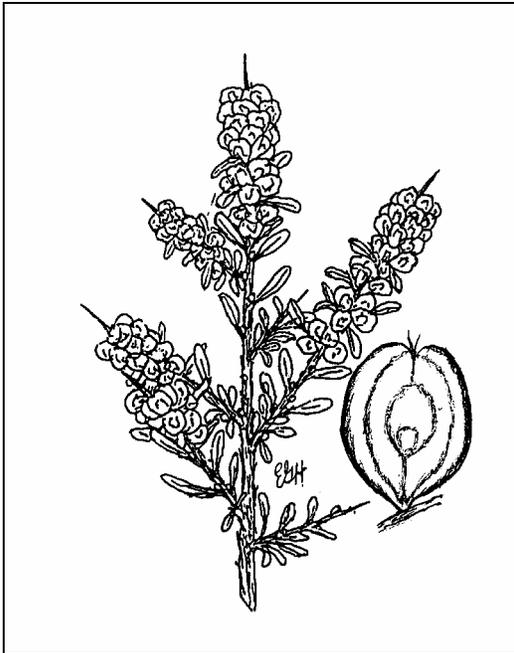


***Grayia spinosa* (Hook.) Moq.**
CHENOPODIACEAE

spiny hopsage

Synonyms: *Atriplex spinosa* Collotzi
A. grayia Collotzi
Grayia polygaloides Hook. & Arn.



General Description.—Alternative common names for spiny hopsage are grayia, Gray's saltbush, saltbrush, spiny-sage, horsebrush, and applebush (Shaw and others 2001, Welsh and others 1987). Shrubs are 0.3 to 1.2 (1.5) m tall, summer deciduous, and erect to rounded with divergent, thorn-tipped branches and gray to brownish exfoliating bark. Young twigs and herbage are scurfy to pubescent, becoming glabrous with age. Alternate, entire, gray-green, fleshy leaves, 5 to 30 (40) mm long and 2 to 13 mm wide, develop from prominent, globose, axillary buds. Blades are linear-oblanceolate with sessile or short-petiolate bases. The species is tetraploid ($4x = 36$) (McArthur and Sanderson 1984). Inflorescences develop on floral shoots that die back following fruit dispersal. Flowers are inconspicuous. Staminate flowers develop in glomerate spikes and consist of a four or five lobed perianth and four or five stamens. Pistillate flowers are produced on dense terminal spicate inflorescences. Some flowers are

vestigial. Each flower consists of a pistil enclosed in two obcompressed chordate bracteoles united along their margins except for a minute apical opening. Bracteoles enlarge at maturity to form a papery sac, 9 to 15 mm in diameter with a dorsally winged margin. Fruits are utricles with the papery pericarp free from the seed. Seeds are 1 to 2 mm in diameter. The testa is comprised of a thin, dark brown outer layer and an elastic inner layer. A well-developed embryo with an inferior radicle encircles the perisperm (Hitchcock and others 1964, Shaw and others 1996, 2001).

Range.—Spiny hopsage is widely distributed in the interior Western United States. It occurs east of the Cascade and Sierra Nevada Mountains from central Washington to southern California and eastward from southern Montana to western Colorado and northern Arizona (Hitchcock and others 1964, Welsh and others 1987).

Ecology.—Spiny hopsage occurs at elevations from 160 to 2,130 m in Wyoming big sagebrush (*Artemisia tridentata* Nutt. ssp. *wyomingensis* Beetle & A. Young), salt desert shrub, Mohave Desert, and pinyon-juniper communities receiving 125 to 300 mm of annual precipitation (Welsh and others 1987). It grows on soils that are silty to sandy, frequently high in calcium, and neutral to strongly basic. It also occurs on sand dunes. Spiny hopsage generally occurs in small patches or as scattered plants. Extensive stands are rare. Plants initiate growth in early spring and rapidly complete their vegetative and reproductive cycles prior to entering summer dormancy. They are most tolerant of summer wildfires after summer leaf fall and can resprout from surviving root crowns (Daubenmire 1970). Regeneration is episodic. Germination occurs in early spring. Most seedlings establish beneath canopies of spiny hopsage or other shrubs. Growth of cheatgrass (*Bromus tectorum* L.), a highly competitive annual, however, is favored

by nutrient accumulation beneath spiny hopsage canopies. This can interfere with natural regeneration of native vegetation and result in increased fine fuel accumulation.

Reproduction.—Most plants are dioecious, but the proportion varies among populations. Flowers appear in February to May and are wind pollinated. Fruits ripen in March to June (Shaw and others 2001) and are dispersed by wind, gravity, and insects. Herbage, flower, and fruit production are highly variable among years (Rickard and Warren 1981); many plants fail to produce flowers in dry years (McArthur and Sanderson 1984). During a drought, spiny hopsage in a southern Idaho wildland planting began flowering 4 years after seeding. Incubating debracted utricles at 15 and 5 °C (8 hrs, 16 hrs) or at 15 °C for 14 days provides an estimate of germination. A 30 to 60 day prechill at 3 to 5 °C is required to enhance germination of utricles from northern populations. Shaw and others (2001) reported an average of 1,030,600 debracted utricles/kg. Germination is epigeal.

Growth and Management.—Seedlings develop rapidly if adequate water is available. Mature plants are drought tolerant. Spiny hopsage is considered one of the most palatable shrubs in salt desert shrub communities in spring and early summer. Its use by wildlife and livestock declines rapidly as plants enter summer dormancy. Although fairly tolerant of grazing, some populations receiving heavy use have been replaced by less palatable species (Blaisdell and Holmgren 1984).

Benefits.—Spiny hopsage contributes to diversity on native sites that generally support few other woody species. It provides cover for birds and other small animals, spring and early summer forage for big game and livestock, and soil stabilization on moderate slopes. Litter rich in potassium and other accumulated cations enhances growth and nutrient content of plants growing beneath its canopy (Rickard and Keough 1968). Native Americans ground parched seed of spiny hopsage to prepare pinole flour (Stubbendieck and others 1986).

References

Blaisdell, J.P. and R.C. Holmgren. 1984. Managing Intermountain rangelands—salt desert shrub ranges. General Technical Report INT-163. U.S. Department of Agriculture,

Forest Service, Intermountain Research Station, Ogden, UT. 52 p.

Daubenmire, R. 1970. Steppe vegetation of Washington. Technical Bulletin 62. Washington State University, Pullman, WA. 131 p.

Hitchcock, C.L., A. Cronquist, M. Ownbey, and J.W. Thompson. 1964. Vascular plants of the Pacific Northwest. Part 2. Flora of the Pacific Northwest. University of Washington Press, Seattle, WA. 730 p.

McArthur, E.D. and S.C. Sanderson. 1984. Distribution, systematics, and evolution of the Chenopodiaceae. In: Proceedings—symposium on the biology of *Atriplex* and related chenopods. General Technical Report INT-172. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, UT. p. 14-24.

Rickard, W.H. and R.F. Keough. 1968. Soil-plant relationships of two steppe desert shrubs. *Plant and Soil*. 19:205-212.

Rickard, W.H. and J.L. Warren. 1981. Response of steppe shrubs to the 1977 drought. *Northwest Science*. 55:108-112.

Shaw, N.L., M.R. Haferkamp, and E.G. Hurd. 2001. *Grayia* Hook. & Arn. hopsage. In: F.T. Bonner, and R.G. Nisley, eds. *Woody Plant Seed Manual*. U.S. Department of Agriculture, Forest Service, Washington, D.C. <http://wpsm.net/> 12 p.

Shaw, N.L., E.G. Hurd, and M.R. Haferkamp. 1996. Spiny hopsage fruit and seed morphology. *Journal of Range Management*. 49:551-553.

Stubbendieck, J., S.L. Hatch, and K. Hirsch. 1986. *North American range plants*. University of Nebraska Press, Lincoln. 465 p.

Welsh, S.L., N.D. Atwood, S. Goodrich, and L.C. Higgins, eds. 1987. *A Utah flora*. Great Basin Naturalist Memoirs 9. Brigham Young University, Provo, UT. 894 p.

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