

Coleogyne ramosissima Torr.

blackbrush

Burton K. Pendleton

Dr. Pendleton is a research plant ecologist at the USDA Forest Service's Rocky Mountain Research Station, Forestry Sciences Laboratory, Albuquerque, New Mexico.

Growth habit, occurrence, and use. Blackbrush—*Coleogyne ramosissima* Torr.—grows in the transition zone between warm and cold deserts of southern California, southern Nevada, southern Utah, northern Arizona, and southwestern Colorado. It is found at elevations of 760 to 1,980 m. Ranging from 0.3 to 1.2 m in height, blackbrush forms almost monotypic stands in the lower Mojave–Great Basin ecotone, bounded by creosote bush (*Larrea tridentata* (Sessé & Moc. ex DC. Corille)) communities at low elevations and by juniper (*Juniperus* spp.)–big sagebrush (*Artemisia tridentata* Nutt.) communities at higher elevations. In the eastern part of its range, blackbrush is bordered by Sonoran communities on the south and by big sagebrush, juniper, and mixed shrub communities of the Colorado Plateau in the north. Distribution of blackbrush is limited by soil depth, temperature extremes, and moisture availability.

Blackbrush occurs as a landscape dominant over much of its range and forms a major vegetational component of national and state parks in Utah, Nevada, and California. Blackbrush provides significant year-round forage for desert bighorn sheep (*Ovis canadensis*) and is eaten by mule deer (*Odocoileus hemionus*) in winter. Foliage may be grazed by goats and sheep in spring, but receives minimal use by cattle. Blackbrush provides habitat to many small mammals, and its seeds are eaten by both rodents and birds.

Blackbrush, although a monotypic genus, occurs over a wide geographic and elevational range. Differences in plant size and germination characteristics suggest ecotypic variability. Use of locally adapted seed collection sites should improve chances for successful propagation and establishment.

Flowering and fruiting. Flowers are perfect, apetalous, with yellow sepals 4.5 to 6.5 mm in length; however, rare individuals with 1 to 4 yellow petals can be found in most populations (Welsh and others 1987). Flowering occurs from late March through early May, each population flowering for 2 to 3 weeks (Bowns and West 1976), with individual plants lasting some 7 to 10 days. Flowering is induced by fall and winter rains, and the timing and degree of flowering varies significantly from year to year (Beatley 1974). Ripe achenes are reddish brown in color (figure 1). The fruit is an ovate glabrous achene, somewhat curved in shape, and 4 to 8 mm long (figure 2). Blackbrush is wind-pollinated (Pendleton and Pendleton 1998).

Blackbrush is mast-fruiting: the size of the seedcrop is related to plant resource reserves. The mast crop comprises almost all of the seed production at low-elevation sites, whereas some

seeds are produced in the more mesic higher-elevation sites in all but the driest intermast years. Periods between mast seedcrops often exceed 5 years. Late frosts can reduce or eliminate flowering and fruit production.

Seed collection, cleaning, and storage. The ripe seeds readily separate from the floral cup. Natural seed-fall is correlated with rain showers, which dislodge the achenes from the floral cup. The fruit ripens between late May and the third week of July, depending upon elevation and year-to-year variation. Harvesting is accomplished by beating the branches with a stick or board. Fruits can be collected onto a tarp spread under the shrub or into a basket or hopper (Nord 1962). Seed collections contain a significant amount of debris and cleaning is required. Seeds can be cleaned in a fanning mill or with a gravity separator (Monsen in press). A portion of the achenes are retained within the floral cup. These can be removed with a barley de-bearder or through use of a rubbing board.

Viability of cleaned seeds is generally high, and the incidence of insect damage is extremely low. Twenty-four collections from Utah and Nevada populations ranged in viability from 74 to 98%. Nineteen collections had viability percentages greater than 85%. The number of cleaned seeds per weight averages 60,000/kg (27,000/lb), with a range of 47,500 to 68,000/kg (21,500 to 31,000/lb).

Seeds of blackbrush are long-lived and orthodox in storage behavior; they can be stored in a cool dry location for long periods without loss of viability (table 1). Germination tests on seeds collected in Washington County, Utah, showed no loss in viability after 10 and 15 years. Plants were produced from this seedlot 12 years after collection. However, the vigor of older seeds (10+ years) in field plantings has not been determined.

Germination. Fresh blackbrush seedlots are 68 to 95% dormant and remain dormant in laboratory storage for the first year after collection (table 1). Seed dormancy increases with increasing elevation of the seed source. Five-year-old seeds are essentially nondormant and will readily germinate at cool temperatures (≤ 15 EC) (Pendleton and others 1995). Stratification of fresh seeds for 4 to 6 weeks at 1 EC will produce rapid maximum germination of all collections when seeds are removed from chill and placed at temperatures between 5 and 25 EC. Under field conditions, seeds are nondormant by October, and germination can occur at this time given proper moisture conditions and cool soil temperatures. Field germination typically occurs during the winter and early spring (figure 3) (Meyer and Pendleton 2002).

Nursery and field practice. Container stock can readily be produced from seeds. However, both stratified and unstratified seeds will germinate and emerge over a long period of time (up to 1 year). The most efficient method to synchronize germination and produce uniform-aged plants is to plant germinated seeds. Fresh seeds should be stratified between moist blotter paper for 6 weeks at 1 EC. When seedlots are removed from 1 EC and kept at room temperature, more than 75% will germinate in 24 to 48 hours. Seed collections 3 years old or older, stratified for 3 to 4 weeks, produce similar results. Germinated seeds, with radicals 2 to 10 mm (0.1 to 0.4 in) long, should be planted about 2 cm deep in a well-draining soil mix. However, using a soil medium that retains moisture often leads to problems with damping-off diseases. Under experimental greenhouse conditions, blackbrush responds positively to inoculation with arbuscular mycorrhizal fungi (Pendleton and Warren 1996). Addition of mycorrhizal inoculum to the planting medium should be considered. Optimal growing temperature for seedling growth is about 20 EC (Wallace and others 1970; Wallace and Romney 1972). Warmer conditions result

in slow growth and plants that enter dormancy. Greenhouse-grown plants are susceptible to aphid infestation, but blackbrush is tolerant of standard control methods.

When seeds are not available, plants can be produced from stem cuttings. About half of the cuttings taken from current-year growth (June or September) and treated with 0.8% indole butyric acid (IBA) or commercial rooting hormone produced roots (Hughes and Weglinski 1991).

Outplanted container stock, whether produced from seeds or cuttings, should be protected from herbivory by tree tubes or diamond netting. Container stock has successfully been outplanted at Joshua Tree National Monument in California (Holden 1994) and on a natural-gas pipeline right-of-way in Arches National Park in Utah.

A limited number of attempts to establish blackbrush through seeding have been reported. In general, these attempts have had poor success (Monsen in press). Factors that may have been responsible include low moisture levels during the germination season, lack of sufficient seeds, seeding at a less than optimal time, weed competition, herbivory, and seed theft by rodents. Seed availability is a major limiting factor in blackbrush reestablishment. Mast crops of seeds occur infrequently (5- to 10-year periods) and should be collected and stored for future use. Blackbrush seeds maintain good viability when stored for these time periods.

Insufficient work has been done to firmly determine the seeding rates and seedbed conditions necessary to establish blackbrush stands from seeds, but experimental work and reported successful seedings do offer some guidelines. Rodent-cached seeds are found at depths of 1 to 3 cm (0.7 to 1.2 in), suggesting that conventional seeders should be set to this planting depth. Because blackbrush does exhibit ecotypic variation, locally collected seeds should be used. Seeding should be done in the late summer or fall. Germination and emergence occurs as early as November (Graham 1991) and, more typically, January to March (Bowns and West 1976; Meyer and Pendleton 2002).

Spring seedings have also been attempted. Blackbrush was included in seed mixes used in experimental restoration plantings at the Nevada Test Site in southern Nevada. The seedings were conducted during March 1993. Although no blackbrush seedlings emerged that spring, some seedlings were observed during subsequent springs (USDE 1994). An experimental spring-seeding conducted in southeastern Utah in March 1992 included stratified and unstratified seeds from 4 populations. Twelve and one-half percent of the stratified seeds emerged during spring 1992 versus <1% of unstratified seeds. During spring 1993, an additional 16% of the stratified seeds and 62% of the unstratified seeds emerged. Stratified seeds produced half as many seedlings as unstratified seeds from March 1992 through May 1993 (Pendleton and Meyer 2002). Blackbrush will form a short-term seedbank during drought conditions, but most, if not all, seeds will germinate when moisture is adequate for winter germination.

As with all dryland and desert species, successful establishment from seeds depends on the availability of moisture during the germination and establishment periods. Spring and early summer precipitation is not the norm for Mojave and Sonoran blackbrush communities, a fact that makes blackbrush seeding establishment in these areas difficult, especially in lower-elevation sites.

References

- Beatley JC. 1974. Phenological events and their environmental triggers in Mojave desert ecosystems. *Ecology* 55: 856–863.
- Bowns JE, West NE. 1976. Blackbrush (*Coleogyne ramosissima* Torr.) on southwestern Utah rangelands. Res. Rep. 27. Logan: Utah Agricultural Experiment Station.
- Graham T. 1991. Unpublished data. Moab, UT: USDI Geological Survey, Forest and Range Ecosystem Science Center.
- Holden MK. 1994. Mojave plant information. Newsletter of the Mojave Native Growers Association (Summer): 2–5.
- Hughes H, Weglinski E. 1991. Blackbrush, *Coleogyne ramosissima*, propagation and revegetation of disturbed sites. In: Plumb GE, ed. 15th annual report, University of Wyoming, National Park Service Research Center: 67–74.
- Meyer SE, Pendleton BK. 2002. Regeneration biology of blackbrush (*Coleogyne ramosissima*: Rosaceae): 2. Field germination and establishment experiments [in review].
- Monsen SB. In press. *Coleogyne ramosissima*. In: Monsen SB, Stevens R, eds. Restoring western ranges and wildlands. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station.
- Nord EC. 1962. Bitterbrush seed harvesting: when, where, and how. *Journal of Range Management* 16: 258–260.
- Pendleton BK, Meyer SE. 2002. Unpublished data. Provo, UT: USDA Forest Service, Rocky Mountain Research Station.
- Pendleton BK, Meyer SE. 2002. Regeneration biology of blackbrush (*Coleogyne ramosissima*: Rosaceae): 1. Habitat-correlated variation in seed germination responses [in review].
- Pendleton BK, Meyer SE, Pendleton RL. 1995. Blackbrush biology: insights after three years of a long-term study. In: Roundy BA, McArthur ED, Haley JS, Mann DK, comps. Proceedings, Wildland Shrub and Arid Land Restoration Symposium. Gen. Tech. Rep. INT-GTR-315. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station: 223–227.
- Pendleton BK, Pendleton RL. 1998. Pollination biology of *Coleogyne ramosissima* (Rosaceae). *Southwestern Naturalist* 43: 376–380.
- Pendleton RL, Warren SD. 1996. The effects of cryptobiotic soil crusts and VA mycorrhizal inoculation on growth and nutrient content of five rangeland plant species. In: West NE, ed. Rangelands in a Sustainable Biosphere: Proceedings, 5th International Rangeland Congress. Denver: Society for Range Management: 436–437.
- USDE [United States Department of Energy]. 1994. Unpublished data. Las Vegas, NV.
- Wallace A, Romney EM. 1972. Radioecology and ecophysiology of desert plants at the Nevada test site. Oak Ridge, TN: US Atomic Energy Commission, Technical Information Service.
- Wallace A, Romney EM, Ashcroft RT. 1970. Soil temperature effects on growth of seedlings of some shrub species which grow in the transitional area between the Mojave and Great Basin deserts. *BioScience* 20: 1158–1159.
- Welsh SK, Atwood ND, Goodrich S, Higgins LC, eds. 1993. A Utah flora. 2nd ed. Great Basin Naturalist Memoirs 9. Provo, UT: Brigham Young University. 986 p.

Table 1—*Coleogyne*, blackbrush: germination of nonstratified and stratified* seeds

Seed age	<u>Percent germination†</u>		Collections
	Range	Mean	
Fresh			
Stratified	5–32	17.6	10
Nonstratified	84–98	91.8	10
1 year			
Stratified	0–13	6.5	10
Nonstratified	85–95	92.0	10
5 years			
Nonstratified	82–96	90	6

Source: Pendleton and Meyer (2002).

* Stratification was a moist chilling for 4 weeks at 1 EC.

† Germination tests done on wet blotter paper with a 12-hour alternating temperature regime of 5 and 15 EC; mean percent viability of these collections > 90%.

Figure 1—*Coleogyne ramosissima*, blackbrush: achene (**right**), opened achene (**middle**), and seed (**left**), marks = ?? mm [color photo].

Figure 2—*Coleogyne ramosissima*, blackbrush: achene with seed (drawing courtesy of Dr. Emerencia Hurd, USDA Forest Service, Bloise, ID).

Figure 3—*Coleogyne ramosissima*, blackbrush: seed germination (**left**) and seedling development (**right**) (drawing courtesy of Dr. Emerencia Hurd, USDA Forest Service, Bloise, ID).



