CaprifoliaceaeCHoneysuckle family

Viburnum L.

viburnum

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Growth habit, occurrence, and use. Among the 135 or so viburnum species, 12 that are either native to North America or have been introduced are discussed here (table 1). All 12 species are deciduous shrubs or small trees. Their characteristics place the viburnums among the most important genera for wildlife food and habitat and environmental forestry purposes. The attractive foliage, showy flowers, and fruits of viburnums have ensured their widespread use as ornamental plants as well. The fruits of most species are eaten by white-tailed deer (*Odocoileus virginianus*), rabbits (*Sylvilagus floridanus*), chipmunks (*Tamias striatus*), squirrels (*Sciurus* spp.), mice (*Reithrodontomys* spp.), skunks (*Mephitis mephitis*), ruffed grouse (*Bonasa umbellus*), ring-necked pheasants (*Phasianus colchicus*), turkeys (*Meleagris gallopavo*), and many species of songbirds. The twigs, bark, and leaves are eaten by deer, moose (*Alces americana*), rabbits, and beaver (*Castor canadensis*) (Martin and others 1951). The fruits of hobblebush, nannyberry, blackhaw, and European cranberrybush are eaten by humans also (Gill and Pogge 1974). Medicinal uses have been found for fruits of European cranberrybush, blackhaw, hobblebush, and rusty blackhaw (Gould 1966; Krochmal and others 1969; Vines 1960). Most species prefer moist, well-drained soils, but drier soils are suitable for some, notably blackhaw, mapleleaf viburnum, and witherod viburnum. Soil texture and pH requirements are less critical than in most other genera; hobblebush, mapleleaf viburnum, and nannyberry are particularly tolerant of acidic soil (Rollins 1970; Spinner and Ostrum 1945). Most species are also shade tolerant, particularly hobblebush, mapleleaf viburnum, and the 3 arrowwoods (Gould 1966; Hottes 1939). The species that more typically thrive in the open or in partial shade include blackhaw, European cranberrybush, nannyberry, and witherod viburnum.

Flowering and fruiting. The small white, or sometimes pinkish, flowers are arranged in flattened, rounded, or convex cymes (figure 1). Flowers are typically perfect, but the marginal blossoms in hobblebush and European cranberrybush are sterile. In some cultivated varieties of European cranberrybush, all flowers may be sterile (Rollins 1970). Flowering and fruit ripening dates are mostly in MayBJune and SeptemberBOctober, respectively, but vary among species and localities (table 2). Pollination is primarily by insects (Miliczky and Osgood 1979). The fruit is a 1-seeded drupe 6 to 15 mm in length, with soft pulp and a thin stone (figures 2, 3, and 4). As viburnum drupes mature, their skins change in color from green to red to dark blue or black when fully ripe (Fernald 1950; Vines 1960). This color change is a reliable index of fruit maturity for most members of the genus in North America. The drupes of European cranberrybush, however, remain orange to scarlet when fully ripe (Fernald 1950). Age of viburnums at first fruiting varies among species, from 2 to 3 years up to 8 to 10 years (table 3). Production is usually meager in early fruiting

years, but most species produce fruit nearly every year. Species such as mapleleaf viburnum and hobblebush that grow in deep shade seldom produce large crops (Gould 1966). Much of the wildlife-habitat and ornamental value in viburnums is due to persistence of their fruits through winter (table 2). Dispersal is accomplished by animals or gravity.

Collection, extraction, and storage. The drupes may be hand-picked when their color indicates full physiological maturity (dark blue or black). After collection, care must be taken to prevent overheating as with all fleshy drupes. If whole drupes are to be sown, they should be spread out to dry before storage. If seeds are to be extracted, drying should be minimized to prevent toughening of the drupe coats. Extraction is recommended because there are good indications that cleaned seeds show higher levels of germination (Smith 1952). Extraction can be easily accomplished by maceration with water. Because good seeds should sink in water, the pulp can be floated off. An alternative method is to wash the pulp through screens with hoses. The seeds should then be dried for storage. Viburnum seeds are orthodox in storage behavior. Viability of air-dried seeds was maintained for 10 years by storage in a sealed container at 1 to 4 °C (Heit 1967). Whole fruits can be stored similarly (Chadwick 1935; Giersbach 1937). Average seed weight data are listed in table 4. Soundness in seed lots of several species has ranged from 90 to 96% (Gill and Pogge 1974).

Germination. Seeds of most viburnum species are difficult to germinate. The only official testing recommendation for any viburnum is to use tetrazolium staining (ISTA 1993). Most species have an apparent embryo dormancy and some have impermeable seedcoats as well (Gill and Pogge 1974). Dormancy in seeds of southern species is more readily overcome than in seeds of northern species. Seeds of the more northern forms need warm stratification for development of the radicle, followed by cold stratification to break dormancy in the epicotyl (shoot). European cranberrybush germinated 97% after 14 weeks of alternating temperatures between 20 and 2 °C (Fedec and Knowles 1973). For this reason, seeds of northern species seldom germinate naturally until the second spring after ripening. In contrast, seeds of some southern viburnums usually complete natural germination in the first spring after seedfall. They ordinarily do not exhibit epicotyl dormancy and do not require cold stratification. Among the 12 species discussed here, only possumhaw and southern arrowwood from the southern part of its range may not need cold stratification (table 5 and figure 5) (Barton 1951; Giersbach 1937). Scarification of seeds has not improved germination (Barton 1958). Germination tests of stratified seeds have been made in sand or soil, but modern procedures would use moist paper blotters. The commonly suggested temperatures are alternating from 20 °C (night) to 30 °C (day) (table 5), but European cranberrybush is reported to germinate well at a constant 20 °C (Fedec and Knowles 1973).

Nursery practice. The warm-cold stratification sequence (table 5) can be accomplished in nursery beds. Seeds or intact drupes can be sown in the spring, to allow a full summer for root development (figure 6). The ensuing winter temperatures will provide the cold stratification needed to break epicotyl dormancy. The principal advantage of this method, compared to stratification in flats or trays, is that seeds need not be handled after their roots emerge during the warm stratification period (Rollins 1970). Seeds of species with more shallow dormancy can be sown in the fall shortly after collection and extraction. For the several species that may be handled in this manner, the latest sowing dates for optimum seedling percentages in the ensuing year are listed in table 6. Sowing done somewhat earlier than these dates gave nearly as good results, but sowing at later dates reduced germination percentages.

The seeds may be broadcast on prepared seedbeds and mulched with sawdust (Rollins 1970). Alternatively, seeds can be sown in drills 20 to 30 cm (8 to 12 in) apart, covered with 12 mm (2 in) of soil, and mulched with straw (Gill and Pogge 1974). Straw mulch must be removed once germination begins, otherwise there is risk of loss due to damping-off fungi. The recommended seedbed density for several viburnums is 215/m^2 (20/ft^2) (Edminster 1947). Seedlings of some species may require shade for best development, although this depends on location and species. The most likely candidates for shading are the arrowwoods, hobblebush (Gould 1966), and mapleleaf viburnum. Seedlings should be ready for outplanting as 1+0 or 2+0 stock. A variety of techniques exist for rooting viburnum species by softwood cuttings, hardwood cuttings, or layering (Dirr and Heuser 1987).

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Figure 1—*Viburnum lentago,* nannyberry: cluster of fruits (a compound cyme) typical of the genus, × 1.

Figure 2—*Viburnum,* viburnum: single fruits (drupes), × 2.

Figure 3—*Viburnum,,* viburnum: cleaned seeds (stones), × 4.

Figure 4—*Viburnum lentago,* nannyberry: longitudinal sections through a stone, × 5.

Figure 5—*Viburnum dentatum,* southern arrowwood: Seedling development at 1, 2, 11, and 29 days after germination; roots and shoots develop concurrently.

Figure 6—*Viburnum lentago,* nannyberry: seedling development from stratified seed—root development during warm stratification (about 150 days) (**a**), very little development during ensuing cold stratification (about 120 days) for breaking epicotyl dormancy (**b**); subsequent development at germinating temperatures (**c**), × 1.

Table 1C *Viburnum,* viburnum: nomenclature and occurrence

Scientific name & synonym(s)	Common name	Occurrence
***acerifolium* L.**	**mapleleaf viburnum,** dock-mackie, mapleleaf arrowwood, possum-haw	Minnesota to Quebec, S to Florida & Texas
***V. dentatum* L.** *V. pubescens* (Ait.) Pursh	**southern arrowwood,** roughish arrowwood, arrowwood viburnum	Massachusetts, S to Florida & E Texas
***V. lantana* L.**	**wayfaringtree,** wristwood, wayfaringtree virbunum	Native of Europe & W Asia; introduced from Connecticut to Ontario
***V. lantanoides* Michx.** *V. alnifolium* Marsh. *V. grandifolium* Ait.	**hobblebush**, hobblebush viburnum, moosewood, tangle legs, witch-hobble	Prince Edward Island to Michigan, S to Tennessee & Georgia
***V. lentago* L.**	**nannyberry,** blackhaw, sheepberry, sweet viburnum	Quebec to Saskatchewan, S to Missouri, Virginia, & New Jersey
***V. nudum* var. *nudum* L.** *V. cassinoides* L.	**possumhaw,** swamphaw	Coastal Plain, from Connecticut to Florida & Texas; N to Arkansas & Kentucky
***V. nudum* var. *cassinoides* (L.) Torr. & Gray**	**witherod viburnum,** wild-raisin, witherod	Newfoundland to Manitoba, S to Indiana, Maryland, & mtns of Alabama
***V. opulus* L** *V. opulus* var. *amerieanum* Ait. *V. trilobum* Marsh.	**European cranberrybush,** cranberrybush, Guelder rose, highbush-cranberry	Native of Europe; escaped from cultivation in N US & Canada
***V. prunifolium* L.**	**blackhaw,** stagbush, sweethaw	Connecticut to Michigan, S to Arkansas & South Carolina
***V. rafinesquianum* J. A. Schultes** *V. affine* Bush ex Schneid. *V. affine* var. *hypomalacum* Blake	**downy arrowwood,** Rafinesque viburnum	Manitoba to Quebec, S to Arkansas & Kentucky
***V. recognitum* Fern.**	**smooth arrowwood,** arrowwood	New Brunswick to Ontario, S to Ohio & South Carolina
***V. rufidulum* Raf.**	**rusty blackhaw,** southern blackhaw, bluehaw, blackhaw, southern nannyberry	Virginia to Kansas, S to E Texas & N Florida

Sources: Dirr and Heuser (1987), Little (1979), Vines (1960).

Table 2C *Viburnum,* viburnum: phenology of flowering and fruiting

Species	Location	Flowering	Fruit ripening	Seed dispersal
V. acerifolium	Midrange	MayBAug	JulyBOct	Fall
	West Virginia	C	late Oct	NovBDec
	South	AprBMay	late July	FallBSpring
V. dentatum	Midrange	MayBJune	SeptBOct	to Dec
	Extremes	JuneBAug	JulyBNov	to Feb
V. lantana	Midrange	MayBJune	AugBSept	SeptBFeb
V. lantanoides	Midrange	MayBJune	AugBSept	Fall
	West Virginia	C	late Sept	OctBNov
	New York	May	AugBSept	AugBOct
V. lentago	Midrange	MayBJune	SeptBOct	OctBMay
	Extremes	AprBJune	mid July	FallBSpring
V. nudum var. *nudum*	South	AprBJune	SeptBOct	C
V. nudum var.	Midrange	JuneBJuly	SeptBOct	OctBNov
cassinoides	Extremes	MayBJuly	JulyBOct	C
V. opulus	Midrange	MayBJune	AugBSept	MarBMay
	Extremes	MayBJuly	SeptBOct	OctBMay
V. prunifolium	Midrange	AprBMay	SeptBOct	to Mar
	Extremes	AprBJune	JulyBAug	OctBApr
V. rafinesquianum	Midrange	JuneBJuly	SeptBOct	Oct
	Extremes	MayBJune	JulyBSept	C
V. recognitum	North	MayBJune	AugBSept	to Dec
	South	AprBMay	JulyBAug	to Feb
V. rufidulum	South	MarBApr	SeptBOct	Dec
	North	MayBJune	C	C

Sources: Brown and Kirkman (1990), Donoghue (1980), Gill and Pogge (1974).

Table 3C *Viburnum,* viburnum: growth habit, height, seed-bearing age, and seed crop frequency

Species	Growth habit	Height at maturity (m)	Year first cultivated	Seed-bearing age (yrs)	Interval between large seed crop (yrs)
V. acerifolium	Erect shrub	2	1736	2B3	1
V. dentatum	Erect shrub	5	1736	3B4	C
V. lantana	Shrub or tree	5	C	C	C
V. lantanoides	Erect or trailing shrub	3	1820	C	3 or 4
V. lentago	Shrub of tree	10	1761	8	1
V. nudum var. *nudum*	Shrub or tree	1.8	C	C	C
V. nudum var. *cassinoides*	Erect shrub	3	1761	C	1
V. opulus	Erect shrub	4	C	3B5	C
V. prunifolium	Shrub or tree	5	1727	8B10	1
V. rafinesquianum	Shrub	2	1830	C	C
V. recognitum	Erect shrub	3	C	5B6	C
V. rufidulum	Shrub or tree	3.5	C	5	C

Source: Gill and Pogge (1974).

Table 4C *Viburnum,* viburnum: fruit and seed weight and yield data

Species	Dried fruits/wt /kg	Dried fruits/wt /lb	No. of cleaned seeds Range /kg	No. of cleaned seeds Range /lb	No. of cleaned seeds Average /kg	No. of cleaned seeds Average /lb	Samples
V. acerifolium	10,600	4,800	24,050B36,600	10,900B16,600	28,000	13,100	5
V. dentatum	C	C	32,200B71,900	14,600B32,600	45,000	20,400	6
V. lantana	C	C	9,250B29,100	4,200B13,200	19,200	8,700	2
V. lantanoides	16,700	7,580	C	C	25,350	11,500	11
V. lentago	4,850	2,200	4,850B27,350	2,200B12,400	13,000	5,900	21
V. nudum var. *cassinoides*	6,600	3,000	55,100B63,950	25,000B29,000	60,850	27,600	3
V. opulus	12,100	5,500	20,700B39,250	9,400B17,800	30,000	13,600	12
V. prunifolium	C	C	8,800B13,230	4,000B6,000	10,600	4,800	5
V. rufidulum	5,200	2,360	C	C	C	C	C

Source: Gill and Pogge (1974).

Table 5C *Viburnum,* viburnum: stratification treatments and germination test results

	Stratification treatments (days)			Germ. percentage	
	Warm period* (first stage)	Cold periodH (second stage)	Germination test durationI	Ave. (%)	Samples
V. acerifolium	180B510	60B120	60+	32	5
V. dentatum'	0	0	60	C	C
V. lantanoides	150	75	100	43	3
V. lentago	150B270	60B120	120	51	3
V. nudum var. *cassinoides*	60	90	120	67	2
V. opulus	60B90	30B60	60	60	3+
V. prunifolium	150B270	30B60	60+	75	2
V. rafinesquianum	360B510	60B120	C	C	C
V. recognitum	360B510	75	60+	69	2
V. rufidulum	180B360	0	C	C	C

Sources: Gill and Pogge (1974), Vines (1960).
Germ. = germination.
* Seeds in a moist medium were exposed to diurnally alternating temperatures of 30/20 °C or 30/10 °C, but a constant 20 °C was equally effective for most species (Barton 1958).
H Seeds and medium were exposed to constant temperature of 5 or 10 °C. Temperatures of 1-6 °C are preferred now for cold stratification.
I At temperatures alternating diurnally from 30 (day) to 20 °C (night).
' Seeds were collected in Texas; temperature was not critical for germination (Giersbach 1937).

Table 6C *Viburnum,* viburnum: latest allowable dates for sowing in nursery beds and seedling percentages obtained in the following year

Species	Nursery location	Latest allowable sowing date*	Seedling %H
V. acerifolium	New York	May 1	55
V. lantana	Ohio	Oct 21	90
V. lentago	Ohio	Oct 7	75
V. opulus	New York	July 1	87
V. prunifolium	New York	May 1	26
V. recognitum	New York	May 1	32

Sources: Giersbach (1937), Smith (1952).

* Sowing dates later than those listed resulted in reduced seedling percentages.

H Number of seedlings in a nursery bed at time of lifting expressed as a percentage of the number of viable seeds sown.