*.

The synonym, *J. occidentalis* Hook. var. *gymnocarpa* Lemmon, came from a term ‘gymnocarpa’ that seems to have been introduced by Lemmon in 1895. It is common to see the seeds exerted from the seed cones in most *Juniperus* species. This is apparently due to insect damage to the immature cone. See the figure 17 to the left of exerted seeds in *J. saltillensis*.



Fig. 17. Gymnocarpy in *J. saltillensis*



Juniperus monosperma leaves and seed cones.

Juniperus occidentalis W. J. Hooker, Fl. Bor. Amer. 2(10): 166 (1838).
Western juniper, Sierra juniper. Type: K!

J. andina Nutt., N. Amer. Sylva 3: 95, t.110 (1849)

Chamaecyparis boursieri Decne., Bull. Soc. Bot. France 1: 70
(1854)

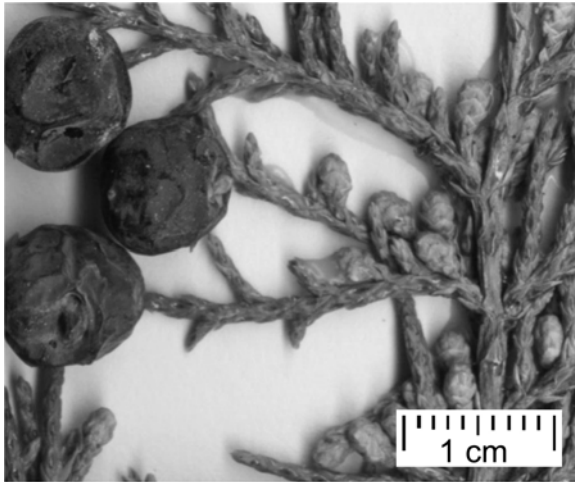
Sabina occidentalis (Hook.) Antoine, Cupress.-Gatt.: 64 (1857)

J. pseudocupressus Dieck, Neuheit.-Off. Nat.-Arb. Zoschen 1899:
8 (1899)

J. californica var. *siskiyouensis* L.F. Henderson, Rhodora 33: 203
(1931)

J. occidentalis f. *robinsoni* O. V. Matthew

Monoecious/Dioecious approx. 50% of the plants monoecious (Vasek, 1966). **Trees** to 20 m. **Trunk bark** red-brown. **Branches** ascending. **Leaves** decurrent (whip) and scale-like, both kinds with visible glands. **Seed cones** blue to blue-black, with resinous pulp, maturing in 2 yrs., 7-10 mm long (avg. 8.3). **Seeds** 1-2(3) per cone (1.6 avg.). **Pollen shed** late spring. **Habitat** dry rocky foothill and mtn. slopes; (near sea level) to 1500-3000 m; Calif., Idaho, Ore., Nev., Wash. **Map:** Vasek, 1966. **Uses** fence posts (but not very rot resistant). **Dist.:** Sierra Nevada of northern California, Oregon and Washington



Juniperus occidentalis leaves, pollen and seed cones.

into Nevada (Fig. 18). **Status:** common and reproducing. Considered a pest (weed) on pasture lands in Oregon. Vasek (1966) reported hybridization with *J. osteosperma* in n. w. Nevada. Terry et al. (2000) confirmed hybridization between *J. occidentalis* and *J. osteosperma* using cp and nuclear DNA markers. Adams et al. (2006) recognized *J. occidentalis* var. *australis* as *J. grandis*.

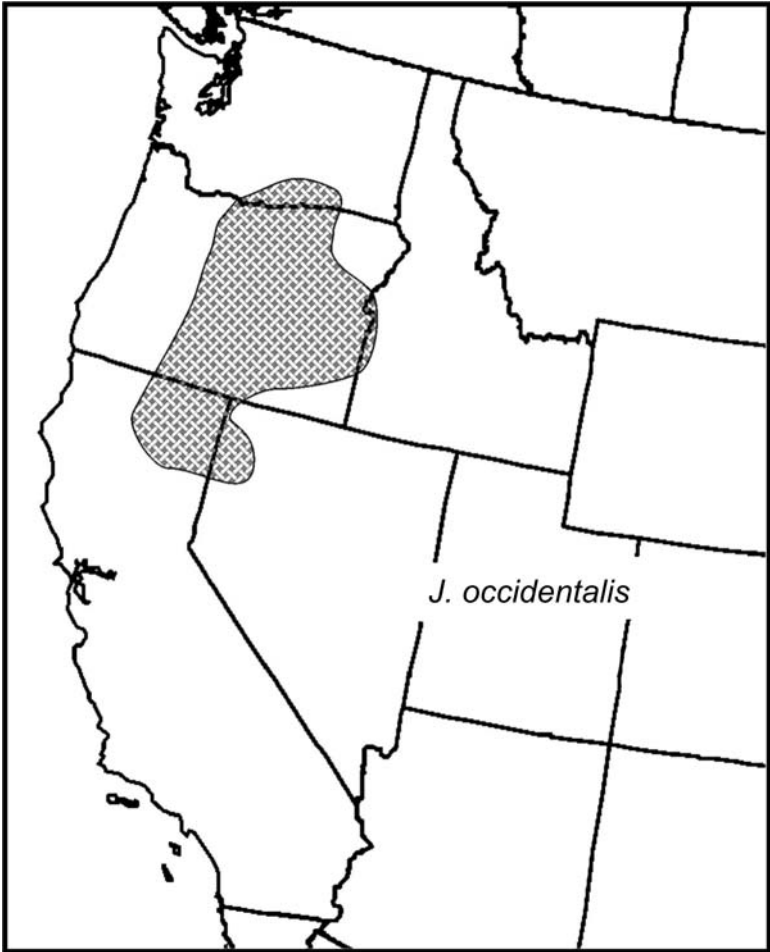


Figure 18. Distribution of *J. occidentalis*.

Juniperus osteosperma (Torrey) Little, Leafl. Western Bot. 5:125 (1948). Utah juniper. Lectotype: NY!

J. tetragona Schlttdl. var. *osteosperma* Torr., Pacif. Railr. Rep. 4(5): 141 (1857)

Sabina osteosperma (Torr.) Antoine, Cupress.-Gatt.: 51 (1857)

J. californica var. *utahensis* Engelm., Trans. St. Louis Acad. Sci. 3: 588 (1878)

J. californicus var. *utahense* Vasey

J. occidentalis Hook. var. *utahensis* (Engelm.) Kent, Veitch's Man. Conif.: 289 (1881)

J. utahensis (Engelm.) Lemmon, (Cone Bearers Calif.) Calif. State Board Forest. Bienn. Rep. 3: 183 (1890)

J. knightii A. Nelson, Bot. Gaz. (Crawfordsville) 25: 198 (1898)

J. monosperma (Engelm.) var. *knightii* (A. Nelson) Lemmon, Handb. W. Amer. Cone-bearers, ed. 4: 114 (1900)

J. utahensis (Engelm.) Lemmon var. *cosnino* Lemmon, Bull. Sierra Club 4: 123, t. 62 (1902)

S. knightii (A. Nelson) Rydberg, Bull. Torrey Bot. Club 32: 598 (1905)

S. utahensis (Engelm.) Rydberg, Bull. Torrey Bot. Club 32: 598 (1905)

J. megalocarpa Sudw., Forestry & Irrig. 13: 307 (1907)

S. megalocarpa (Sudw.) Cockerell, Muhlenbergia 3: 143 (1908)

J. utahensis (Engelm.) Lemmon var. *megalocarpa* (Sudw.)

Sargent, Bot. Gaz. (Crawfordsville) 67: 208 (1919)

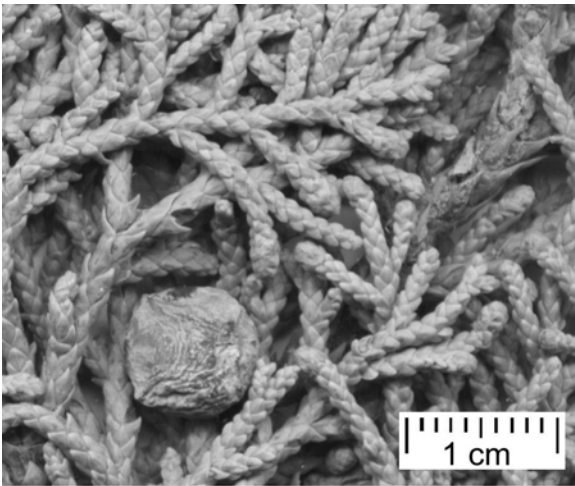
J. californica Carriere subsp. *osteosperma* (Torr.) E. Murray, Kalmia 12: 21 (1982)

J. californica Carr. var. *osteosperma* (Torr.) E. Murray, Kalmia 12: 21 (1982)

Monoecious or rarely Dioecious (10%). Shrubs multi- (seldom one) stemmed shrub or tree, 3-6 (-12) m. with round crown. **Trunk bark** exfoliating in thin gray-brown strips. Bark on twigs (5-10 mm diam.) brown or gray, not exfoliating in scales or flakes. **Branches** erect. **Leaves** decurrent (whip) and scale-like, foliage light yellow-green. Whip- and scale-leaf margins denticulate (20 X). Leaf-glands not conspicuous (embedded in the leaf, therefore not visible). **Seed cones** fibrous, bluish-brown, with white glaucous, often almost tan beneath the glaucous, (6-) 8-9(-13) mm. Maturing in 1-2 yrs. **Seeds** 1(2) avg.

1.07 per cone, 4-5 mm long. **Pollen shed** spring. **Habitat** dry, rocky soil and slopes; 1300-2600 m. **Uses** none known, not rot resistant. Trunks of living trees often with rotted heartwood. **Dist.:** Ariz., Calif., Colo., Idaho, Mont., Nev., N. Mex., Utah, Wyo., USA (Fig. 19.). **Status:** abundant in Utah and adjacent states. Considered a weed in ranch lands.

The dominant juniper of Utah. Reported to hybridize with *J. occidentalis* (see *J. occidentalis* above).



Juniperus osteosperma leaves and seed cone.

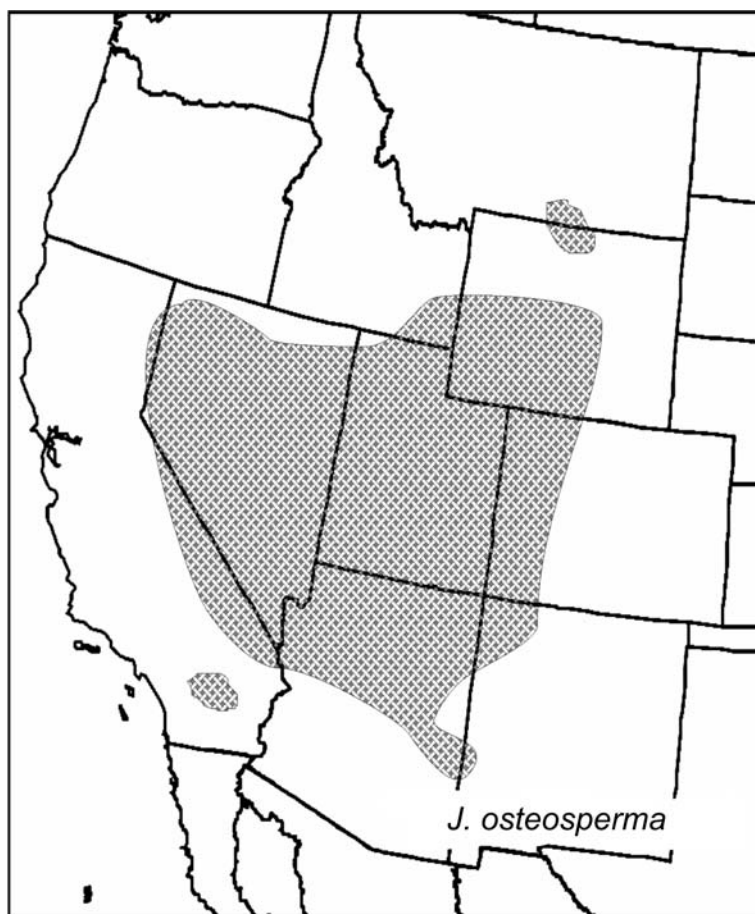
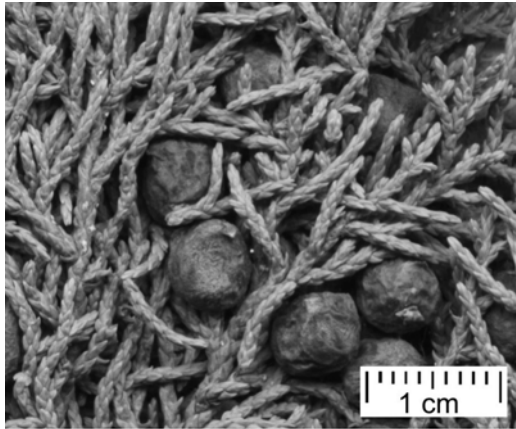


Figure 19. Distribution of *J. osteosperma*.

Juniperus pinchotii Sudworth, Forest. & Irrig. 11: 204 (1905). –
 Copper berry juniper, Pinchot juniper, red-berry juniper. Type: US!
J. erythrocarpa Cory, Rhodora 38: 186 (1936)
J. monosperma (Engelm.) Sarg. var. *pinchotii* (Sudw.) Melle,
 Phytologia 4: 29 (1952)
J. texensis Melle, Phytologia 4: 26 (1952)
J. pinchotii Sudw. var. *erythrocarpa* (Cory) Silba, Phytologia
 Mem. 7: 35 (1984)

Diocious. **Trees**, shrub to small shrubby tree, 1-6 m, usually multi-stemmed at the base and forming broad shrubs. **Trunk bark** thin, ashy-gray, exfoliating in long strips. **Branches** stiff, erect or spreading, the bark in long, narrow scales. **Leaves** both decurrent (whip) and scale-like. Whip- and scale-leaf margins denticulate (20 X), leaves yellow-green. Adaxial leaf surface not glaucous. Many glands ruptured and with a white, crystalline (mostly camphor) exudate, both whip- and scale-leaf glands elliptical to elongate. **Seed cones** copper to copper-red, not glaucous, globose to ovoid, 6-8 (-10) mm; soft and juicy, sweet pulp, 1(2) seeded, the hilum scar approx. ½ as long as the seed. **Seeds** 4-5 mm long. **Pollen shed** fall. **Habitat** 300-1000(-1700) m; gravelly soils on rolling hills and ravines, limestone, gypsum. **Uses** occasionally used as fence posts, but it is not rot resistant. **Dist.:** N. Mex., Okla., Tex.; northeastern Mexico (Fig. 20).



Juniperus pinchotii leaves and seed cones.

Status: this species is abundant in its range and is an invasive weed that invades degraded grasslands. It has greatly increased in areas that are not subjected to periodic burning.

The species forms hybrids with *J. coahuilensis* (see above). No hybridization with *J. ashei* has been noted (see above) nor has hybridization with *J. monosperma* (see above) been documented, at least by terpenoid analyses.

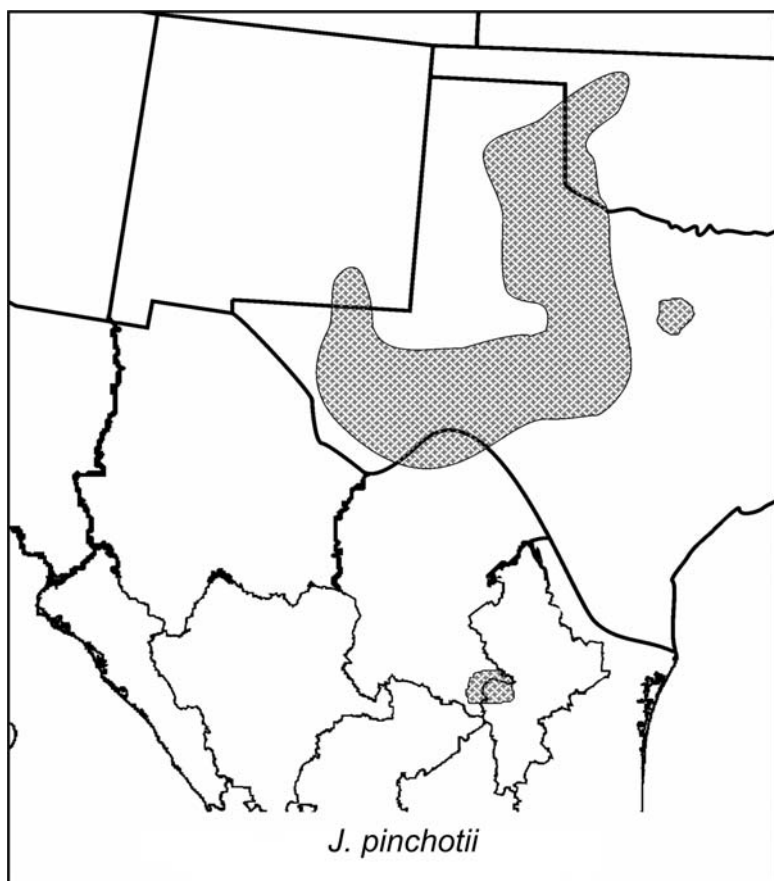


Figure 20. Distribution of *J. pinchotii*.

Juniperus scopulorum Sargent, Gard. & Forest 10: 420, f. 54 (1897).- Rocky mountain juniper. Type: not designated by Sargent; Lectotype: A! Yellowstone Natl. Pk. (designated by Zanoni, 1978).

J. excelsa Pursh, Fl. Amer. Sept. 2: 647 (1814), non M.-Bieb. (1800)

J. virginiana L. var. *montana* Vasey, (Cat. Forest Trees U.S. 30) Rep. U.S. Dept. Agric. 1875: 47 (1876)

J. occidentalis Hook. var. *pleiosperma* Engelm., Trans. St. Louis Acad. Sci. 3: 590 (1878)

J. virginiana L. var. *scopulorum* (Sarg.) Lemmon, Handb. W. Amer. Cone-Bearers, ed. 4: 114 (1900)

Sabina scopulorum (Sarg.) Rydberg, Bull. Torrey Bot. Club 32: 598 (1905)

J. scopulorum var. *patens* Fassett, Bull. Torrey Bot. Club 72: 46 (1945) [= *X. fassettii* Boivin (*horizontalis* x *scopulorum*)]

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

J. scopulorum Sarg. f. *columnaris* (Fassett) Rehder, Bibliogr. Cult. Trees Shrubs: 63 (1949)

J. fassettii A. Boivin, Naturaliste Canad. 93: 372 (1966)

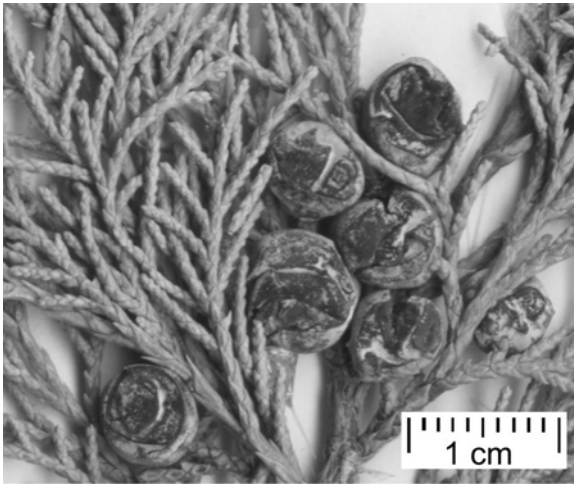
J. scopulorum var. *columnaris* Fassett (environmentally induced by gases from burning coal, see Adams, 1982)

J. virginiana L. subsp. *scopulorum* (Sarg.) E. Murray, Kalmia 13: 8 (1983)

Dioecious. **Trees** single (rarely multi-) stemmed tree to 20 m. pyramidal to occasionally round crowns. Twigs (3-5 mm diam.) with smooth bark, twigs (6-15 mm diam.) with bark exfoliating in plates, reddish-copper beneath. **Trunk bark** brown, exfoliating in thin strips. Foliage light to dark green but often blue and blue-gray due to glaucousness. **Branches** erect to occasionally pendulous at the tips. **Leaves** both decurrent (whip) and scale. Whip-leaves growing only at branchlet tips (on mature trees). Scale-leaves not overlapping, or, if so, then not by more than 1/5 the length, obtuse to acute, margins entire at 20 X (and 40 X). **Seed cones** maturing in 2 yrs., globose to 2-lobed, appearing light blue when with heavy glaucous, but dark blue-black beneath glaucous (when mature). [Note: cones may appear tan beneath the glaucous when immature], 6-9 mm, borne on mostly straight peduncles. **Seeds** (1)2(3) per cone, 4-5 mm long. **Chromosome**

number $2n = 22$ (Hall, Mukherjee and Crowley, 1973). **Pollen shed** March-April. **Habitat** rocky soils, and slopes, eroded hillsides, sea level (Vancouver Isl., Puget Sound), otherwise 1200-2700 m. **Uses** fence posts. **Dist.:** Canada: Alberta, B.C., USA: Ariz., Colo., Idaho, Mont., Neb., N.D., N. Mex., Nev., Ore., S.D., Tex., Utah, Wash., Wyo., N. Mexico (Fig. 21). **Status:** abundant and increasing, considered a weed in rangelands.

Juniperus scopulorum hybridizes with its eastern sibling species, *J. virginiana* in the zones of contact in the Missouri R. Basin (Comer, Adams and Van Haverbeke, 1982; Flake, Urbatsch and Turner, 1978; Van Haverbeke, 1968). Relictual hybridization with *J. virginiana* is present in Palo Duro Canyon in the Texas Panhandle (Adams, 1983). The species hybridizes with *J. horizontalis* (see *J. horizontalis*, above).



Juniperus scopulorum leaves and seed cones.

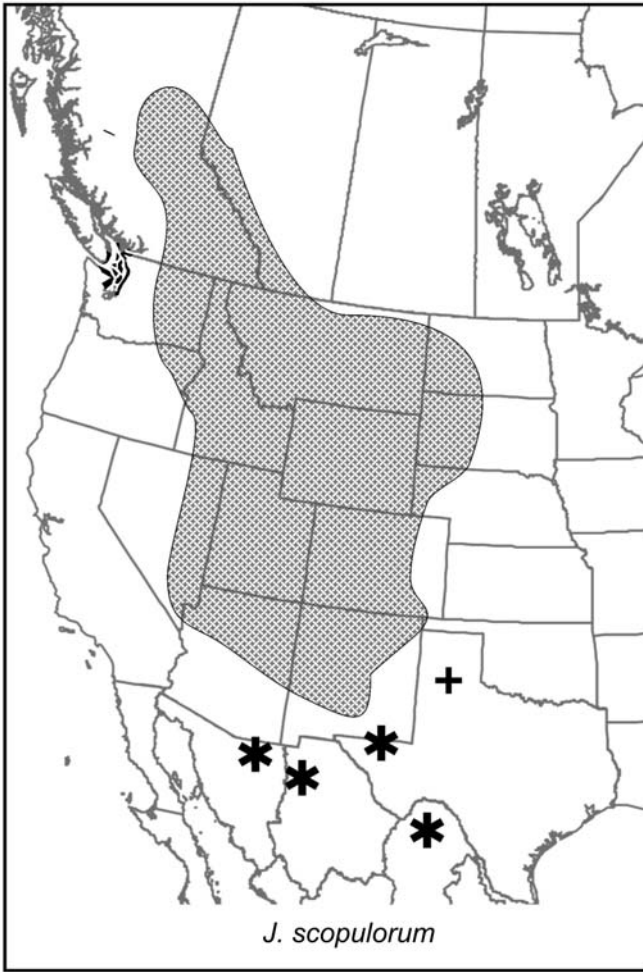


Figure 21. Distribution of *J. scopulorum*. The + symbol in Palo Duro Canyon of the Texas Panhandle denotes that the plants are intermediate between *J. scopulorum* and *J. virginiana* (see Adams, 1983).

***Juniperus virginiana* L., Sp. Pl. 2:1039 (1753).**

In the present treatment, two varieties are recognized. However, var. *virginiana* can be divided into pyramidal (var. *virginiana*) and strict (var. *crebra*) growth habits. Research is currently being conducted to determine if var. *crebra* merits recognition.

Key to varieties:

1. Seed cones 4-6 mm; crowns strict, pyramidal to round; bark reddish-brown; scale-leaves acute; pollen cones 3-4 mm; inland and in old fields var. ***virginiana***
1. Seed cones 3-4 mm; crowns flattened; bark cinnamon-reddish; scale-leaves bluntly obtuse to acute; pollen cones 4-5 mm; on sand on fore-dunes (coastal)..... var. ***silicicola***

Juniperus virginiana* var. *silicicola (Small) E. Murray, *Kalmia* 13: 8 (1983). Southern red cedar, coastal red cedar. Co-Type: USA, Alabama, Mobile, C. T. Moir, NYBG.

Sabina silicicola J. K. Small, N. Y. Bot. Gard. 24: 5 (1923)

J. barbadensis C. Mohr *non* Linnaeus

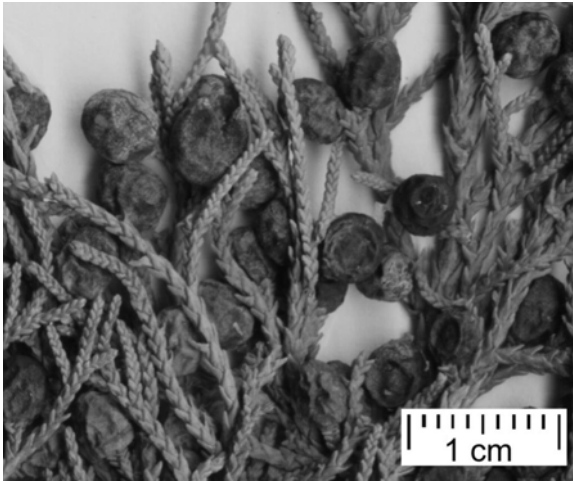
J. silicicola (J. K. Small) L.H. Bailey, *Cult. Conif. N Amer.* 18 (1933)

J. virginiana L. subsp. *silicicola* (Small) E. Murray, *Kalmia* 13: 8 (1983)

J. virginiana L. var. *silicicola* (Small) J. Silba, *Phytologia Mem.* 7: 37 (1984)

Dioecious. **Trees** small tree to 10 m, with a flattened crown, pyramidal when young and protected or crowded. **Trunk bark** cinnamon-reddish, exfoliating in narrow strips. **Branches** spreading to pendulous, ultimate twigs terete or 4-angled. **Leaves** both decurrent (whip) and scale. Scale-leaves bluntly obtuse to acute. Whip- and scale-leaf margins entire (20 X and 40 X). Pollen cones 4-5 mm. **Seed cones** maturing in 1 year, blue, glaucous, resinous, ovoid 4-5 mm in diam. **Seeds** tan to chestnut brown, 1.5-3 mm long. **Pollen shed** late winter - early spring. **Habitat** coastal fore-dunes, coastal river sand banks, sea level- 15 m. **Uses** none known. **Dist.:** along the coast from N.C., S.C., Ga., to western FL and AL (Fig. 22). **Status:** This southern variety of *J. virginiana* appears to be restricted to coastal fore-dunes and differs little in morphology or leaf terpenoids from the upland *J.*

virginiana (Adams, 1986). Both of these taxa are distinct from the Caribbean junipers (*J. barbadensis* var. *lucayana* Britt., Bahamas, Jamaica, Cuba; *J. bermudiana* L., Bermuda), see Adams, Zanoni and Hogge, 1984; Adams, 2008). There appears to be some intergradation of characters between *J. virginiana* and this variety in Georgia (Adams, 1986).



Juniperus virginiana var. *silicicola* leaves and seed cones.

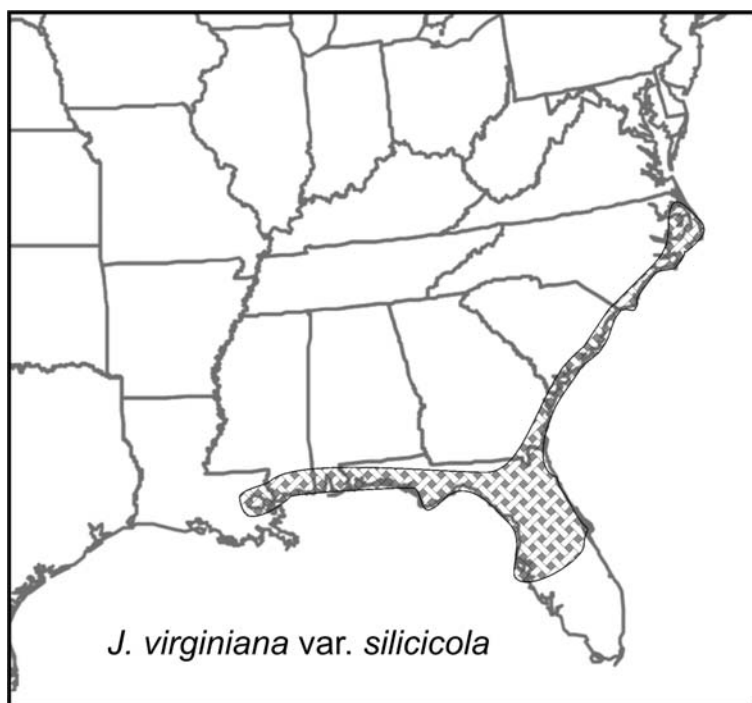


Figure 22. Distribution of *J. virginiana* var. *silicicola*.

Juniperus virginiana L. var. *virginiana*, Sp. Pl. 2:1039 (1753). Red cedar, Virginia cedar, eastern red cedar. Type: LINN!

J. caroliniana Mill., Gard. Dict., ed. 8: *Juniperus* No. 4 (1768)

J. arborescens Moench, Methodus: 699 (1794)

J. caroliniana Du Roi, Harbk. Baumz., ed 2, 1: 497 (1795)

J. hermannii Spreng., Syst. Veg. 3: 908 (1826)

J. foetida Spach var. *virginiana* (L.) Spach, Ann. Sci. Nat. Bot., ser. 2, 16: 298 (1841)

J. virginiana L. var. *vulgaris* Endl., Syn. Conif.: 28 (1847)

Sabina virginiana (L.) Antoine, Cupress.-Gatt.: 61 (1857)

J. virginiana L. var. *crebra* Fernald & Griscom, Rhodora 37: 133, t. 332 (1935)

J. virginiana L. var. *ambigens* Fassett; (=X *Ambigens*, *virginiana* x *horizontalis*) Bull. Torrey Bot. Club 72: 380 (1945)

J. virginiana L. subsp. *crebra* (Fernald & Griscom) E. Murray, Kalmia 12 :21 (1982)

Dioecious. **Trees** single stemmed to 30 m, pyramidal to strict. **Trunk bark** brown, exfoliating in thin strips. **Branches** foliage erect or occasionally lax, green but turning reddish-brown in the winter, twigs (3-5 mm diam.) with persistent dead scale leaves, bark on twigs (6-15 mm diam.) not exfoliating in plates, if so brownish beneath. **Leaves** both decurrent (whip) and scale. Whip-leaves growing only at branchlet tips (on mature trees), with an elliptical or elongated gland. Scale leaves overlapping (more than ¼ length). Scale-leaf margins entire (20 X and 40 X). **Seed cones** blue-black to blue brownish, maturing in 1 year, borne terminally, 3-6(7) mm in diam., 1-2(3) seeded. **Seeds** tan to brown, 2-4 mm long. **Chromosome number** $2n = 22$, $3n = 33$ (Hall, Mukherjee and Crowley, 1979). **Pollen shed** March-April. **Habitat** upland or low woods, old fields, glades, fence rows and river swamps, near sea level to 1400 m. **Uses** production of eastern red cedar wood oil, furniture, fence posts, widely cultivated for landscaping. **Dist.:** Canada: Ont., Que.; United States (Fig. 23): all states except: Alaska, Ariz., Calif., Colo., Idaho, Mont., Nev., N. Mex., Ore., Utah, Wash., Wyo. **Status:** Perhaps the most aggressive, weedy juniper in the world. It is spread by birds and invades abandoned fields and roadsides in the eastern United States from the Atlantic ocean to the Edwards Plateau in central Texas and into the central Great Plains.

Juniperus virginiana hybridizes with the sibling species, *J. horizontalis* (see *J. horizontalis*, above) and *J. scopulorum* (see *J. scopulorum*, above). Earlier reports of hybridization between *J. ashei* and *J. virginiana* (Hall, 1952) were negated in subsequent studies (Adams, 1977; Flake, von Rudloff and Turner, 1969).

Eastern Red Cedar is an aggressive, weedy species. *Juniperus v. virginiana* (and most junipers) are disseminated by birds and a typical pattern in the USA is the 'fence row junipers' where birds have dropped the seeds while sitting on the fence wire. It also invades disturbed sites as well as old fields. *Juniperus v. virginiana* is the most weedy juniper known in that it can invade tall (0.5 m tall) grass. The control of *Juniperus* is a major problem in the United States. Interestingly, the junipers of the eastern hemisphere are seldom weeds. Of course, much of the juniper habitat in the eastern hemisphere has been grazed by goats for centuries, whereas goat grazing is a relatively modern phenomenon in the western hemisphere and little practiced in the United States.



Juniperus virginiana var. *virginiana* leaves and seed cones.

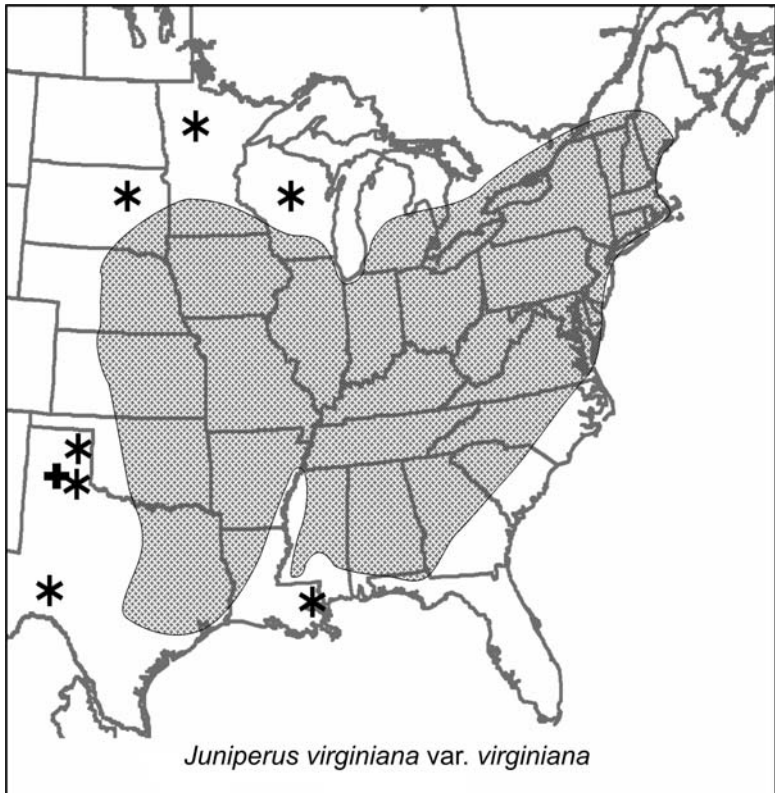


Figure 23. Distribution of *J. virginiana* var. *virginiana*. The + symbol at Palo Duro Canyon, Texas Panhandle denotes plants that are intermediate to *J. scopulorum* (see Adams, 1983).

ACKNOWLEDGEMENTS

Thanks to Billie Turner (and others) for reviewing this paper and to Baylor University of support.

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