Solanaceae—Nightshade family

# *Solanum dulcamara L.*

## bitter nightshade

John C. Zasada and John A. Crossley

Dr. Zasada is a research silviculturist at the USDA Forest Service's North Central Research Station, Grand Rapids, Minnesota; Dr. Crossley retired from the USDA Forest Service's Northeastern Forest Experiment Station.

**Growth habit, occurrence, and use.** Bitter nightshade—*Solanum dulcamara* L., also known as European bittersweet—is a climbing perennial vine, somewhat woody at the base. It grows to a height of 1.8 to 3.6 m. It is native in Europe, northern Africa, and eastern Asia. In its natural range in Europe, it occurs on sites ranging from wet and shaded to dry and exposed. Its presence indicates a habitat in which the moisture regime may fluctuate from moist to waterlogged. It occurs on mineral to peat soils characterized by a high nitrogen supply and with a ph range of 4.8 to 7.9 (Pegtel 1985). Pegtel (1985) has briefly summarized many aspects of the species biology within its natural range.

Naturalized in North America, it is often found in moist thickets, from Nova Scotia to Minnesota, south to North Carolina and Missouri (Curtis 1959; Gleason 1958) and from Idaho to Washington and California (Crossley 1974). Its present values are highest in the southern wet-mesic forest type in Wisconsin (Curtis 1959). Bitter nightshade has been cultivated since 1561, chiefly for ornamental purposes, but it also has food and cover value for wildlife. The fresh berries are poisonous to most humans and are fatal to rabbits, but some birds and other wildlife eat them with impunity. Gunn and Gaffney (1974) state that any medicinal values are offset by the poisonous properties of the fruits and berries. Recommendations for medicinal use are only for external application; it has been used as an ingredient in ointments.

Leaves of the typical variety are minutely pubescent or nearly glabrous. Many plants from Nova Scotia to Ontario, however, have distinctly hairy leaves and branches. These plants have been segregated as the variety *villosissimum* Desv. (Gleason 1958). Mathe and Mathe (1973) found that plants from western and eastern European sources differ in their alkaloid chemistry, suggesting the presence of chemical taxa within the species.

Bitter nightshade is 1 of 1,200 species in the genus, most of which occur in the tropical and subtropical regions of both hemispheres (Crossley 1974). The genus contains economically important agricultural species—such as potato (*S. tuberosum* L.) and eggplant (*S. melongena* L.)—that have been domesticated through plant breeding and for which there is a large amount of information available. (The tomato genus—*Lycopersicon*—is also a member of the Solanaceae.) The nightshade genus also contains a number of agricultural weed species that affect the production of crops such as sorghum, soybeans, and cotton, and for which there is a significant amount of information available on various aspects of seed biology (for example, Rogers and Ogg 1981). Some of the information may be useful for understanding the seed biology of bitter

nightshade, but we did not review this information in detail. Seed characteristics of 42 economically important *Solanum* spp., including bitter nightshade, have been described (Gunn and Gaffney 1974).

**Flowering and fruiting.** The violet flowers, which occur in long peduncled cymes, bloom from July to August. Bumblebee species—*Bombus* spp.—are important pollinators (Liu and others 1975). The ovoid to ellipsoid scarlet berries ripen from August to October.

The fruit is a juicy berry 8 to 11 mm in diameter that contains from 40 to 60 seeds. The seeds are 2 to 3 mm by 1.7 to 2.5 mm by 0.7 to 1 mm, strongly flattened, tannish pink, irregular disks, and dully glistening as if coated with fine sugar. The embryo is coiled within the seed (figure 1) (Gleason 1958; Gunn and Gaffney 1974). In cross-section, the embryo is seen as 4 small round structures within the endosperm; the presence of 2 or 3 sections of embryo in a cross-section of the seed is common in the genus (Gunn and Gaffney 1974). Good seedcrops are borne almost annually.

**Collection of fruits; extraction and storage of seeds.** Seeds may be collected from July to September by hand-picking the ripe berries (Crossley 1974). The fruits may be rubbed through a 10-mesh screen, and the pulp and empty seeds floated off with water. Large-scale extraction can be done in a macerator. Parts of the fruit may adhere to the seed (Gunn and Gaffney 1974). Crossley (1974) found in 1 collection that there were about 700,00 seeds/kg (350,000/lb) and that , after careful cleaning, purity should be 99 to 100% and soundness from 92 to 99%. Seeds from genetically transformed plants had seed weights that were 40 to 70% of those of normal plants (Lee and Davey 1988).

Seeds have maintained high viability when stored in airtight containers for 1 year at either 2 to 3 EC or room temperature (20 EC). A moisture content of 6% has been satisfactory for storage periods of less than 1 year (Crossley 1974; Roberts and Lockett 1977). Information is lacking on viability after longer periods, but these seeds appear to be orthodox in storage behavior and should keep well as described above.

**Germination.** Freshly collected seeds have a high germination capacity with no pretreatment. Seeds germinate at constant temperatures of 30 to 35 EC, but the best germination occurs at alternating temperatures (Crossley 1974; Pegtel 1985; Roberts and Lockett 1977) (table 1). There are no official test prescriptions for bitter nightshade, but other species of nightshade tested at alternating temperatures of 20 and 30 EC (AOSA 1993). Stratification (4 to 5 EC) increases germination at constant temperatures but not at alternating temperatures. Germination of fresh and 1-year-old unstratified seeds at constant temperatures of 20 to 30 EC was greater than 95%; treatment with potassium nitrate improved germination at 30 EC but not at lower temperatures (Roberts and Lockett 1977). Pegtel (1985) found no effect of potassium nitrate on germination. Stratification did not significantly widen the range of constant temperatures at which seeds would germinate (Crossley 1974; Roberts and Lockett 1977; Pegtel 1985). Seeds appear to germinate well without light, however light requirements have not been studied in detail. Seeds will germinate completely in 5 to 6 months under field conditions when covered by 5 cm (2 in) of soil (Roberts and Lockett 1977). Seeds collected from plants growing in a variety of microclimatic conditions did not differ in their response to constant and alternating temperature conditions (Pegtel 1985). Germination is epigeal (figure 2).

**Nursery practice.** It is suggested that seeds be sown in the fall if untreated or if stratified, sown in the spring and covered with about 0.3 cm (0.1 in) of soil. Seeds mixed

thoroughly in the surface 7.5 cm (3 in) of soil in September–October and kept under field conditions (in Great Britain) began to emerge in late March; 6, 41, and 2% of seedlings appeared in March, April, and May, respectively. Forty-nine percent of the seeds planted produced germinants; 95% of seeds germinated in laboratory tests (Roberts and Lockett 1977). In other nightshade species, maximum seedling emergence occurred when seeds were covered by 1 to 2.5 cm (0.4 to 1.0 in) of soil (Boyd 1981). Root or stem cuttings can be used for vegetative propagation (Crossley 1974).

## References


AOSA [Association of Official Seed Analysts]. 1993. Rules for testing seeds. Journal of Seed Technology 16(3): 1–113.

Boyd JW. 1981. Effects of certain environmental factors on the growth and development of silverleaf nightshade (*Solanum eleagnifolium*). Dissertation Abstracts International [B] 42(9): 3513–3514.

Crossley JA. 1974. *Solanum dulcamara* L., bitter nightshade. In: Schopmeyer CS, tech. coord. Seeds of woody plants in the United States. Agric. Handbk. 450. Washington, DC: USDA Forest Service: 777–778.

Curtis JT. 1959. The vegetation of Wisconsin. Madison: University of Wisconsin. 657 p.

Gleason HA. 1958. The new Britton and Brown illustrated flora of the northeastern United States and adjacent Canada. New York: New York Botanical Garden.

Gunn CR, Gaffney FB. 1974. Seed characteristics of 42 economically important species of Solanaceae in the United States. Tech. Bull. 1471. Washington, DC: U.S. Department of Agriculture. 34 pp.

Lee JY, Davey MR. 1988. Morphological variation of *Solanum dulcamara* plants transformed with Ri plastids [abstract]. Research Report of the Office of Rural Development (Korea) [Biotechnology] 30(3): 21–27.

Liu HJ, Macfarlane RP, Pengelly DH. 1975. Relationships between flowering plants and four species of *Bombus* (Hymenoptera: Apidae) in southern Ontario [abstract]. Canadian Entomologist 107: 577–588.

Mathe I, Mathe I Jr. 1973. Data to the European area of the chemical taxa of *Solanum dulcamara* L. [abstract]. Acta Botanica Academiae Scientiarum Hungaricae 19(1/4): 441–451.

Pegtel DM. 1985. Germination in populations of *Solanum dulcamara* L. from contrasting habitats. New Phytologist 100(4): 671–679.

Roberts HA, Lockett PM. 1977. Temperature requirements for germination of dry-stored, cold-stored and buried seeds of *Solanum dulcamara* L. New Phytologist 79(3): 505–510.

Rogers BS, Ogg AG Jr. 1981. Biology of weeds in the *Solanum nigrum* complex (Solanum section Solanum) in North America [abstract]. Agric. Rev. Manual (West. Ser.) ARM-W-23. Washington, DC: USDA Science and Education Administration. 30 p.

**Table 1—***Solanum dulcamara,* bitter nightshade: pregermination treatments and germination

| Storage (months) | Stratification (days) | Germination conditions* | | Total germination (%) |
|---|---|---|---|---|
| | | Days | Temp (EC) | |
| 0 | 0 | ND | 20/30 | 95 |
| 3 | 0 | ND | 20/30 | 95 |
| 6 | 0 | ND | 20/30 | 95 |
| 0 | 0 | ND | 25 | 5 |
| 1 | 1 | ND | 25 | 80 |
| 3 | 3 | ND | 25 | 85 |
| 6 | 6 | ND | 25 | 75 |
| 0 | 0 | ND | 15 | 0 |
| 1 | 1 | ND | 15 | 5 |
| 3 | 3 | ND | 15 | 30 |
| 6 | 6 | ND | 15 | 65 |

**Source:** Roberts and Luckett (1977).
* ND = exposed to natural daylight for short periods but no light in germination incubators; 20/30 = 16 hrs at low temp and 8 hrs at high temp (10/25 EC and 10/30 EC were also used but they made little difference).

**Figure 1—***Solanum dulcamara,* bitter nightshade: exterior view of seeds (**above**); longitudinal section through seed (**below**). Longitudinal section based on Crossley (1974) and Gunn and Gaffney (1974). A cross-section of the seed intersects the coiled embryo 4 times (approximate magnification, H 16).

**Figure 2—***Solanum dulcamara,* bitter nightshade: seedling development at 1, 2, 6, and 12 days after germination.