BerberidaceaeCBarberry family

Berberis L.

barberry

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Growth habit, occurrence, and use. The barberries include about 500 species of spiny or unarmed, evergreen or deciduous shrubs (rarely small trees) native to Asia, Europe, North Africa, and to North, Central, and South America (Ahrendt 1961). Some authorities consider that the genus *Mahonia,* consisting of about 100 species that closely resemble the barberries, should be a section of *Berberis* (Hitchcock and others 1964), whereas others consider *Mahonia* to be a separate genus (Ahrendt 1961). The USDA plant nomenclature system (USDA NRCS 1999) separates them into 2 separate genera, and that is the authority used for this manual (table 1). Thus, *Mahonia* is treated separately in a later chapter. The barberry genus is essentially diploid, with 2n = 28 (Cadic 1992). Many interspecific hybrids are known, such as those between Japanese and common barberries (*B.* × *ottawensis* Scheid.), and Japanese barberry and Julian berberis (Rehder 1940). There area also include over 60 crosses within *Berberis*, 6 in *Mahonia* , and 4 AMahoberberis@ hybrids (Ahrendt 1961).

Several barberry species are grown as ornamentals because of their handsome foliage and often attractive flowers or fruits (Bailey 1939; Rehder 1940; Schlosser and others 1992). Barberries also are of value for wildlife food (Decker and others 1991), cover, and erosion-control planting. However, the common barberry, as an invasive exotic, is considered by many to be a noxious weed (Mack 1991). The names, heights, habits, and ripe fruit colors of some common species are listed in table 1.

A yellow dye can be extracted from barberry roots, and the plants contain many alkaloids (Hussain and others 1984; Ikram 1975; Kostalova and others 1986; Pitea and others 1972). Some of those alkaloids (for example, berberine and jatrorrhizine) are used for medicinal purposes (Ikram 1975; Liu and others 1991). Other barberry extracts may significantly reduce infection with fireblightC*Erwinia amylovora* (Burrill) Winslow et al.Cinfection when applied as bactericides (Mosch and Zeller 1989). Three species that have potential value for conservation planting are listed in table 2. Many of the barberries are alternate hosts for the black stem rustC*Puccinia graminis* Pers:Pers.Cof grains, but common barberry is the most susceptible species (LHBH 1976). Some species (for example, Korean barberry and Japanese barberry) are resistant (Rehder 1940).

Flowering and fruiting. Perfect yellow flowers are borne in the spring in racemes, panicles, umbels, fascicles, or individually, depending on the species (Ahrendt 1961). Stamens are contact-sensitive, and they respond to a tactile stimulus by snapping toward the stigma (Fleurat-Lessard and Millet 1984; Lebuhn and Anderson 1994; Millet 1976, 1977). Fruit set and fruit weight are improved by spraying with 200 ppm gibberellic acid (GA3) at full bloom and again 15 and 30 days later (Malasi and others 1989). The fruit is a berry with one to several seeds (figure 1). Late-fruiting

plants often contain more seeds per berry than early-fruiting plants in common barberry; and late-fruiting, large-berried plants may disperse seeds more efficiently than early-fruiting plants with smaller berries (Obeso 1989). Predation by fly larvae (diptera: Tripetidae) tends to increase with increasing number of seeds in the fruit, however, and individual developing seeds have a greater average probability of escaping predation when they occur singly in fruits (Herrera 1984). Fruits having the least number of seeds contain the highest amounts of edible pericarp (Malasi and Paliwal 1984). Starch is not present, but polyfructans are characteristic of barberry fruits (Srepel and Mijatovic 1975). Soluble sugar and anthocyan levels increase while those of chlorophyll and berberine decrease during the ripening of those fruits (Chandra and Todaria 1983).

Good fruit crops are borne almost annually. They ripen in the summer and autumn (table 3). In New Zealand, the proportion of mature flowers that survive to produce ripe fruit and the proportion of ripe fruit taken by birds may be higher in introduced, naturalized barberry species than in most other species with similar reproductive ecology that are growing within their natural range (Allen and Wilson 1992). As a result, establishment of seedlings of Darwin barberry may exceed that of native shrub and tree species in New Zealand (Allen 1991). The presence of a waxy bloom does not increase fruit attractiveness, but physical alteration of the fruit surface reduces fruit selection by birds (Allen and Lee 1992). Seed dispersal by both birds and mammals is widespread (Rudolf 1974; Vines 1960).

Collection of fruit; extraction and storage of seeds. Ripe barberry fruits may be picked by using protective gloves, or they may be flailed onto cloths or receptacles spread beneath the bushes. The ripe fruits may be run through a macerator or blender with water and the pulp then screened out or floated off. The seeds should then be dried superficially and either sown immediately or stored in sealed containers at temperatures slightly above freezing (Heit 1967a; NBV 1946; Rudolf 1974). Seed purity and soundness for the species included here have been as high as 90 to 99% (Davis 1927; Rafn and Son nd; Rudolf 1974). Seeds of Japanese and common barberries remained viable for at least 4 years when held at 1 to 3 °C in sealed containers (Heit 1967b), which indicates that these species are orthodox in storage behavior. Fruit yields, seed yields, and numbers of seeds per weight are listed in table 4 for 3 species.

Pregermination treatments. Seeds of some barberry species have embryo dormancy that requires cold stratification to provide prompt germination. Dirr and Heuser (1987) recommend 1 to 2 months for wildfire and Japanese barberries, and 2 to 3 months for boxleaf, paleleaf, cutleaf, Darwin, Julian, and Korean barberries. Germination data for 3 species are found in table 5. However, a simple cold stratification is not always successful. Immature or improperly developed embryos may be present in some barberry seeds, and maximum germination may require warm incubation, followed by cold stratification as in the closely related *Mahonia* genus (Dirr and Heuser 1987; McLean 1967). Under natural conditions, barberry seeds germinate in the spring following seed dispersal (Kern 1921).

Germination tests. Germination of seeds from several barberry species has been tested in sand-filled flats, in petri dishes, on paper or blotters, or in standard germinators. Day temperatures of 16 to 30 °C, night temperatures of 13 to 21 °C, and germination periods of 20 to 95 days have been used. Results are summarized in table 5. For Japanese and common barberries, the Association of Official Seed Analysts (AOSA 1993) recommends germination of excised embryos in covered petri dishes at temperatures of 18 to 22 °C for 10 to 14 days. This method may be satisfactory for

other barberry species.

Nursery practice. Whole berries or (preferably) cleaned seeds may be sown in the fall, or stratified seeds may be sown in the spring. Injury from molds is more likely if whole berries are used (Chadwick 1936). Fall-sown beds should be mulched until germination begins (NBV 1946). The seeds should be covered with 0.3 to 1.3 cm (c to 2 in) of soil plus 0.6 cm (3 in) of sand (Rudolf 1974). Germination is epigeal (Terabayashi 1987), and seedlings develop rapidly (figure 2). In a sowing of common barberry, 22% of the seeds survived to produce shrubs (Swingle 1939). Barberries may be field-planted as 2+0 stock (Rudolf 1974).

The barberries can be propagated from rooted stem cuttings. Several deciduous species are best rooted when propagated from softwood cuttings collected in the summer, but many of the evergreen species root better when hardwood cuttings are collected in the autumn or winter (Dirr and Heuser 1987). Both should be treated with indole butyric acid (IBA) rooting hormone in talc or in solution.

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Figure 1C*Berberis thunbergii*, Japanese barberry: longitudinal section through 2 seeds in a berry, × 6.

Figure 2C*Berberis thunbergii*, Japanese barberry: seedling development at 1 and 16 days after germination.

Table 1C*Berberis,* barberry: nomenclature, height, growth habit, and color of ripe fruit

Scientific name & synonym	Common name(s)	Height at maturity (m)	Growth habit	Color of ripe fruit
B. buxifolia **Lam.**	**boxleaf barberry**	0.6B2.1	Deciduous	Pruinose blue
B. candidula **(C.K. Schneid.) C.K. Schneid.**	**paleleaf barberry**	0.6B1.2	Evergreen	Purplish, bloomy
B. circumserrata **(C.K. Schneid.) C.K. Schneid.**	**cutleaf barberry**	0.6B0.9	Deciduous	Pale red
B. darwinii **Hook.**	**Darwin barberry**	1.5B2.4	Evergreen	Pruinose blue
B. gagnepainii **C.K. Schneid.**	**black barberry**	0.9B1.8	Evergreen	Pruinose blue
B. gilgiana **Fedde**	**wildfire barberry**	1.8B2.4	Deciduous	Reddish
B. julianiae **Schneid.**	**Julian barberry,** wintergreen barberry	1.8B3.0	Evergreen	Bluish-black
B. koreana **Palibin.**	**Korean barberry**	1.2B1.8	Deciduous	Bright red
B. sargentiana **C.K. Schneid.**	**Sargent barberry**	1.8B2.7	Evergreen	Black
B. thunbergii **DC.** *B. trifoliata* Moric.	**Japanese barberry**	0.9B1.8	Deciduous	Bright red
B. tricanthophora **Fedde**	**threespine barberry**	0.9B1.5	Evergreen	Bluish-black
B. vernae **C.K. Schneid.**	**Verna barberry**	0.9B1.2	Deciduous	Pale red
B. verruculosa **Hensl. & E.H. Wilson**	**warty barberry**	0.9B1.8	Evergreen	Violet-black
B. vulgaris **L.**	**common barberry,** European barberry	1.8B3.0	Deciduous	Scarlet or purple

Sources: Ahrendt (1961), Dirr (1990), Dirr and Heuser (1987), Garrett (1969), Hitchcock and others (1964), McMinn (1951), Rehder (1940), Rudolf (1974), Vines (1960).

Table 2C*Berberis,* barberry: occurrence and uses of 3 species with potential value for conservation planting

Species	Occurrence	Uses
B. koreana	Korea	Wildlife habitat or food, environmental forestry
B. thunbergii	Japan	Wildlife habitat or food, environmental forestry
B. vulgaris	Europe, up to 1,525 m in the Alps	Wildlife habitat or food, watershed

Source: Rudolf (1974).

Table 3C*Berberis,* barberry: phenology of flowering and fruiting for 3 species

Species	Location	Flowering dates	Fruit ripening dates*
B. koreana	NE US & Carver Co., MN	MayBearly June	SeptBOct
B. thunbergii	Japan	AprBJune	Oct
	SE US	MarBApr	MayBSept
	NE US & Germany	MayBJune	SeptBNov
B. vulgaris	NE US & Western Europe	AprBJune	SeptBOct

Sources: Bailey (1939), Loiseau (1945), McMinn (1951), Mirov and Kraebel (1939), NBV (1946), Ohwi (1965), Plummer and others (1965), Radford and others (1964), Rudolf (1974), Van Dersal (1938), Vines (1960), Wappes (1982), Wyman (1947).

* Fruits of these 3 species often remain on bushes over winter.

Table 4C*Berberis,* barberry: seed yield data

Species	Place of collection	Fruit wt/fruit vol kg/hl	Fruit wt/fruit vol lb/bu	Seed wt/fruit vol kg/hl	Seed wt/fruit vol lb/bu	Thousands of cleaned seeds/wt: Range /kg	Range /lb	Average /kg	Average /lb	Samples
B. koreana	Carver Co., Minnesota	39	30	4	3	C	C	84	38	2
B. thunbergii	US	9B15	16B25	C	C	55B82	25B37	64	29	5+
B. vulgaris	US	C	C	C	C	75B90	34B41	84	38	2

Source: Rudolf (1974).

Table 5C*Berberis,* barberry: stratification periods, germination test conditions, and results for 3 species

Species	Cold stratification* (days)	Daily light (hrs)	Germination test conditions: Medium	Temp. (°C): Day	Temp. (°C): Night	Duration (days)	Germination rate: Amount (%)	Germination rate: Period (days)	% germination: Average (%)	% germination: Purity Samples	Soundness (%)	(%)
B. koreana	60	16	Sand or perlite	16	16	20	64	6	88	1	97	95
B. thunbergii	90	C	Wet paper or sand	24H	13H	40	C	C	90	4	93	95
B. vulgaris	40	C	Wet paper or sand	24H	13H	40	C	C	91	2+	C	96

Sources: Davis (1927), Heit (1968a,b), McLean (1967), Mirov and Kraebel (1939), Morinaga (1926), Plummer and others (1968), Rafn and son (nd), Rudolf (1974), Swingle (1939), Vines (1960).

* Cold stratification temperatures ranged from –1 to 5 °C.

H 21 to 27 °C during the day and 10 to 16 °C during the night.