

WEEDS

DALMATIAN TOADFLAX

(*Linaria genistifolia* ssp. *dalmatica* L.)

INTRODUCTION

Dalmatian toadflax, also known as broad-leaved toadflax, is native to the Mediterranean regions of Europe and western Asia. In North America it has escaped from ornamental plantings and invades open, low-elevation, coniferous forests and adjacent shrub-steppe, from sea level up to 2,800 m (9186 ft). In BC, toadflax occurs most frequently in the Southern Interior and is primarily associated with the bunchgrass, ponderosa pine and Interior Douglas fir biogeoclimatic zones. It is most commonly found on sandy or gravelly soil on roadsides, railroads, pastures, cultivated fields, rangelands and clear cuts. While toadflax can rapidly colonize disturbed or cultivated ground, plants can also invade healthy native plant communities.

A persistent and aggressive invader, Dalmatian toadflax has expanded significantly in the western United States and western Canada during the last few decades. It is expected to continue to increase as biological control of diffuse knapweed (*Centaurea diffusa*) is achieved in the drier regions of these areas. Toadflax plants displace native vegetation, thereby altering the species composition of natural communities. In North America, Dalmatian toadflax and the closely related common or yellow toadflax (*L. vulgaris*) are strong competitors. They quickly colonize open sites, and adapt to a wide range of environmental conditions. Once they become established, both species are particularly

competitive with winter annuals and shallow-rooted perennials.

While some researchers claim that Dalmatian toadflax is toxic to livestock when consumed in significant amounts, reports of livestock poisonings are rare. Deer reportedly graze prostrate shoots in fall, winter, and early spring, and horses are suspected of feeding on mature plants. Dispersal probably occurs in the feces and hair of these animals, as well as by birds and water.

IDENTIFICATION

Dalmatian toadflax is a member of the figwort family (Scrophulariaceae). Mature plants grow from 0.8-1.5 m (2.6-5.0 ft) tall and contain from 1-25 vertical, floral stems. Waxy, light green leaves are broad, 2-5 cm (0.8-2.0 in) long, heart-shaped, alternate, and generally clasp the stem. The tap root may penetrate 1 m (3 ft) into the soil, while horizontal roots may grow to be several meters long, and can develop adventitious buds that may form independent plants. Bright yellow, 'snapdragon-like' flowers are 2.5-4 cm (1.0-1.6 in) long. Seeds are sharply angular, slightly winged, and 1-2 mm (0.03-0.08 in) long.

Dalmatian toadflax is easily differentiated from common toadflax. Common toadflax only grows to 0.6 m (2 ft) tall and has leaves that are long, narrow and pointed at both ends. Dalmatian toadflax is also more robust than common toadflax, with increased branching near the top of the plant.

BIOLOGY

Dalmatian toadflax reproduces by seed and vegetative propagation. Once established, high seed production and the ability for vegetative reproduction allow for rapid spread and long persistence.

Toadflax relies upon insects for pollination; the two most important pollinators are bumble bees and halictid bees. Spring emergence occurs about mid-April and depends primarily on temperature. Flowering occurs from May-August and seeds mature from July-October. A mature plant can produce up to 500,000 seeds annually, and they can remain viable for up to ten years. Prostrate stems emerge in September; they are tolerant of freezing and are associated with floral stem production the following year.

Vegetative reproduction from root buds can occur as early as 2-3 weeks after germination, and is possible from root fragments as short as 1 cm (0.4 in) in length. These buds can grow their own root and shoot systems, and become independent plants the next year. Vegetative propagation can allow a stand of toadflax to spread rapidly.

Individual plants live up to five years with an average lifespan of 3.8 years. The life span of toadflax stands depends on environmental conditions and the reproductive success of individual plants. The relatively short lifespan of toadflax plants bodes well for controlling these species.



PREVENTION

The most effective way to ensure that your lands do not become infested with Dalmatian toadflax is by prevention. Here are some recommendations to prevent Dalmatian toadflax invasion on your rangelands:

- Maintain grasslands in a healthy, vigorous condition to ensure a productive plant community; competitive perennial grasses and forbs utilize water and nutrients that would otherwise be readily available to toadflax
- Follow a well-designed grazing plan; excessive livestock grazing reduces competition from grass and favours weeds
- Confine livestock for five days after they have grazed in an infested pasture to ensure that undigested seeds are not spread to new areas with their manure
- Regularly patrol your property for Dalmatian toadflax plants and immediately treat new infestations
- Cooperate with adjacent landowners and encourage them to control Dalmatian toadflax and other weeds
- Immediately seed disturbed, bare soils with a suitable seed mix that provides dense, early colonization to prevent weed invasion; the seedlings of toadflax are considered ineffective competitors for soil moisture with established perennials and winter annuals
- Clean your vehicles and machinery of plant material and soil after leaving a toadflax infestation

PHYSICAL CONTROL

Individual plants and small patches of Dalmatian toadflax can be hand-pulled or hand-cut to prevent seed formation. Hand-pulling is most successful where soils are sandy and/or moist, allowing for removal of as much root as possible. Hand-cutting toadflax stands to ground level in spring or early summer is an effective way to eliminate seed production and dispersal, but it will not destroy plants. Mechanical mowing might even be less effective on toadflax than cutting because it leaves several centimetres of stem above the soil surface that may allow them to re-sprout more rapidly. In addition, damage to surrounding plants should be evaluated before mowing is used. Since the plant also spreads through vegetative propagation, and the seeds can remain viable for up to ten years, physical removal must be repeated annually for at least ten years to completely control a stand.

On agricultural land, intensive clean cultivation techniques are recommended for successful toadflax control. This requires at least two years with 8-10 cultivations in the first year and 4-5 cultivations in the second year. Cultivation can be reduced by substituting herbicide treatment for some of the cultivation operation.

BIOLOGICAL CONTROL

Biological control consists of introducing host-specific insects or diseases to reduce the number of weeds. Two biological control agents have been successfully released in BC: a stem boring weevil, *Mecinus janthinus*, feeds on new shoots, while a stem-boring moth, *Eteobalea intermediella*, feeds on the roots of toadflax. Two seed head feeding insects and another root feeding insect are currently being prepared for release.

CHEMICAL CONTROL

Herbicide treatment, with appropriate timing, can significantly reduce toadflax seed production; however, permanent, long-term control of Dalmatian toadflax cannot be achieved with herbicide treatment alone. The herbicides Tordon 22K, Banvel and Roundup are considered effective for controlling toadflax. The addition of a silicone-based surfactant may also help to increase herbicide uptake through the waxy leaf surface. Unfortunately, chemical control of established Dalmatian toadflax populations requires high rates, and often repeat applications. When infestations are large (>10 hectares), spraying should be limited to spot treatment and perimeter spraying to slow the rate of spread and the ecological impact of Dalmatian toadflax.

Research in BC has shown that spot treatment using Tordon 22K or Banvel at rates as low as 4.5 L/ha and 4.2 L/ha respectively can provide good control of toadflax when applied in spring during active growth. Tordon treatment zones should extend 1-2 metres beyond target plants to control regenerative rootstocks. If late summer or early fall rains are sufficient to initiate regrowth from stem bases, toadflax can alternatively be sprayed with Tordon in the fall. Seedlings may re-appear within 2 to 3 years of herbicide application and require retreatment.

An alternate treatment for toadflax is a 1:2 Roundup:water mixture with surfactant in a wick-type applicator to wipe the leaf and stem surfaces. The best timing is late bud to early bloom stages. Retreatment should be made at 3 year intervals if re-sprouting occurs.

Consult your local Ministry of Agriculture and Food office for the most current information on appropriate chemical controls. As with all pesticide treatment, herbicide applicators must handle and apply herbicides in a safe and responsible manner, as dictated by legislation and guidelines under the <i>Pesticide Control Act</i> .
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MONITORING

Monitoring of treated toadflax stands should be conducted in early June when plants have formed buds and are beginning to flower. Any management program should also be conducted in June. This is when root carbohydrate reserves are at their lowest, which makes it more difficult for the plant to recover from disturbance. Follow-up work in late June or early July is recommended to locate and remove any late-flowering plants.

POST-TREATMENT GRAZING MANAGEMENT

During early spring, perennial bunchgrasses are growing from root reserves and are more susceptible to competition from invasive weeds. Native grass seedlings are often poor competitors with weeds so it is important to maintain weed control until the grass stand is vigorous and competitive. It is essential that

enough leaf area remains after grazing to allow regrowth when soil moisture is available.

Failure to alter land management practices to allow the native plant community time to recover and resist competition from weeds will lead to a reduction of forage available for grazing animals.

Management practices that will assist the recovery of the native plant community include:

- delay spring grazing until range readiness has been achieved¹
- avoid compaction of wet soils
- avoid congregations of livestock whenever possible, to ensure there are no areas of high soil disturbance
- employ appropriate grazing systems that maintain the vigour and health of the range plants

The recovery potential of areas that have been cleared of toadflax is very high. Plant communities that are in good condition may recover without replanting of desirable species. However, replanting competitive native grasses and forbs can help accelerate recovery of the area.

¹Rangeland Handbook for BC. 1998. Available from the BC Cattlemen's Association (250) 573-3611

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