Rhamnaceae Buckthorn family

*Frangula* P. Mill.

buckthorn

Andrew Youngblood

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**Growth habit, occurrence, and use.** The buckthorn genus *Frangula* and the closely related genus *Rhamnus* have until recently been treated as a single genus, *Rhamnus*; consisting of more than 125 species of evergreen or deciduous shrubs and trees with alternate branches and simple leaves with prominent pinnate veins (Hickman 1993). However, Kartesz and Gandhi (1994) used floral morphology and leaf venation, as well as anatomical features of xylem vessels to support segregation of *Frangula* (PLANTS 2001). Under their treatment, *Frangula* species lack winter bud scales, the pinnate leaf nerves are almost straight rather than arcuate, and thorns are absent. Both *Rhamnus* and *Frangula* are native to the temperate region of North America, Europe, and Asia and also occur in the Neotropics and southern Africa as shrubs and trees up to 1.5 m dbh and over 60 m tall (Johnston and Johnston 1978; Krüssmann 1985). The common name, buckthorn, is probably misapplied and is based on Europe species of *Rhamnus* that are thorny (Mozingo 1987; USDA 1937). At least 16 species and subspecies are distributed within the United States (table 1).

Glossy buckthorn, which is native to Europe, North Africa, and western Europe, also is naturalized in northeastern and central United States and southern Canada, where it grows to a height of 6 m and is often used for hedges. The fruits are eaten by American robins (*Turdus migratorius*), Bohemian waxwings (*Bombycilla garrulus*), cedar waxwings (*B. cedrorum*), rose-breasted grosbeaks (*Pheucticus ludovicianus*), and starlings (*Sturnus vulgaris*). Dispersal of seeds by birds and subsequent germination and establishment represents a rapidly increasing problem; for example, this non-native invasive shrub has replaced natural open and semi-open wetland communities in southern Ontario (Catling and Porebski 1994).

Beechleaf buckthorn is a low-growing shrub with dark green leaves found in rock crevices, hanging gardens, and desert shrub communities in the Southwest (Welsh and others 1990).

Within North America, the largest assemblage of *Frangula* species in the genus is in the West, especially California and northern Mexico. Six subspecies of California buckthorn are recognized (Kartesz and Gandhi 1994), yet the extent to which published seed handling characteristics apply equally within this complex is unknown. California buckthorn is an evergreen shrub that reaches maximum heights of 2 to 6 m. The fruits were gathered historically by Native Americans for culinary as well as medicinal purposes and are a preferred food of birds and bears (Conrad 1987). *Frangula californica* var. *californica*, which was introduced on Mauna Kea on the island of Hawaii in 1940 to provide food for introduced game birds, is now well established and shows signs of becoming an invasive pest (Conrad 1996). Regeneration of

Frangula---1
California buckthorn is primarily by stump-sprouting after fire (Keeley 1981; Martin 1982; Conrad 1987).

Carolina buckthorn, native to eastern North American, is a deciduous shrub or small tree with maximum height of about 10 m. It often occurs over basic rock in moist deciduous woods (Radford and others 1968).

Cascara, or Pursh buckthorn, native to the coniferous forest zone in northwestern United States and British Columbia, is a deciduous tall shrub or tree that grows to a height of 12 m. The bark of cascara is harvested for its cathartic properties and the retail value of the 1977 bark harvest was $75 million. According to Heiser (1993), cascara is northern North America’s principal wild plant in terms of the number of drug products and the cascara derivative is considered the world’s most widely used cathartic. The Spanish common name *cascara sagrada* means *Aholy bark* and may be derived from its use by Franciscan missionaries in California (Arno and Hammerly 1977). The low-growing and spreading variety *arbucula* occurs on serpentine slopes in the Wenatchee Mountains of Washington and may tolerate open and dry sites (Kruckeberg 1982). Cascara regenerates primarily by stump-sprouting after fire (Leege 1979). It is an alternate host for crown rust *Puccinia coronata* Corda which causes yellow leaf spot in the aecial stage; economic damage by crown rust is confined to heavy damage in fields of oats grown in close proximity to plant communities containing cascara (Ziller 1974).

Red buckthorn is a low-growing deciduous shrub with reddish branchlets found on dry open slopes in chaparral and montane zones of California and Nevada.

The earliest know cultivation of species native to North America includes 1727 for Carolina buckthorn and the mid-1800’s for California buckthorn and cascara (Krüssmann 1985).

**Flowering and fruiting.** The inconspicuous perfect flowers are either borne in small umbels or fascicles or are solitary. The flowers are bisexual and mostly 5-merous. White to greenish white petals (brown in beechleaf buckthorn) are equal to the sepals in number and alternating, or lacking. There are 5 stamens. The ovary has 2 or 3 cells. When Orme and Leege (1980) followed phenological changes in cascara in northern Idaho for 3 years, they found that flowering occurred in late May to mid-June and that fruits began developing 1 week later.

Fruits are drupaceous, the berrylike pulpy mesocarp embedding 2 or 3 smooth-sided stones (Johnston and Johnston 1978; Kartesz and Gandhi 1994). Fruits, which are generally black or reddish black, average 5 mm in diameter for Carolina buckthorn, 10 mm for cascara, 12 mm for red buckthorn, and up to 15 mm for California buckthorn. Dispersal is mostly by birds. Cascara begins to produce fruit when it is 5 to 7 years old (Hubbard 1974); comparable information for other species is lacking. Good seedcrops for all species are likely to occur in most years.

**Collection, extraction, and storage.** Fruits can be collected from the shrubs and trees when ripe; collecting fruits about 2 weeks before they are fully ripe may limit losses to birds (Hubbard 1974). Fruits can be run through a macerater with water soon after collecting and full seeds can be cleaned of other material by repeated decantation (Radwan 1976). Data on yield of seeds are scant and based on limited samples: yields are about 11 seeds/g (312/oz) for California buckthorn and 6 seeds/g (170/oz) for cascara (Piper 1986).

Seed storage guidelines have not been developed for *Frangula* species, but it appears that seeds can be stored adequately for several years if they are kept in sealed containers at low temperatures (Hubbard 1974). Seeds of California buckthorn are relatively short lived (< 9
months) if allowed to dry to room conditions (Keeley 1987).

**Pregemination treatment.** Fresh seeds of California buckthorn apparently have no innate germination requirements (Hubbard 1974; Keeley 1981, 1987). During laboratory tests involving 1 month of stratification at 5 EC, however, more than 75% of the total germination occurred after 7 days of incubation at 23 EC in the dark. Germination increased to 90% when seeds were incubated with an initial heat treatment of 100 EC for 5 minutes and then placed on soil containing 0.5 g (1.4 oz) powdered charred wood (charate) of the chaparral shrub chamisia, or greasewood *Adenostoma fasciculatum* Hook. & Arn. This treatment is designed to simulate conditions after a chaparral fire (Keeley 1987). Seeds of cascara germinated best when stratified in the dark for 112 days at 5 EC, then incubated for 28 days at 30 EC for 10 hours under cool-white fluorescent light followed by 14 hours of darkness at 20 EC (Radwan 1976). Dormant seeds responded favorable to applications of 500 ppm of potassium gibberellate (K-GA₃) when light was available during germination and may represent a practical alternative to artificial cold stratification for breaking dormancy (Radwan 1976). Clean seeds of glossy buckthorn have been treated with sulfuric acid (H₂SO₄) for 20 minutes to break dormancy; the acid treatment should be done carefully; soaking seeds of other buckthorns was harmful (Hubbard 1974).

There are no officially prescribed germination tests procedures for buckthorns. Viability tests by tetrazolium staining have been suggested for European species (Enescu 1991). Seeds should be soaked in water for 24 hours, cracked open in a vise, then re-soaked overnight. Staining should take place in a 1% tetrazolium solution for 24 hours at 30 EC (Dirr 1990). To be considered viable, the embryos must be completely stained, with the exception of the extreme third of the distal ends of the radicle and cotyledons.

**Nursery and field practice.** Detailed nursery techniques have not been developed for most *Frangula* species. The available information suggests that for most of the species, the seeds should be sown in the spring at a depth of 10 to 40 mm (0.4 to 1.6 in) after they have been treated to break dormancy (Hubbard 1974). In contrast, cascara seeds may germinate faster and produce more vigorous plants when seeds are sown at a depth of 3 mm (0.1 in) (Radwan 1976). Germination is epigeal, with thick, straight cotyledons (Kartesz and Gandhi 1994). Cascara has also been propagated by cuttings, and glossy buckthorn by grafting (Hubbard 1974).

References


Figure 1B *Frangula purshiana*, cascara: fruit, H 4.

[same as Handbook 450, 1974, p. 705, fig. 1]

Figure 2B *Frangula*, buckthorn: seeds, H 4.

[same as Handbook 450, 1974, p. 705, fig. 2, except do not include *R. alnifolia, R. davurica*] Label as follows: *F. alnus* glossy buckthorn; *F. californica* California buckthorn; *F. purshiana* cascara

Figure 3B *Frangula californica*, California buckthorn: longitudinal section through a seed, H 10.

[same as Handbook 450, 1974, p. 707, fig. 4].
<table>
<thead>
<tr>
<th>Scientific name &amp; synonym(s)</th>
<th>Common name</th>
<th>Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Rhamnus frangula</em> L.</td>
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<tr>
<td><em>R. frangula</em> var. <em>angustifolia</em> Loud.</td>
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<tr>
<td><em>F. betulifolia</em> (Greene) V. Grub. ssp. <em>betulifolia</em></td>
<td>beechleaf buckthorn, birchleaf buckthorn</td>
<td>Nevada, Utah, Arizona, New Mexico, Texas, &amp; Mexico</td>
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<td><em>R. betulifolia</em> Greene</td>
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<tr>
<td><em>F. betulifolia</em> (Greene) V. Grub. ssp. <em>obovata</em> (Kearney &amp; Peebles) Kartesz &amp; Gandhi</td>
<td>obovate buckthorn</td>
<td>Nevada, Arizona, &amp; New Mexico</td>
</tr>
<tr>
<td><em>F. californica</em> (Eschsch.) Gray ssp. <em>californica</em></td>
<td>California buckthorn</td>
<td>California; naturalized on the Island of Hawaii</td>
</tr>
<tr>
<td><em>R. californica</em> Eschsch.</td>
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<tr>
<td><em>F. californica</em> (Eschsch.) Gray ssp. <em>crassifolia</em> (Jepson) Kartesz &amp; Gandhi</td>
<td>California buckthorn</td>
<td>California</td>
</tr>
<tr>
<td><em>R. californica</em> Eschsch. ssp. <em>cuspidata</em> (Greene) Kartesz &amp; Gandhi</td>
<td>California buckthorn</td>
<td>California</td>
</tr>
<tr>
<td><em>R. tomentella</em> Benth. ssp. <em>cuspidata</em> (Greene) C.B. Wolf</td>
<td>California buckthorn</td>
<td>Serpentine soils of SW Oregon &amp; N California</td>
</tr>
<tr>
<td><em>F. californica</em> (Eschsch.) Gray ssp. <em>occidentalis</em> (T.J. Howell) Kartesz &amp; Gandhi</td>
<td>California buckthorn</td>
<td>California</td>
</tr>
<tr>
<td><em>R. californica</em> (Eschsch.) ssp. <em>occidentalis</em> (J. Howell) C.B. Wolf</td>
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</tr>
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<td>California buckthorn</td>
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</tr>
<tr>
<td><em>F. californica</em> (Eschsch.) Gray ssp. <em>tomentella</em> (Benth.) Kartesz &amp; Gandhi</td>
<td>California buckthorn</td>
<td>California</td>
</tr>
<tr>
<td><em>R. californica</em> Eschsch. ssp. <em>tomentella</em> (Benth.) C.B. Wolf</td>
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<tr>
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<td>California buckthorn</td>
<td>California</td>
</tr>
<tr>
<td><em>F. californica</em> (Eschsch.) Gray ssp. <em>ursina</em> (Benth.) Kartesz &amp; Gandhi</td>
<td>California buckthorn</td>
<td>California, Nevada, Arizona, &amp; New Mexico</td>
</tr>
</tbody>
</table>
**F. caroliniana** (Walt.) Gray
*R. caroliniana* Walt.
*R. caroliniana* Walt. var. *mollis* Fern.

**Carolina buckthorn,** yellow buckthorn, yellowwood
New Jersey S to Florida, W to Missouri, Kentucky, Arkansas, & Texas

**F. purshiana** (DC.) Cooper
*R. purshiana* DC.

**Cascara, cascara sagrada,** Pursh buckthorn, chittam, coffeetree
British Columbia, Washington, Oregon, N California, also N Idaho & W Montana

**F. rubra** (Greene) V. Grub. ssp. *modocensis* (C.B. Wolf) Kartesz & Gandhi
*R. rubra* Greene ssp. *modocensis* C.B. Wolf

**Modoc buckthorn**
California

**F. rubra** (Greene) V. Grub. ssp. *nevadensis* (A. Nels.) Kartesz & Gandhi
*R. rubra* Greene ssp. *nevadensis* (A. Nels) C.B. Wolf

**Nevada buckthorn**
Nevada

**F. rubra** (Greene) V. Grub. ssp. *obtusissima* (Greene) Kartesz & Gandhi
*R. rubra* Greene ssp. *obtusissima* (Greene) C.B. Wolf

**Obtuse buckthorn**
California & Nevada

**F. rubra** (Greene) V. Grub. ssp. *rubra*  
*R. rubra* Greene

**Red buckthorn,** Sierra buckthorn, coffeeberry
California & Nevada

**F. rubra** (Greene) V. Grub. ssp. *yosemitana* (C.B. Wolf) Kartesz & Gandhi
*R. rubra* Greene ssp. *yosemitana* C.B. Wolf

**Yosemite buckthorn**
California