RosaceaeCRose family

Chamaebatiaria millefolium (Torr.) Maxim.

fernbush

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Other common names. desert sweet, fernbush, fern-bush, or desert-sweet.

Synonyms. *Spiraea millefolium* Torr., *Sorbaria millefolium* Focke, *Basilima millefolium* Greene, *Chamaebatiaria glutinosa* Rydb., and *Spiraea glutinosa* Fedde (Davis 1952; Hitchcock and others 1961; Peck 1961; Young and Young 1986).

FernbushC*Chamaebatiaria millefolium* (Torr.) Maxim.)Cis the only species in its genus and is endemic to the Great Basin, Colorado Plateau, and adjacent areas of the western United States. Fernbush is an upright, generally multistemmed, sweetly aromatic shrub 0.3 to 2 m tall. The bark of young branches is brown and becomes smooth and gray with age. Leaves are leathery, alternate, simple, bipinnatisect, stipulate, and more or less clustered near the ends of the branches. Foliage and young branches are viscid and pubescent, with simple and stellate hairs that are sharp-pointed or glandular-capitate. Populations in New Mexico are reportedly evergreen (Phillips 1949), whereas northern populations are largely deciduous, retaining a few leaves near the branch tips through winter and initiating leaf development in early spring (Hitchcock and others 1961; Kirkwood 1930).

Fernbush is distributed east of the Cascade and Sierra Nevada Mountains from Deschutes Co., Oregon, to southern California and eastward across southern Oregon and Idaho, Nevada, Utah, and northern Arizona and New Mexico (Hitchcock and others 1961; Phillips 1949; Welsh and others 1987; Young and Young 1992). Fernbush is often present as an early successional species on cinder cones and basalt lava flows but is also found on soils derived from limestone and granite (Eggler 1941; Everett 1957; Merkle 1952). It occurs in cracks and fissures of rock outcrops and on well-drained soils of dry, rocky, gravelly canyons and mountain slopes at elevations ranging from 900 to 3,400 m (Albee and others 1988; Hickman 1993). Fernbush grows in isolated populations or as an associated species in sagebrush scrub (*Artemisia* spp.), sagebrush, northern juniper, mountain brush, aspen, limber pine, ponderosa pine, spruceBfir, and western bristlecone pine communities (Hickman 1993; Munz and Keck 1959; Welsh and others 1987).

Fernbush is occasionally browsed by mule deer (*Odocoileus hemionus*), sheep, and goats, but only very little by cattle (Mozingo 1987; van Dersal 1938). Native Americans used a tea made from its leaves for treatment of stomachaches (Mozingo 1987).

Unlike its namesake genusC*Chamaebatia* Benth., mountain miseryCfernbush is not nodulated by nitrogen-fixing actinomycetes (McArthur and Sanderson 1985). Plants are cyanogenic

(Fikenscher and others 1981). The species is a very rare host of juniper mistletoe *(Phoradendron juniperinum* Engelm.) (Hawksworth and Mathiasen 1978).

First cultivated in 1878 (Rehder 1940), fernbush has long been recognized as an attractive ornamental because of its profuse and conspicuous inflorescences of white- to cream-colored flowers, long flowering season, and aromatic, fernlike foliage (Bailey 1902; Hitchcock and others 1961; Phillips 1949; Young and Young 1986). It is used effectively in mass plantings, xeriscapes, screens, and hedges when planted in full sun. Specimen plants provide color and texture accents (Phillips 1949).

Genetic variation, hybridization, and origin. McArthur (1984) and McArthur and others (1983) described *Chamaebatiaria* and other monotypic western North American genera of the Rosaceae as showing little variation compared to larger genera such as *Rosa* (rose) or *Cercocarpus* (mountain-mahogany). Typical of shrubby western North American members of subfamily Spiraeoideae, fernbush has x = n = 9 chromosomes (McArthur and Sanderson 1985). Hybridization of fernbush with other species has not been reported.

Chamaebatiaria (subfamily Spiraeoideae) was named for its morphologic resemblance to *Chamaebatia* (subfamily Rosoideae). McArthur and Sanderson (1985) suggest that shrubby Spiraeoideae and Rosoideae of western North America may be rather closely related based on the similarities in morphologic and other characteristics of the 2 groups. Wolfe and Schorn (1989) and Wolfe and Wehr (1988) discuss evidence from Paleogene montane floras of the Rocky Mountains indicating the possible divergence of *Chamaebatiaria* and *Chamaebatia* from a common Eocene ancestor. They suggest both lines adapted to progressively drier post-Eocene conditions than the mesic coniferous forest environment inhabited by the ancestor.

Flowering and fruiting. The showy, white, insect-pollinated flowers develop in profuse, terminal, leafy-bracteate panicles up to 20 cm in length (figure 1). Flowers are complete, regular, and about 0.8 to 1.5 cm in diameter. The calyx consists of 5 persistent green sepals. A glandular disk lining the hypanthium bears 5 petals and numerous stamens. Pistils are 5 (rarely 4), ovaries superior, and styles free. The ovaries are more or less connate below in flower, but separate in fruit. The pubescent, coriaceous, few-seeded follicles dehisce along the ventral suture and upper half of the dorsal suture (figure 2). Seeds are erect, yellowish to brownish, linear to narrowly fusiform, and somewhat flattened at each end (figures 2 and 3). The outer layer of the soft thin seedcoat is ridged, giving the body of the seed a 3-angled appearance; the inner layer is thin and translucent. A fleshy endosperm layer adheres to the seedcoat. The embryo is linear-oblong with 2 flat cotyledons and occupies the central portion of the seed (figure 3). Germination is epigeal (figure 4) (Hickman 1993; Hitchcock and others 1961; Hurd 1995; Kirkwood 1930; Welch and others 1987).

Irrigated plants may begin flowering during the second growing season (Shaw 1992B95). Plants flower from June to September (Hitchcock and others 1961; Phillips 1949) with irrigation prolonging the flowering season (Shaw 1995). Fruits ripen from August to October.

Collection of fruits, seed extraction, cleaning, and storage. Fruits are harvested by clipping or stripping inflorescences when they are dry and brown, but before follicles open. Seeds can also be collected by briskly shaking or beating the inflorescences once the follicles begin dehiscing. Most follicles open during air drying, releasing the seeds. Debris may then be removed with screens or a seed blower. Larger collections may be cleaned using air-screen machines. For 2 Idaho seed lots produced with irrigation, the number of seeds per seed weight averaged

3,713,473/kg (1,684,420/lb) (Hurd 1995). Storage requirements and seed longevity have not been determined, but the seeds are probably orthodox in storage behavior.

Pregermination treatments and germination and viability tests. Fresh seeds are nondormant whereas stored seeds require 1 to 3 months of prechill to relieve dormancy (McDorman 1994; Phillips 1949; Young and Young 1986, 1992). The optimum temperature range for germination of southwestern populations is 18 to 26 ˚C (Phillips 1949).

Fernbush germination has received little study. Shaw (1995) examined the germination of 3 seed collections. Nampa, ID, and Sun Valley, ID, collections were harvested from irrigated plantings of seeds from a single unknown source. The third collection was from an irrigated Sante Fe, NM, planting of seed from a western New Mexico source. All 3 collections were cleaned and held in dry storage for 4 to 5 months before testing. Total germination percentage of the Sante Fe, NM, and Sun Valley, ID, seed collections, (but not the Nampa, ID, seed collection) was greater when untreated seeds were incubated at 20/10 ˚C (8 hours/16 hours) than at 15 ˚C for 28 days. A 28-day wet prechill at 3 to 5 ˚C (table 1) improved the total germination percentage of all seed collections when they were subsequently incubated at either 15 ˚C or 20/10 ˚C for 28 days.

Viability of fernbush seeds may be tested as follows: soak seeds in water at room temperature for 1 hour. Drain the water away. Make a horizontal slit across the center of each seed without cutting it in half. Submerge seeds in a 1% 2,3,5-triphenyl tetrazolium chloride solution for 6 hours at room temperature. Evaluate as described by Grabe (1970) for seeds of dicotyledonous species other than legumes. Embryos may be read in place. The endosperm of viable seeds is living and will stain red (Hurd 1995).

Nursery practice. Nursery plantings should be made in late fall or early winter. As an alternative, artificially wet-prechilled seeds may be planted in early spring. Fernbush seeds are small and must be sown on the soil surface or with a very light covering of sand or soil. Seedlings develop rapidly with irrigation and reach an adequate size for lifting after 1 growing season (Shaw 1995).

Seeds for production of container stock should be wet prechilled before planting. Survival of germinants moved from seeding flats to production containers is low (Everett 1957). Better establishment is obtained by sowing seed directly into containers and thinning to 1 seedling/container. Developing seedlings are easily moved from small to larger containers (Phillips 1949). Seedlings should be grown in a well-drained medium.

Direct seeding. Seeds should be planted in fall or early winter. Seedlings emerge in spring from seed naturally dispersed in late summer on rough or mulched soil surfaces (Mackie 1995; McDorman 1994; Shaw 1995). Naturally occurring seedlings generally establish where vegetative competition is limited (Shaw 1995).

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Table 1C *Chamaebatiaria millefolium,* fernbush: germination test conditions and results

Source	Elevation (m)	Origin	Cold, wet prechill (days)*	% Germination 15 °C IncubH	% Germination 20/10 °C IncubH	Seed fill (%)	Seed viability (%)
Nampa, ID	831	Unknown'	0	3	1	100	96
			28	72	65		
Sun Valley, ID	1,773	Unknown'	0	12	20	100	86
			28	33	44		
Santa Fe, NM	2,134	W New Mexico	0	9	22	100	85
			28	58	60		

*

Prechill temperature = 3 to 5 °C.

H Incubation time = 28 days; seeds were exposed to 8 hours of light (PAR = 350 µM m/sec) each day with temperatures of either constant 15 °C or 8 hours of 20 °C and 16 hours of 10 °C. In the alternating temperature regime, plants were exposed to light during the high-temperature period.

I Based on the percentage of viable seeds to germinate normally.

' The Nampa and Sun Valley, ID, plants were grown from the same unknown seed source.