PolygonaceaeCBuckwheat family

Eriogonum Michx.

wild-buckwheat, buckwheatbrush

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Growth habit, occurrence, and uses. The North American genus *Eriogonum*Cwild-buckwheat, also buckwheatbrushCis made up of about 200 species of annual and perennial herbs and shrubs, most of which are found in the West. About half are woody, at least at the base. The habit of the woody species may be either (a) truly shrubby, (b) subshrubby, with annual renewal of upper shoots, or (c) pulvinate (mat-forming), with the woody shoots condensed into an above-ground caudex. The usually evergreen leaves are borne alternately and may be predominantly basal or borne along the stems. There may be whorls of leaves on the flowering stalks. The leaves are usually tomentose, at least below, and the stem nodes are often tomentose as well. The often-flat-topped inflorescences are usually borne above the leafy part of the plant and are conspicuous and characteristic even after seed dispersal.

Most plant communities in the West contain at least 1 species of woody wild-buckwheat (table 1). Some species are widely distributed and of wide ecological amplitude (for example, sulfurflower wild-buckwheat), whereas others are narrowly restricted geographically and often edaphically as well (for example, pretty wild-buckwheat). Wild-buckwheat species are often important pioneer plants after natural disturbance, and their presence may facilitate the establishment of later-successional species. This makes them useful for erosion control and for revegetation of anthropogenically disturbed sites such as mined land and highway rights-of-way (Ratliff 1974; Zamora 1994). Some species are important as browse plants for wild ungulates, particularly in the early spring when their evergreen habit makes them more highly nutritive than many other spring browse species (Tiedemann and Driver 1983; Tiedemann and others 1997). Some wild-buckwheat species are important bee plants. In California, Mojave buckwheatbrush has been rated third in importance for honey production, exceeded only by 2 native *Salvia* species (Kay and others 1977). Many wild-buckwheat species also have tremendous potential as easily grown, drought-tolerant ornamentals. Their interesting forms and leaf textures combined with masses of showy, long-lasting flowers make them excellent candidates for home xeriscapes. Named varieties that have been released are 'Sierra' sulfurflower wild-buckwheat (Stevens and others 1996) and ›Umatilla= snow wild-buckwheat (Tiedemann and others 1997).

Flowering and fruiting. The small, usually perfect flowers of wild-buckwheat are borne in clusters within cuplike or cylindrical involucres that are variously solitary or arrayed in capitate, cymose or paniculate inflorescences. Each flower consists of a perianth with 9 stamens inserted at its base and a superior 1-celled and 1-seeded ovary. The perianth is made up of 6 fused segments in 2

whorls of 3. The ovary ripens in fruit into a usually 3-angled achene. This achene is held more or less tightly within the perianth, depending on the species. For example, in snow wild-buckwheat the achenes fall free of the perianth at dispersal, whreas in Shockley wild-buckwheat the woolly perianth with the achene enclosed is the dispersal unit. The ovule within the seed is anatropous, so that the radicle end is pointing outward and upward. This makes it possible for germination and emergence to take place with the perianth still attached.

Wild-buckwheat species may flower at any time from early spring to fall, depending on species and habitat. Within a given habitat, species may bloom in succession. For example, at mid-elevation in central Utah, cushion wild-buckwheat blooms in spring, followed by James wild-buckwheat in early to midsummer, and finally by lace buckwheatbrush in late summer and fall. The bloom time for any species usually lasts well over a month, and the plants are almost as showy in fruit as in flower. The flowers are insect-pollinated.

Seed collection, cleaning, and storage. The window of opportunity for seed collection of wild-buckwheats is often rather wide, as the fruits usually persist on the plant for 2 to 3 weeks after maturity (Stevens and others 1996). When achenes are mature, the perianths dry and often change color, turning brown or rusty. At this point, the achenes can be harvested by hand-stripping or by beating them into hoppers or other containers. Combine harvesting has proven successful for sulfurflower wild-buckwheat in seed production fields (Stevens and others 1996). The harvested material will include achenes, perianths, involucres, and inflorescence branches. After the material is dried thoroughly, it may be threshed in a barley de-bearder and cleaned with a fanning mill. Species with tightly held achenes may require hand-rubbing through screens or on a rubbing board, which is also an alternative cleaning method for small seedlots of any species. The material should not be handled too roughly, as the radicle end of the achene is often slender and easily damaged. Achene weights vary both among and within species but are usually in the range of 350 to 1,360/g (10,000 to 39,000/oz) (table 2). Seed quality is also variable (table 2).

There are few published reports of viability evaluation beyond germination percentages obtained without pretreatment, which may underestimate viability if there is a dormant fraction. Stevens and others (1996) report that viabilities of >90% may be expected from sulfurflower and Wyeth wild-buckwheats in an agronomic setting if seeds are harvested when fully mature; these values are comparable to those for wild-collected lots of many species (table 2). Insects may damage 10 to 35% of the fruits prior to harvest, but damaged seeds are normally eliminated in cleaning. Post-harvest damage from insect infestations is also possible (Stevens and others 1996). There is little information on maintenance of viability during storage for species of wild-buckwheat. Stevens and others (1996) report high viability for sulfurflower and Wyeth wild-buckwheats during 10 to 15 years in warehouse storage, which would indicate orthodox storage behavior. Other species are perhaps comparable.

Seed germination and testing. Seedlots of many species of wild-buckwheats contain at least a fraction that will germinate without any pretreatment (tables 2 and 3) (Young 1989). The size of this fraction depends on species and on the particular lot involved. Stevens and others (1996) report that seeds of sulfurflower and Wyeth wild-buckwheats lose dormancy during short periods of dry storage, and Mojave buckwheatbrush seeds are also reported to dry after-ripen (Kay and others 1977). Dormant seeds of most species we have examined lose dormancy during chilling at 1 °C for periods of 8 to 12 weeks (table 3).

To date there are no formal procedures for evaluating the seed quality of wild-buckwheat species, and tetrazolium (TZ) staining is probably the procedure most commonly employed. To evaluate using TZ, achenes are soaked overnight in water, clipped through both pericarp and seed coat at the cotyledon end (the wide end or hilum), and placed in 1% TZ solution for several hours at room temperature. Achenes are bisected longitudinally for evaluation (Belcher 1985).

Field seeding and nursery practice. Wild-buckwheats are generally readily established from direct seeding (Ratliff 1974; Stevens and others 1996; Tiedemann and Driver 1983; Zamora 1994). They establish best when seeded at a depth of 2 to 5 mm (1/16 to 3/16 in), either by drilling or by broadcasting followed by covering (for example, raking). Seeding should take place before the season of maximum precipitation, which is generally fall or early winter in northern rainfall regions and midsummer in southern rainfall regions. Most wild-buckwheats are early seral and do not compete well with heavy stands of perennial grasses. Wild-buckwheats planted for field seed production are reported to reach 30 to 50% of maximum production, 200 to 400 kg/ha (180 to 360/ac), the second year after planting (Stevens and others 1996).

Most species of wild-buckwheat are also easily propagated in a nursery setting. Shaw (1984) reported that Wyeth wild-buckwheat may be successfully produced as 1+0 bareroot stock. Because of the taprooted habit, plants must be lifted carefully. Other woody wild-buckwheats could probably be produced as bareroot stock, but no published information is available. Wild-buckwheats may also be produced as container stock; book planters or tube containers such as those used for producing conifer seedlings are most appropriate. Nondormant lots may be direct-sown, whereas seedlots requiring chilling may be sown as chilled seed or as young germlings (Landis and Simonich 1984). Seedlings of many species grow rapidly and should not be held in small containers for more than a few months. Many species flower the first year and may even form flowering stalks while still in small tube containers.

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Figure 1C*Eriogonum fasciculatum,* Mojave wild-buckwheat: achene in calyx (left) and achene with calyx (right), × 12.

Figure 2C*Eriogonum fasciculatum,* Mojave wild-buckwheat: longitudinal section through a seed excised from an achene, × 30.

Figure 3C*Eriogonum fasciculatum,* Mojave wild-buckwheat: very young seedling (left) and older seedling (right).

Table 1C *Eriogonum*, wild-buckwheat: habit, habitat, and geographic range

Species	Common name*	Habitat	Range
SHRUBS			
***E. corymbosum* Benth.**	**lace buckwheatbrush,** buckwheatbrush, crisp-leaf buckwheat	Desert shrub, pinyon juniper, mostly on shales	Colorado Plateau, Uinta Basin, & adjacent areas
***E. fasciculatum* Benth.**	**Mojave buckwheatbrush,** California buckwheatbrush, flat-top buckwheatbrush	Warm desert shrub, coastal sage scrub, chaparral, pinyon-juniper	Mojave & Colorado Deserts & coastal & cismontane S California
***E. heermannii* Dur. & Hilg.**	**Heermann buckwheatbrush,** molecule model plant	Warm desert shrub, mostly on rock outcrops	Mojave Desert
SUBSHRUBS			
***E. brevicaule* Nutt.**	**shortstem wild-buckwheat**	Open, barren hills, mountain brush to alpine	Central Rocky Mtns of Wyoming, Utah & Idaho
***E. heracleoides* Nutt.**	**Wyeth wild-buckwheat,** parsnipflower buckwheat	SagebrushBgrassland to aspen & Douglas-fir	N Rocky Mtns from BC to central Utah
***E. jamesii* Benth.**	**James wild-buckwheat**	Desert shrub to mountain brush & ponderosa pine	S Rocky Mtns S into N Mexico
***E. niveum* Dougl. ex Benth.**	**snow wild-buckwheat**, snow eriogonum	SagebrushBgrassland	Columbia River Plateau
***E. umbellatum* Torr.**	**sulfurflower wild-buckwheat,** sulfur wildbuckwheat	SagebrushBgrassland to spruceBfir	Widespread in W North America
PULVINATE/ MAT-FORMING			
***E. bicolo*r M.E. Jones**	**pretty buckwheatbrush**	Cold desert shrub, on Mancos Shale	Central Utah
***E. ovalifolium* Nutt.**	**cushion wild-buckwheat,** roundleaf buckwheat	Wide range, from cold desert to alpine	Widespread, W North America
***E. shockleyi* S. Wats.**	**Shockley wild-buckwheat,**	Desert shrub to	Idaho & Colorado to SE

mat buckwheat	pinyonBjuniper	California, Arizona, & New Mexico

Source: Meyer and Paulsen (2000).
Note: The genus *Eriogonum* is not that of the true, domesticated buckwheat, hence the common names of wild-buckwheat and buckwheatbrush.

Table 2C*Eriogonum,* wild-buckwheat: achene weights and typical viability percentages

	Achenes/weight		Viability	
Species	/g	/lb	%	Test
SHRUBS				
E. corymbosum	900	410,000	93	Post-chilling cut test
	2,000	900,000	C	C
E. fasciculatum	1,330	600,000	4B34	Germination %, no pretreatment
	520B1,085	236,000B490,000	20B46	Germination %, no pretreatment
E. heermannii	660	300,000	95	Post-chilling cut test
SUBSHRUBS				
E. brevicaule	700	320,000	84%	Post-chilling cut test
E. heracleoides	350	160,000	95%	Post-chilling cut test
	310	141,000	87%	Post-chilling cut test
E. jamesii	350	160,000	C	C
E. niveum	1,290B1,360	585,000B620,000	52B72%	Germination %; no pretreatment
E. umbellatum	470	213,000	86%	Post-chilling cut test
	265	120,000	C	C
PULVINATE/ MAT-FORMING				
*E. bicolo*r	960	436,000	47%	Post-chilling cut test
E. ovalifolium	990	450,000	95%	Post-chilling cut test
E. shockleyi	750	340,000	86%	Post-chilling cut test

Sources: Belcher (1985), Kay and others (1977), Meyer and Paulsen (2000), Stevens and others (1996), Tiedemann and Driver (1983).

* Post-chilling cut tests (AOSA 1996) are considered accurate for recently harvested seedlots; however, tetrazolium staining (TZ) is required for seedlots stored for more than 2 years.

Table 3C*Eriogonum,* wild-buckwheat: germination percentages

		Germination* (% of total viable seed)				
Species	Samples	No chill	4 weeks	8 weeks	12 weeks	16 weeks
E. brevicaule	2	3	28	65	86	96
E. corymbosum	3	28	79	100	100	100
E. heracleoides	3	4	11	30	55	77
E. jamesii	2	54	79	91	94	100
E. ovalifolium	2	22	74	98	98	100
E. umbellatum	4	7	30	74	99	100

Source: Meyer and Paulsen (2000).

* Germination percentage determined after 0 to 16 weeks of chilling at 1 °C followed by 4 weeks of incubation at 10/20 °C