BerberidaceaeCBarberry family

Mahonia Nutt.

Oregon-grape

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Growth habit, occurrence, and use. *Mahonia*Cthe Oregon-grapeCis a genus of about 100 evergreen shrubs native to Asia, Europe, North Africa, and the Americas (Ahrendt 1961). Some authorities (Hitchcock and others 1964) place these species in the genus *Berberis,* and that nomenclature was accepted in the 1974 edition of this book (Rudolf 1974). Most authorities (LBHB 1976; USDA NRCS 1999), however, now separate the genera by placing the evergreen species with compound leaves in *Mahonia*. The distinction is far from clear, however, as Abarberry@ is a common name for some *Mahonia* species (table 1), and intergeneric hybrids have been reported (Ahrendt 1961).

Several Oregon-grape species are valued as ornamentals because of their foliage, flowers, or fruits (Bailey 1939; Dirr and Heuser 1987; Rehder 1940; Schlosser and others 1992). Like the closely-related barberries, Oregon-grapes also are of value for wildlife food (Decker and others 1991), cover, and erosion-control planting. The names, heights, habits, and ripe fruit colors of some common species are listed in table 1. Six species that have potential value for conservation planting are listed in table 2. Like the barberries, some Oregon-grapes are alternate hosts for the black stem rust of grainsC*Puccinia graminis* Pers: Pers). Some species, for example, hollyleaf barberry, Cascade Oregon-grape, and Oregon-grape, are resistant (Rehder 1940).

Like the seeds of the genus *Berberis,* seeds of some members of the genus *Mahonia* contain chemical substances of potential commercial value. The seeds of the Beale Oregon-grape contain alkaloids that are used in folk medicine in Asia (Zhao and others 1991), and seeds of hollyleaf barberry contain tertiary alkaloids of note (Kostalova and others 1986).

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 (Millet 1976, 1977). The fruit (figure 1) is a berry with one to several seeds (figures 2 and 3). A single sample of 100 fruits indicated that most Cascade Oregon-grape berries have about 3 seeds (Minore 1994). Good fruit crops are borne almost annually; the fruits ripen in the summer and autumn (table 3). Seed dispersal by both birds and mammals is widespread (Rudolf 1974; Vines 1960).

Collection of fruit; extraction and storage of seeds. Ripe fruits may be picked by hand (with gloves) or flailed onto cloths or receptacles spread beneath the bushes. The 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 1967; NBV 1946; Rudolf 1974). Seed purity and

soundness can be in the 90% range (Rafn and Son nd; Rudolf 1974). Seeds of Fremont mahonia and Oregon-grape did not loose viability for 5 years when stored in unsealed containers in an unheated shed in a temperate climate (Plummer and others 1968). Fruit yields, seed yields, and numbers of seeds per weight are listed in table 4.

Pregermination treatments. Seeds of Fremont mahonia and red barberry usually germinate without pretreatment (Dirr and Heuser 1987; Rudolf 1974; Swingle 1939). The seeds of Fremont mahonia have some intermediate embryo dormancy, however, and germination is improved by 6 to 10 weeks of cold stratification at day/night thermoperiods of 5/1 °C (Baskin and others 1993). Beale Oregon-grape and Japanese mahonia should germinate well with only 1 to 2 months of cold stratification (Dirr and Heuser 1987). Seeds of other species also have embryo dormancy that requires cold stratification to overcome (table 5), but simple cold stratification is not always successful. Seeds of cascade Oregon-grape did not germinate after 90 days of cold stratification (Rudolf 1974); up to 5 months of treatment may be required for this species (Dirr and Heuser 1987). Immature or improperly developed embryos are probably present in some species, as maximum germination of hollyleaf barberry was obtained with 4 months of warm stratification followed by 4 months of cold stratification (Dirr and Heuser 1987). A third stratification period (cold + warm + cold) is best for seeds of Oregon-grape (McLean 1967). Under natural conditions, Oregon-grape seeds germinate in the spring after seeds are dispersed (Kern 1921).

Germination tests. Germination of seeds from 4 species of Oregon-grape 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 (table 5). Actual germination tests are not prescribed for species of Oregon-grape by the International Seed Testing Association, but germination estimates with tetrazolium chloride (TZ) staining procedures are recommended (ISTA 1993). Seeds should be pre-moistened for 18 hours at 20 °C, cut open by removing a third of the seed at the distal end, and incubating in 1% TZ for 18 hrs at 30 °C. All tissues should stain in viable seeds. For the closely related 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 also be satisfactory for species of Oregon-grape.

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).

Oregon-grapes can be propagated from rooted stem cuttings. Many species root best when hardwood cuttings are collected in the autumn or winter (Dirr and Heuser 1987). They should be treated with indole-butyric acid (IBA) rooting hormone in talc or in solution.

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Figure 1C*Mahonia nervosa*, Cascade Oregon-grape: a spike of berries, × 1.

Figure 2C*Mahonia aquifolium*, hollyleaf barberry: seeds, × 10.

Table 1C*Mahonia,* Oregon-grape: nomenclature, height, and color of ripe fruit

Scientific names	Common name(s)	Height at maturity (m)	Color of ripe fruit
***M. aquifolium* (Pursh) Nutt.** *B. aquifolium* Pursh	**hollyleaf barberry,** Oregon grapeholly	0.6–3.0	Blue-black, bloomy
***M. bealei* (Fortune) Carr.** *B. bealei* Fortune	**Beale Oregon-grape,** leatherleaf mahonia	1.8–3.0	Light blue, bloomy
***M. fortunei* (Lindl.) Fedde** *B. fortunei* Lindl.	**Chinese mahonia**	1.5–1.8	Purple-black
***M. fremontii* (Torr.) Fedde** *B. fremontii* Torr.	**Fremont mahonia**	0.9–4.6	Bluish black
***M. haematocarpa* (Woot.) Fedde** *B. haematocarpa* Woot.	**red barberry**	0.9–3.7	Blood red
***M. japonica* (Thunb.) DC.**	**Japanese mahonia**	1.8–3.0	Blue
***M. nervosa* (Pursh) Nutt.** *B. nervosa* Pursh	**Cascades Oregon-grape,** Cascades barberry	0.3–1.8	Deep blue, bloomy
***M. nevinii* (Gray) Fedde** *B. nevinii* Gray	**Nevin barberry**	0.9–1.8	Yellowish red to deep red
***M. pinnata* (Lag.) Fedde** *B. pinnata* (Lag.)	**cluster mahonia**	2.4–3.0	Pruinose blue
***M. repens* (Lindl.) G. Don** *B. repens* Lindl.	**Oregon-grape,** creeping barberry	0.3–2.4	Purple, bloomy

Sources: Ahrendt (1961), Dirr (1990), Dirr and Heuser (1987), Hitchcock and others (1964), McMinn (1951), Rehder (1940), Rudolf (1974), USDA NRCS (1999), Vines (1960).

Table 2C*Mahonia*, Oregon-grape: occurrence and uses of 6 species for conservation planting.

Species	Occurrence	Uses
M. aquifolium	British Columbia to Alberta, S to W Montana, W Idaho, through Washington & Oregon to California	Wildlife habitat or food, environmental forestry
M. fremonti	Extreme W Texas, New Mexico, Arizona, California, Colorado, Utah, & Nevada at 1,220 to 2,130 m, & in Baja California & Sonora, Mexico	Wildlife habitat or food, environmental forestry
M. haematocarpa	Dry, sunny sites up to 1,340 m in W Texas, Colorado, New Mexico, Arizona, & adjacent Mexico	Wildlife habitat or food, environmental forestry
M. nervosa	British Columbia S to central California, mainly W of Cascades in Oregon & Washington, E to N Idaho	Wildlife habitat or food, watershed, environmental forestry
M. nevinii	California	Wildlife habitat or food, watershed
M. repens	Montana to British Columbia, S to New Mexico & California, including W South Dakota	Wildlife habitat or food, watershed

Source: Rudolf (1974).

Table 3C*Mahonia*, Oregon-grape: phenology of flowering and fruiting

Species	Location	Flowering dates	Fruit ripening dates
M. aquifolium	Mineral Co., Montana (975 m)	Late AprBearly May	Late JulyBearly Aug
	Jackson Co., Oregon (685 m)	MarBMay	SeptBOct
M. fremontii	Texas, NE US	MayBJune	AugBSept
	Utah & California	MayBJune	July BAug
M. haematocarpa	Texas & SW US	Spring	JuneBAug
M. nervosa	Clackamas Co., Oregon (90 m)	Early Apr	MidBAug
	Jackson Co., Oregon (990 m)	Mid-May	Late Aug
	C	AprBJune	JulyBAug
M. nevinii	California	MarBMay	June
M. repens	Black Hills, South Dakota (1,830 m)	May BJune	JuneBJuly
	C	AprB May	AugBSept

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).

Table 4C*Mahonia,* Oregon-grape: seed yield data

Species	Place of collection	Fruit weight/vol		Seed weight/fruit vol		Thousands of cleaned seeds Range		Average		Samples
		kg/hl	lb/bu	kg/hl	lb/bu	/kg	/lb	/kg	/lb	
M. aquifolium	Jackson Co., Oregon	44	34	4	3	C C	73	33	1	
	Pacific Northwest	C	C	C	C	84B95	38B43	90	41	2
M. fremontii	Utah	C	C	C	C	C C	93	42	1+	
M. haematocarpa	C	C	C	C	C	C C	227	103	1	
M. nervosa	Clackamas Co., Oregon	39	43*	C	C	C C	51	23	1	
	Pacific Northwest	C	C	C	C	C C	66	30	2	
M. nevinii	California	C	C	C	C	C C	126	57	1	
M. repens	Basin, Montana; & Utah	C	C	C	C	119B157	54B71	136	62	2

Source: Rudolf (1974).

* Data are for berries without stems; data for other species are for berries with stems.

Table 5C*Mahonia*, Oregon-grape: stratification periods, germination test conditions, and percentage germination

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)	Percent germination: Ave. (%)	Percent germination: Samples	Purity (%)	Soundness (%)
M. aquifolium	90	8	Sand or perlite	30	20	30	22	12	25	1	95	99
M. fremontii	0	C	C	C	C	C	C	C	85	2+	90	90+
M. nevinii	90	C	Soil	C	C	95	C	C	77	1	C	C
M. repens	196I	C	Wet paper	21	21	10	62H	150	74	1	90	C

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

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

H Maximum germination was obtained with 4 months of warm stratification at 20 °C, followed by 4 months of cold stratification at 2 to 4 °C (Dirr and Heuser 1987).

I Successive stratification periods were 30 days at 1 °C, 60 days at 21 °C, and 196 days at 1 °C. During the final cold period, 62% of the seeds germinated. An additional 12% germinated after the temperature was again raised to 21 °C for a total of 74%.