RosaceaeCRose family

Cotoneaster Medik.

cotoneaster

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Growth habit, occurrence, and use. The genus *Cotoneaster* includes about 50 species of shrubs and small trees native to the temperate regions of Europe, northern Africa, and Asia (excepting Japan) (Cumming 1960). Growth habits range from nearly prostrate to upright. Cold-hardy types are more or less deciduous, whereas those native to warmer regions are evergreen (Heriteau 1990). Cotoneasters are valued as ornamentals for their glossy green foliage, attractive fruits, and interesting growth habits. Fall foliage color is often a showy blend of orange and red. Cotoneasters are adapted to sunny locations with moderately deep and moderately well-drained silty to sandy soils. Several hardy species are commonly used in mass plantings, hedges, shelterbelts, wildlife plantings, windbreaks, recreational areas, and along transportation corridors on the northern Great Plains, the southern portions of adjoining Canadian provinces, and occasionally in the Intermountain and other areas (Plummer and others 1968; Shaw and others, in press; Slabaugh 1974). They require little maintenance and provide ground cover, soil stabilization, snow entrapment, and aesthetic values. Peking cotoneaster provides food and cover for wildlife (Johnson and Anderson 1980; Kufeld and others 1973; Leach 1956; Miller and others 1948). Six species used in conservation plantings are described in table 1 (Hoag 1965; Nonnecke 1954; Plummer and others 1977; Rheder 1940; USDA SCS 1988; Zucker 1966). Use of cotoneasters in some areas may be limited due to their susceptibility to fire blight (infection with the bacterium *Erwinia amylovora*), borers (*Chrysobothris femorata* (Olivier)), lace bugs (*Corythucha cydonia* (Fitch)), and red spiders (*Oligonychus platani* (McGregor)(Griffiths 1994; Krüssman 1986; Wyman 1986).

Cotoneasters are apomictic and will, therefore, propagate true from seed (Wyman 1986). However, because of the apomictic habit, many variants occur within each species (Everett 1982). This variability has been exploited in cultivar development (Krüssman 1986; LHBH 1976). A number of hybrids have also been developed as ornamentals.

Flowering and fruiting. Cotoneaster flowers are perfect, regular, and white to pink. They develop singly or several to many together in corymbs produced at the ends of leafy lateral branchlets. Flowers are small, but in some species attractive due to their abundance. Fruits are black or red berrylike pomes that ripen in late summer or early fall and often persist into winter (Wyman 1949) (figure 1). The fruits contain 1 to 5 seeds (Rehder 1940) (figures 2 and 3), averaging 3 for Peking, hedge, and black cotoneasters; 2 for cranberry and rock cotoneasters; and 2 or 3 for European cotoneasters (Uhlinger 1968 & 1970). Phenological data are provided in table 2.

Collection of fruits. Ripe fruits are collected by hand stripping or flailing in early autumn, preferably after leaf fall. Fruit firmness and color (table 3) are good criteria of ripeness. Leslie (1954) recommends that fruits of Peking, hedge, and black cotoneasters be collected slightly green. The minimum fruit-bearing age of hedge cotoneaster is 3 years. Fruit crops are produced annually.

Extraction, cleaning, and storage of seed. Seeds may be extracted by macerating fresh fruits and skimming off or screening out the pulp. Seeds are best cleaned while fresh, because it is difficult to remove dry fleshy material by maceration. Most empty seeds can be eliminated by floating the seedlot twice in water (Uhlinger 1968 & 1970). Seeds may be removed from dried fruits by abrasion (Slabaugh 1974) and the debris separated using a 2-screen fanning machine. Number of seeds per weight for 3 species are provided in table 4. About 0.5 kg (1 lb) of cleaned seeds of European cotoneaster are obtained from 2.7 kg (6 lb) of fruits (USDA SCS 1988). Seeds of the cotoneasters are orthodox in storage behavior. Leslie (1954) and USDA SCS (1988) recommend that seeds of cotoneasters be stored dry in sealed containers in a cool place. Seeds of European cotoneaster, however, can be stored in an unheated warehouse for at least 16 years without loss of viability (Jorgensen 1966; Plummer 1968).

Pregermination treatments. Seeds of many cotoneasters exhibit double dormancy due to their hard, impermeable seedcoats and the physiological condition of their embryos. First-year germination is enhanced by acid scarification followed by warm incubation and wet prechilling (USDA SCS 1988) (table 5). Addition of a commercial compost activator to the wet prechilling medium reportedly improved emergence of spreading cotoneaster—*C. divaricatus* Rehd. & Wilson (Cullum and Gordon 1994).

Duration of effective pretreatments varies with species, seedlot, and year due to differences in seedcoat thickness and degree of embryo dormancy. Meyer (1988), for example, found that seeds of cranberry and spreading cotoneasters scarified for 1.5 hours in concentrated sulfuric acid germinated over an increasing range of incubation temperatures as the duration of wet prechilling at 2 °C increased from 0 to 4 months. After 4 months of prechilling, germination of both species occurred at constant incubation temperatures from 4.5 to 26.5 °C. This variability in response adds to the difficulty of securing prompt, consistent germination (Uhlinger 1968 & 1970).

Germination tests. Table 6 lists germination test conditions and results for 4 cotoneaster species (see table 5 for pretreatments). The effect of light on germination of seeds of Peking, hedge, and black cotoneasters varies among seed lots, but germination of black cotoneaster was generally improved by exposure to cool-white fluorescent light (Uhlinger 1968 & 1970). Pretreatment with gibberellic acid partially replaced the effect of light (Uhlinger 1968 & 1970).

Because of the dormancy in these seeds, the International Seed Testing Association recommends use of tetrazolium staining rather than germination tests for evaluation of seed quality (ISTA 1993). Seeds are stained by first soaking them in water for 18 hours, then removing the distal third of the seeds with a transverse cut; and finally placing the seeds in a 1.0% solution of tetrazolium chloride for 20 to 24 hours. Viable seeds usually stain completely, but seeds are considered viable if only the radicle tip and the distal third of the cotyledons are unstained (ISTA 1993).

The excised embryo method may also be used to test seed germinability of spreading cotoneaster (Smith 1951). Seeds are first scarified in sulfuric acid for 3 hours, then soaked in 27 °C tapwater for 2 days before the embryos are excised and incubated under conditions favorable for

germination.

Nursery practice. Seeds of cotoneaster species may be given appropriate scarification pretreatments and seeded in midsummer to provide the warm incubation and overwinter wet-prechilling required to relieve dormancy and permit germination in the spring. Scarified seeds provided with warm incubation pretreatment in the laboratory may be fall-planted; however, scarification, warm incubation, and wet prechilling in the laboratory are required for spring-planting. A seeding rate of 250 seeds/m^2 (23/ft^2) is recommended for producing lining-out stock of rock cotoneaster (Macdonald 1993); 100 to 130 seeds/m (10 to 12/ft) are recommended for European cotoneaster var. Centennial (USDA SCS 1988). Seeds of this variety are planted 0.3 cm (0.1 in) deep and covered with 1.5 to 2 cm (0.5 to 0.75 in) of soil (USDA SCS 1988). European and hedge cotoneaster seedbeds may be mulched with hay or other suitable material (Hinds 1969; USDA SCS 1988). Filtered shade until August is recommended for seedlings of Peking, hedge, and black cotoneasters (Leslie 1954). For hedge cotoneaster, an average seedling yield of 30% was obtained in a North Dakota nursery (Hinds 1969). Seedlings of this species are usually ready for outplanting after 2 growing seasons.

Cotoneasters are propagated vegetatively from softwood and occasionally from hardwood cuttings (Dirr and Heuser 1987; Wyman 1986). Cuttings are taken from June to August (Dirr and Heuser 1987) and treated with 1,000 to 3,000 ppm IBA. Macdonald (1993) recommended that heel cuttings be used when evergreen species are rooted in cold frames. Cuttings, particularly those of evergreen species, root readily and are easily transplanted and overwintered. Layering and grafting are also used to obtain small numbers of plants.

Field planting. Nursery stock is generally used to establish conservation plantings. Wildland seedings of Peking cotoneaster have been only marginally successful (Shaw and others, in press). Germination is erratic and seedlings grow slowly, particularly if the site is not kept weed-free.

Bareroot plantings of European cotoneaster ›Centennial= may be established using 1+0 or 2+0 bareroot seedlings with stem diameters of 0.5 to 1.3 cm (0.2 to 0.5 in) just above the root collar (USDA SCS 1988). Seedlings should be planted in fallowed ground at 1.2- to 1.5-m (4- to 5-ft) spacings immediately after the soil thaws in spring. At least 5 years of weed control are often required. Average survival ranges from 70 to 95% (USDA SCS 1988). Fruit-producing stands are obtained in 3 to 4 years.

Literature Cited

Cullum FG, Gordon AG. 1994. Dormancy release of tree and shrub seeds using a compost activator pretreatment. Combined Proceedings of the International Plant Propagators= Society 43: 125B130.

Cumming WA. 1960. Germination studies with *Cotoneaster lucida* being conducted at the Canada Experimental Farm, Morden, Manitoba. Western Canadian Society of Horticulture Report Proceedings 16: 43B44.

Dirr MA, Heuser CW Jr. 1987. The reference manual of woody plant propagation. Athens, GA: Varsity Press. 239 p.

Everett TH, ed. 1982. The New York Botanical Garden illustrated encyclopedia of horticulture.

Volume 10. New York: Garland Publishing: 893B897.
Fordham AJ. 1962. Methods of treating seeds at the Arnold Arboretum. Plant Propagators= Society Proceedings 1962: 157B163.
Griffiths M. 1994. Index of garden plants. Portland, OR: Timber Press. 1234 p.
Heriteau J. 1990. The National Arboretum book of outstanding garden plants. New York: Simon and Schuster. 292 p.
Hinds LW. 1969. Personal communication. Bismarck, ND: Lincoln-Oakes Nurseries.
Hoag DG. 1958. Hardy cotoneasters for North Dakota. Bulletin of the North Dakota Agricultural Experiment Station 20: 30B33.
Hoag DG. 1965. Trees and shrubs for the northern plains. Minneapolis: Lund Press. 376 p.
Huxley A, ed. 1994. The new Royal Horticultural Society dictionary of gardening. London: Macmillan. 1298 p.
ISTA [International Seed Testing Association]. 1993. Rules for testing seeds: rules 1993. Seed Science and Technology 21 (Suppl.): 1B259.
Johnson TK, Anderson ES. 1980. Conservation planting handbook for Wyoming and Colorado. Laramie: University of Wyoming, Agriculture Extension Service. 123 p.
Jorgensen K. 1996. Personal communication. Ephraim, UT: Utah Division of Wildlife Resources.
Krüssman G. 1986. Manual of cultivated broad-leaved trees & shrubs. Volume 3, PRUBZ. Portland, OR: Timber Press. 510 p.
Kufeld RC, Wallmo OC, Feddema C. 1973. Foods of the Rocky Mountain mule deer. Res. Pap. RM-111. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 31 p.
Leach HR. 1956. Food habits of the Great Basin deer herds in California. California Fish and Game 42: 243B308.
Leslie WR. 1954. Propagation of cotoneaster. Western Canadian Society of Horticulture Report Proceedings 10: 88.
LHBH [Liberty Hyde Bailey Hortorium]. 1976. Hortus third. New York: Macmillan. 1290 p.
McDermand J. 1969. Personal communication. Bismarck, ND: USDA Soil Conservation Service, Bismarck Plant Materials Center.
Macdonald B. 1993. Practical woody plant propagation for nursery growers. Volume 1. Portland, OR: Timber Press. 669 p.
Meyer MM Jr. 1988. Rest and postdormancy of seeds of *Cotoneaster* species. HortScience 23: 1046B1047.
Miller HW, Ball CC, Knott NP. 1948. The comparative value of woody plants as food for upland game birds. Biol. Bull. 8. Olympia: Washington State Game Department and USDA Soil Conservation Service. 39 p.
Nonnecke IL. 1954. A study of climatological influence on plant growth in the Lethbridge area. Western Canadian Horticultural Society Report Proceedings 10:109B113.
Plummer AP, Christensen DR, Monsen SB. 1968. Restoring big-game range in Utah. Pub. 68-3. Salt Lake City: Utah Division of Fish and Game. 183 p.
Plummer AP, Monsen SB, Stevens R. 1977. Intermountain range plant names and symbols. Gen. Tech. Rep. INT-38. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 82 p.

Rehder A. 1940. Manual of cultivated trees and shrubs. 2nd ed. New York: Macmillan. 996 p.
Rosendahl CO. 1955. Trees and shrubs of the upper Midwest. Minneapolis: University of Minnesota Press. 411 p.
Shaw NL, Monsen SB, Stevens R. [In press]. Rosaceous shrubs. In: Monsen SB, Stevens R, comps. Restoring western ranges and wildlands. Provo, UT: USDA Forest Service, Rocky Mountain Research Station.
Slabaugh PE. 1974. *Cotoneaster* B. Ehrh., cotoneaster. In: Shopmeyer CS, tech. coord. Seeds of woody plants in the United States. Agric. Handbk. 450. Washington, DC: USDA Forest Service: 349B352.
Smith BC. 1951. An investigation of the rest period in the seed of the genus *Cotoneaster*. American Society of Horticulture Science Proceedings 57: 396B400.
Uhlinger RD. 1968 & 1970. Personal communication. North Platte: University of Nebraska, North Platte Experiment Station.
USDA SCS [USDA Soil Conservation Service]. 1988. ›Centennial= cotoneaster. Prog. Aid 1406. [Bismarck, ND]: USDA Soil Conservation Service, Bismarck Plant Materials Center. 6 p.
Wyman D. 1949. Shrubs and vines for American gardens. New York: Macmillan. 442 p.
Wyman D. 1986. Wyman=s gardening encyclopedia. New York: Macmillan. 1221 p.
Zucker I. 1966. Flowering shrubs. Princeton, NJ: Van Nostrand. 380 p.

Figure 1—*Cotoneaster,* cotoneaster: fruit, × 2.

Figure 2—*Cotoneaster,* cotoneaster: seeds, × 4.

Figure 3—*Cotoneaster horizontalis*, rock cotoneaster: longitudinal section through a seed, × 12.

Table 1C *Cotoneaster,* cotoneaster: nomenclature and occurrence

Scientific name & synonym(s)	Common name	Occurrence
***C. acutifolius* Turcz.** *C. acutifolia* Turcz. *C. pekinensis* Zab.	**Peking cotoneaster**	North China; introduced from North Dakota to Nebraska & upper Midwest, S Canadian Prairie provinces
***C. apiculatus* Rehd. & Wilson** *C. apiculata* Rehd. & Wilson	**cranberry cotoneaster**	W China; introduced from North Dakota to Nebraska & upper Midwest
***C. horizontalis* Dcne.** *C. davidiana* Hort.	**rock cotoneaster,** rock spray cotoneaster, quinceberry	Western China; introduced from North Dakota to Nebraska & upper Midwest, S central Washington
***C. integerrimus* Medic.** *C. vulgaris* Lindl.	**European cotoneaster**	Europe, W Asia, Siberia
***C. lucidus* Schltdl.** *C. acutifolia* Lindl., not Turzc. *C. sinensis* Hort.	**hedge cotoneaster**	Altai Mountains & Lake Baikal region of Asia
***C. niger* (Thunb.) Fries** *C. melanocarpus* Lodd.	**black cotoneaster,** darkseed cotoneaster	Europe to NE & central Asia, introduced from North Dakota to Nebraska

Source: Krüssman (1978), LHBH (1976), Slabaugh (1974).

Table 2C *Cotoneaster,* cotoneaster: phenology of flowering and fruiting

Species	Location	Flowering dates	Fruit ripening dates	Seed dispersal dates
C. acutifolius	Northern Great Plains	MayBJune	SeptBOct	SeptBwinter
C. apiculatus	Southern Michigan	MayBJune	AugBSept	FallBwinter
C. horizontalis	C	June	SeptBNov	SeptBwinter
C. integerrimus	Great Plains	MayBJune	AugBSept	C
C. lucidus	North Dakota	MayBJune	Sept	C
C. niger	C	MayBJune	C	C

Sources: Krüssman (1986), Macdonald (1986), Slabaugh (1974), USDA SCS (1988), Zucker (1966).

Table 3C*Cotoneaster,* cotoneaster: height, year first cultivated, and color of flowers and ripe fruit

Species	Height at maturity (m)	Year first cultivated	Flower color	Color of ripe fruit
C. acutifolius	1.8B3.9	1883	Pink	Black
C. apiculatus	0.3B1.5	1910	Pink	Scarlet
C. horizontalis	0.9B1.2	1880	White-pink	Light to dark red
C. integerrimus	1.2B3.6	C	Pinkish	Red
C. lucidus	1.8B2.7	1840	White, tinged w/pink	lack
C. niger	1.5-2.4	1829	Pinkish-white	Blackish red

Sources: Griffiths (1994), Hoag (1958, 1965), LHBH (1976), Leslie (1954), Krüssman (1986), Rehder (1940), Rosendahl (1955), USDA SCS (1988).

Table 4C *Cotoneaster,* cotoneaster: seed yield data

	Cleaned seeds/wt			
	Range		Average	
Species	/kg	/lb	/kg	/lb
C. acutifolus	48,466B58,212	21,984B26,405	59,300	26,900
C. horizontalis	C	C	141,094	64,000
C. integerrimus	C	C	35,274	16,000
C. lucidus	C	C	51,560	23,390

Sources: Cumming (1960), McDermand (1969), Plummer and others (1968), Slabaugh (1974), Uhlinger (1968 & 1970), USDA SCS (1988).

Table 5C *Cotoneaster,* cotoneaster: pregermination treatments

Species	Immersion time in conc H_2SO_4 (min)	Wet prechill at 4 °C	
		Medium	Period (days)
C. acutifolius	10B90	Peat	30-90
C. apiculatus	60B120	Sand & peat	60-90
C. horizontalis	90B180	Peat	90-120
C. integerrimus	120	C	120*
C. lucidus	5B20	Sand & perlite	30-90
C. niger	10B90	Peat	30-90

Sources: Dirr and Heuser (1987), Fordham (1962), Leslie (1954), McDermand (1969), Slabaugh (1974), Smith (1951), Uhlinger (1968 & 1970), USDA SCS (1988).
* Wet prechilling was preceded by 90 days of warm incubation at 21 °C.

Table 6C *Cotoneaster,* cotoneaster: germination test conditions and results

	Germination test conditions					Percentage germination	
	Daily light		Temp. (°C)		Duration	Ave.	No. of
Species	(hrs)	Medium	Day	Night	(days)	(%)	samples
C. acutifolius	9	Wet paper	25	10	C	70-80	C
C. horizontalis	24	Wet paper	27	C	C	100	C
		Sand	30	20	100	30	5+
C. lucidus	9	Wet paper	25	10	C	70	C
C. niger	9	Wet paper	25	10	C	80	C

Sources: Smith (1951), Slabaugh (1974), Uhlinger (1968 & 1970).