

Aralia L.

Aralia

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Growth habit, occurrence, and uses. The genus *Aralia* comprises about 20 species of deciduous trees, shrubs, and herbs found in North America, Asia, Malayasia, and Australia (Blum 1974; Fernald 1950). The main species in North America include 3 perennial herbs and a small tree (table 1) the devil-s-walkingstick that is planted as an ornamental, as is the exotic Japanese angelica-tree *CA. elata* (Miq.) Seem. Animals utilize the vegetative growth and fruits to varying degrees. Two species were used for medicinal purposes by Native Americans. Underground parts are known for their aromatic qualities (Blum 1974; Braun 1961; Dirr 1990; Fernald 1950; Kenfield 1966; Krochmal and others 1969; MacKinnon and others 1992; Meeker and others 1993; Moore 1993; Stupka 1964; Tehon 1951; Voss 1985).

Within their respective ranges, the species occupy different types of sites. Devil-s-walkingstick is intolerant of shade, occurring mostly on disturbed sites with no or light forest canopy. It develops best on rich, mesic soils but also occurs on a range of site conditions. Dense stands are formed by shoot production from rhizomes. The stem has prominent spines, hence the species' common name of devil-s-walkingstick (Sullivan 1992).

Of the herbaceous perennials, wild sarsaparilla is the most widely distributed. It is a common understory species in a variety of forest types. In Wisconsin, for example, it occurs throughout the state but is most common in northern forests with dry-mesic to wet-mesic moisture regimes (Curtis 1959); it occupies similar sites in Newfoundland, Michigan, and British Columbia (MacKinnon and others 1992; Meades and Moores 1994; Voss 1985). Compound leaves develop annually from a well-developed rhizome system. Clones may be 10 m or more in diameter (Bawa and others 1982; Edwards 1984). The age of the perennial shoot-bearing portion of the rhizome can be determined from leaf scars and frequency of flowering from inflorescence scars (Bawa and others 1982).

Spikenard and bristly aralia are less widespread than wild sarsaparilla. Spikenard occurs on relatively richer sites and is described as one of the largest herbaceous plants in the flora of Michigan (Voss 1985).

Bristly aralia occurs on drier sites. Small clones are formed by development of the rhizome system and consist of vegetative and reproductive ramets (Thomson and Barrett 1981). A distinguishing characteristic is the presence of spines on the stem (Curtis 1959; Voss 1985).

Flowering and fruiting. The flowers of *Aralia* are polygamous, white or green, and occur in umbels or panicles (Fernald 1950; Harrar and George 1962). Wild sarsaparilla has 3 to 4 umbels/inflorescence (figure 1) and bristly aralia has approximately 9 umbels/ramet. Flowering occurs from May to September depending on species; fruits mature in late summer or fall (figure 2) (Blum 1974; Fernald 1950). Flowers of wild sarsaparilla develop on a separate stalk that is overtopped by the associated vegetative stalk. In the other species, flowers are terminal and axillary or a combination of the two (Fernald 1950). Fruits are light green when immature, changing to bluish or purplish black when mature (Dirr 1990; Mackinnon and others 1992; Meades and Moores 1994; Soper and Heimberger 1982; Voss 1985). Male flowers retained in bristly aralia umbels with both male and hermaphrodite flowers turn red, making the fruit more conspicuous than if only the fruits were present (Thomson and Barrett 1981).

In bristly aralia, umbels contain male-only and hermaphrodite flowers. During the early stages of flowering, all flowers function as males; the female portion of the hermaphrodite flowers were receptive after the male parts had ceased to function. The number of flowers per umbel ranges from 30 to 40. Twenty-seven to 35% of the flowers are hermaphrodites and more than 90% of these produced fruits (Thomson and Barrett 1981).

Wild sarsaparilla is dioecious with complete flowers uncommon (Bawa and others 1982). The sex ratio tends to be male-dominated but varies among sites and with time during the period of flowering, as male and female ramets do not flower synchronously (Barrett and Helenrum 1981). Inflorescences on female plants contain on average 55 to 125 flowers. About 68% of the flowers produced fruits. Controlled pollinations produced 90 to 100% fruit set; flowers remain receptive for about 6 days. Some of the main differences between male and female clones are that males have more flowers per inflorescence, greater frequency of flowering, and occur in higher densities and greater numbers of ramets than do females (Barrett and Helenrum 1981; Barrett and Thomson 1982; Bawa and others 1982).

Insects are the major means of pollination in the genus (Bawa and others 1982; Barrett and Helenrum 1981; Thaler and Plowright 1980; Thomson and Barrett 1981; Thomson and others 1982). In areas treated to control spruce budworm, 71 and 49% of flowers produced fruits in sprayed and unsprayed sites, respectively (Thaler and Plowright 1980).

The fruit is a small, berry-like drupe containing 2 to 5 compressed, crustaceous, light reddish brown nutlets that are round, oblong, or egg-shaped. Each nutlet contains 1 compressed, light brown seed with a thin coat that adheres closely to the fleshy endosperm (Sargent 1965; Thomson and Barrett 1981) (figures 2 and 3).

Collection, extraction, and storage. *Aralia* fruits may be collected when they begin to fall from the plants in autumn (table 2). The seeds are ripe when the endocarps of the nutlets become hard and brittle, and this ripening may occur somewhat later than the ripening of pulp. The fruits should be run through a macerator, with water, immediately after collecting. This will prevent fermentation and enable the pulp and empty seed to float off or be screened out. Small samples can be pulped by rubbing, with water, between 16-mesh screens. Purity of seeds cleaned by the macerator technique was 98% (Blum 1974), but soundness in some lots has been only 30 to 60% (Heit 1968). Seed size and weight of cleaned seeds is indicated in figures 3 and 4 and table 3. Refrigerated storage of cleaned seed in sealed containers is recommended (Dirr and Heuser 1987; Heit 1967a), but the duration of viability under these conditions is not known.

Seeds of early successional aralia species from temperate and tropical regions elsewhere in the world have been found in soil seed banks (Cheke and others 1979; Hirabuki 1988). Seed banks in beechBbirchBmaple forests in New England had a minor amount of spikenard, bristly aralia, and wild sarsaparilla (Graber and Thompson 1978). No information was found on buried seed of devil-s-walkingstick, a plant that better fits the ecological characteristicsCthat is, early successional, intolerant speciesCof the aralia species found to occupy seed banks in other parts of the world (Cheke and others 1979; Hirabuki 1988). The longevity of aralia seeds in the forest floor environment is not known.

Germination. Aralia seeds have dormant embryos, and some species, notably bristly aralia, appear to have impermeable endocarps (hardseededness) (Heit 1967b). There may be a combination of both hardseededness and embryo dormancy, requiring either mechanical or chemical scarification of the seedcoat in addition to a prechilling treatment (Heit 1967b). Seed dormancy in devil's-walkingstick can be overcome satisfactorily by 3 months of stratification at low temperatures (Blum 1974; Dirr and Heuser 1987). Hartmann and others (1990) also suggest that a 30-minute soak in sulfuric acid in addition to stratification improves germination. Dirr and Heuser (1987) reported 1% germination without stratification and 55% following 3 months of cold treatment. Although pretreatment with sulfuric acid and stratification at low temperatures will partially overcome hardseededness and embryo dormancy, other complications such as immature embryos further hinder germination (Heit 1968). In a study by Nichols (1934), seeds of wild sarsaparilla had 34% germination in 21 to 35 days after pretreating for 71 days at low winter temperatures in a cold frame. However, in this same study, seeds of bristly aralia had only 8% germination after exposure to low temperatures for 83 days. Seeds not exposed to low temperatures, on the other hand, had only 3% germination. Seeds of bristly aralia were shown to benefit from afterripening at temperatures ranging between 1 to 10 °C; optimum 5 °C for 90 to 120 days before planting in a greenhouse (Crocker 1948). Japanese angelica-tree may benefit from 3 months of warm followed by 3 months of cold treatment; however, 70% germination has been reported following cold treatment only (Dirr and Heuser 1987).

Warm plus cold stratification of wild sarsaparilla brought about germination of 24% (with a potential germination of 66 to 92%). The seed was stratified for 60 days at 20 °C (night) to 30 °C (day), plus 60 days at 5 °C, plus 60 more days at 20 to 30 °C, plus 60 more days at 5 °C. Similar treatment brought about only 0.5% germination of bristly aralia (Blum 1974). Obviously, this species still needs further study before fully satisfactory seed treatments can be developed (Heit 1967a).

Nursery practice. Heit (1968) recommends treating small lots of aralia seeds with sulfuric acid for 30 to 40 minutes and broadcast sowing in September. The aralias also may be propagated vegetatively. Root and rhizome cuttings offer the best method of vegetative propagation (Dirr and Heuser 1987).

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Table 1 *Aralia*, aralia: nomenclature, occurrence, growth habit, and height

Scientific name	Common name	Occurrence	Year first cultivated	Growth habit	Height at maturity (m)
<i>A. hispida</i> Vent.	bristly aralia, wild-alder, bristly sarsaparilla, dwarf-elder	Newfoundland to North Carolina & W to Minnesota & Indiana	1788	Perennial herb	0.3B0.9
<i>A. nudicaulis</i> L.	wild sarsaparilla, small spikenard	Newfoundland to North Carolina & W to Manitoba & Missouri	1731	Perennial herb	0.2B0.4
<i>A. spinosa</i> L.	devils-walkingstick, angelica-tree, Hercules-club, prickly-ash	Pennsylvania to Florida, W to SW Iowa & W Texas; range extended by planting in Massachusetts, Oregon, Washington, & western Europe	1688	Tree	7.7B9.2
<i>A. racemosa</i> L.	spikenard, petty morrel, life-of-man	Quebec to Manitoba, Great Lakes region, New England, & SE US	C	Perennial herb	0.5B3.0

Source: Blum (1974).

Table 2 *Aralia*, aralia: phenology of flowering and fruiting

Species	Seed dispersal dates	Flowering		Fruit
		dates	dates	
<i>A. hispida</i>	JuneBJuly	AugBSept	AugBSept	
<i>A. nudicaulis</i>	MayBJune	Aug	Aug	
<i>A. spinosa</i>	JulyBAug	SeptBOct	SeptBOct	

Source: Blum (1974).

Table 3 *Aralia*, aralia: seed data

Species	/kg	Range	Cleaned seeds/wt		Samples
			/lb	Average /kg /lb	
<i>A. hispida</i>	207,740B218,790	94,000B99,000	203,320	92,000	2
<i>A. nudicaulis</i>	185,640B245,310	84,000B111,000	218,300	99,000	3
<i>A. spinosa</i> *	232,050B346,970	105,000B157,000	288,850	131,000	2

Source: Blum (1974).

* 100 pounds of fruit have yielded 11 pounds of seed.