

Biology, Ecology, and Management of Scotch Broom (*Cytisus scoparius* L.)

By

Melissa Graves, MSU Extension Integrated Pest Management and Weeds Specialist, Department of Land Resources and Environmental Sciences, Bozeman, Montana

Jane Mangold, MSU Extension Invasive Plant Specialist, Department of Land Resources and Environmental Sciences, Bozeman, Montana

Jim Jacobs, Invasive Species Specialist, NRCS, Bozeman, Montana



Figure 1. Scotch broom colony (Photo courtesy of J.S. Peterson, USDA Plants Database, 2009).

Abstract

Scotch broom (see Figure 1), a member of the pea family (Fabaceae), is a highly invasive perennial shrub reaching up to 13 feet (4 meters) in height. Young plants have green stems that become woody as the plant matures. The deciduous leaves are alternately arranged on the stem and ones lower on the plant have three leaflets per leaf similar to a clover leaf. The leaves are not divided into three leaflets higher on the plant, but are instead simple. The flowers, which resemble a pea flower, are bright yellow, but may occasionally be tinged with red or purple. Blossoms are typically found in the leaf axils or at the branch tips. Scotch broom spreads rapidly and its rapid growth rate allows it to crowd out other plant species, especially in disturbed sites, pastures, roadsides, and open woods. Control of Scotch broom is difficult once it becomes established, with repeated treatments often required to manage populations. Scotch broom is currently limited to Sanders and Lincoln Counties in northwestern Montana, therefore prevention and early detection are key to its management.



Figure 2. A sketch of Scotch broom stem, leaves, flower and seed pod. Britton, N.L., and A. Brown. 1913. *An illustrated flora of the northern United States, Canada and the British Possessions*. Vol. 2: 350. Courtesy of Kentucky Native Plant Society. Scanned by Omnitek, Inc.

PLANT BIOLOGY

Identification

Scotch broom (Fabaceae) is a perennial deciduous shrub. It grows rapidly, attaining heights up to 13 feet (4 meters), and produces main and lateral stems during the same growing season. The stems are green and angled with no spines or thorns. Stems become woody as the plant ages. The leaves, which are located at branch bases, have three leaflets and are alternately arranged on the stems (see Figure 2). Upper leaves are simple and lack a stalk or petiole. The 1/5- to 1/3-inch (4-8 millimeters) leaflets are typically egg-shaped and widest at the tip. Leaf tips may be pointed or even spine-tipped. The leaves of Scotch broom are sometimes hairy. As with other members of the pea family, Scotch broom has nodulated roots and is an efficient nitrogen fixer.

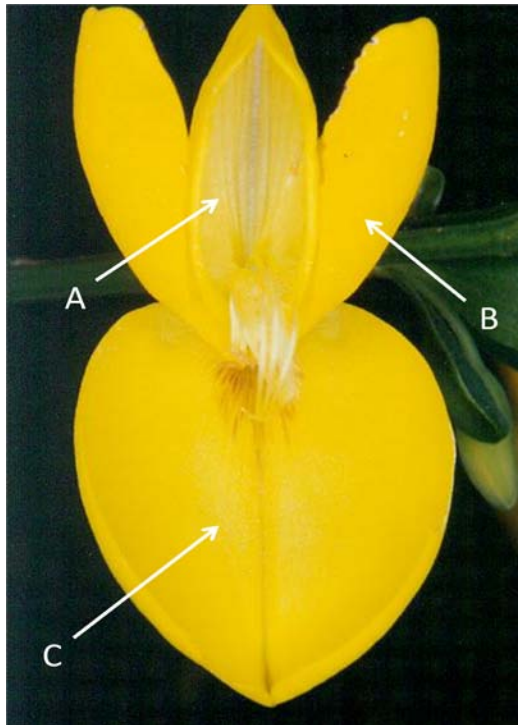


Figure 3. A) keel petals, B) wing petals, and C) banner (Photo courtesy of Ted W. Anderson, Anderson Technologies, 2010).

The flowers are arranged in terminal racemes or may be solitary in the leaf axils. They are bright yellow, but may be tinged with red or purple, and are approximately 3/4-inch (2 centimeters) in length. Flowers of Scotch broom are typical of those in the pea family, with five petals; two wings, two keels, and a banner or standard (see Figure 3). The wings are oblong to ovate in shape. The keel petals of Scotch broom are typically fused to form one structure, which contains both the pollen and seed producing flower parts. The flowers have a slender, strongly curved style, which is longer than the keel. Scotch broom flowers have ten stamens, five long stamens above the ovary and five short stamens below.



Figure 4. Scotch broom seed pods (Photo courtesy of Victorian Resources Online, 2010).

The fruit of Scotch broom is a green flattened pod from 3/4-inch to 2 inches (2-5 centimeters) in length, turning black when mature. The pods are typically hairless, but the outer edges may be fringed with hairs (see Figure 4). Each pod contains between five and nine seeds. Seeds are identifiable by a small crest-like growth at the point of attachment to the pod (hilum, see Figure 5).

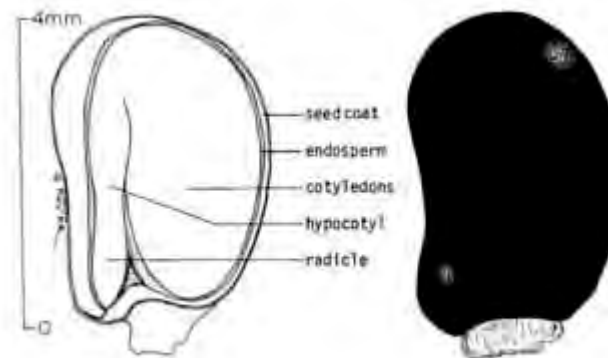


Figure 5. Scotch broom seed. Photo by Suzanne Foster. Courtesy of USDA Forest Service.

Scotch broom can be distinguished from other ornamental brooms by flower color, fruit, stem, and leaf features. Spanish broom (*Cytisus multiflorus*) has white flowers and yellow seeds, French broom (*Genista monspessulanus*) retains leaves year-round, osiris (*Cytisus beanie*) has linear-shaped leaves and a partially prostrate growth form, and common gorse (*Ulex europaeus*) has spiny stems, perennial leaves, and a coconut-like smell.

Life History

Scotch broom is a long-lived perennial shrub. It can grow up 8 feet (2.5 millimeters) within the first two years and may live 20 years or more. The shrubs reach their full height around 6 to 11 years. Flowering normally begins in early to late spring, depending on climate. Peak flower production typically occurs between May and June, followed by fruit set. It is pollinated by bees (*Osmia* spp. and *Apis* spp.) and bumble bees (*Bombus* spp.). Seed dispersal occurs from mid-July to mid-August.

Reproduction occurs by seed with no vegetative reproduction, but it can re-sprout after cutting. Although full growth may take several years, seed production can begin around two years of age. Seed production is extremely variable, ranging from 4,000 to 30,000 or more seeds per plant. Some studies indicate there may be up to 2,000 seeds per square foot of soil. Seeds of this species can remain viable in the soil for up to 30 years. While buried seeds may have a delayed germination, they are capable of germinating from a depth of up to 2.4 inches (6 centimeters).

Habitat

Scotch broom prefers temperate areas with cool winters and warm summers, but it can tolerate very cold conditions as well. It is found in areas with a wide range of soil moisture conditions. It prefers a soil pH of less than 6.5, and is therefore rarely found on limestone soils. Nor is it a species typically found on calcareous soils. It is very competitive in areas with low soil fertility. This species is typically found in disturbed areas, along roadsides, in pastures, open forests, gravel pits, and cultivated fields, but is known to colonize undisturbed shrubland, grassland, and open canopy forests located below 4,000 feet. It is also shade tolerant, requiring as little as 10% sunlight for seedling establishment.

Distribution: Scotch broom is native to central and southern Europe and North Africa. According to herbarium records, it was introduced to the United States in the 1850's. This species was used as an ornamental plant, but was also used to control soil erosion. It is currently listed as an invasive plant in numerous countries of the world including Australia, New Zealand, Canada, and the United States. This species is found in 27 states in the United States, mostly along both coasts and neighboring inland states. Western states reporting populations of Scotch broom include: Alaska, California, Idaho, Montana, Oregon, Utah, and Washington. At this time California reports the most significant populations with over 700,000 acres infested. It is listed as a noxious weed in Hawaii, Idaho, Oregon (Class B), and Washington (Class B). As of 2010, it has only been reported in Sanders and Lincoln counties, in Montana.

Spread

Seeds are catapulted from mature pods when the pods dry and audibly snap apart sending seeds 3 feet (1 millimeter) from the parent plant. Ants are known to contribute to longer range dispersal of up to 15 feet (5 millimeters). Seeds may also be spread over longer distances by animals, vehicles, and flooding. Humans aid plant establishment through disturbance and improper vegetation management. A common method of dispersal in the Pacific Northwest is through gravel and vehicles used for road construction associated with timber harvest. Horticultural plantings provide a seed source for population spread.

Impacts

Scotch broom is highly reproductive and has a rapid growth rate that allows it to form nearly monospecific stands thus reducing plant community diversity. It is one of the few invasive plants known to impact conifer forests. During dry seasons this species has been known to reduce biomass of juvenile trees in Douglas-fir forests by as much as 96%.

Scotch broom is toxic to livestock due to the presence of the quinolizidine alkaloids sparteine and isosparteine. Livestock poisonings have been reported in Europe, but are very rare in the United States. People who have eaten flowers and seeds have suffered from nausea and vomiting.

In addition to these problems, scotch broom has also been recognized as a host for several species of *Phytophthora* pathogens. These pathogens cause a number of diseases, including root rot, and may spread to other plant species.

MANAGEMENT ALTERNATIVES

In Montana, Scotch broom is listed as a Priority 1B noxious weed. Priority 1B weeds have limited presence in the state and management criteria are containment, eradication when possible, as well as education. Management is prioritized by local weed districts. Therefore, contact your local weed coordinator or county extension agent if populations are present. Preventing the spread of Scotch broom seeds by humans is critical to its management. Vehicles and equipment should be regularly and thoroughly cleaned before being moved from infested sites to non-infested areas. Early detection and control of Scotch broom in previously non-infested sites is the key to preventing the establishment of new colonies.

Herbicide ^{1/}

Contact your local weed coordinator or county extension agent for herbicide recommendations that are most effective in your area. Glyphosate (Roundup[®] and others) can be used as a foliar herbicide to control established plants during active growth after all leaves have expanded and before they fall off the stem. This herbicide should be applied with a non-ionic surfactant (based on label recommendations) at a rate of 1.25 to 1.5% solution. Triclopyr + 2,4-D (Crossbow[®]) can be used as either a broadcast application (1.5 gal/acre) or high-volume foliar application (1 to 1.5% mixture) during active plant growth. Triclopyr (Garlon 3A or 4 and others) or Picloram (Tordon 22K[®] and others) can also be used for control of scotch broom when applied at label rates for either non-crop (pasture or rangeland) or forest preparation. Use caution when applying herbicides to avoid injury to non-target species. Always read and follow product labels to ensure correct usage and to reduce environmental risks.

Mechanical Removal

Mowing or cutting Scotch broom plants at the end of a dry season has been shown to significantly reduce re-sprouting and if done repeatedly can eventually reduce populations. Cutting the stems below the soil surface may disturb the soil and stimulate germination of seeds from the seed bank. Bush hog removal, which involves twisting the stems off instead of cutting, has been used to control Scotch broom, but does not eliminate re-sprouting and may cause damage to non-target species.

Prescribed Burning

Prescribed burning can be used successfully, but requires multiple burns to effectively control this species. This technique can also be used prior to herbicide application to increase control of Scotch broom. Burning is more effective when done in mid-summer as new plants are sprouting. A high-intensity burn combined with a low-intensity burn 2-3 years later can result in long-term control. Burn trials conducted on French broom (*Genista monspessulana*) in Australia and New Zealand indicated that burning reduced the existing plant populations, but increased seed germination from the seed bank. Higher intensity burning is required to prevent seed germination, but this technique damages seeds of desirable species in the seed bank. This can result in increases in weed species.

Grazing Management

Livestock losses after grazing Scotch broom have been reported and therefore using grazing management to control populations should be approached with caution. During field grazing trials in British Columbia, sheep would not eat Scotch broom. However, La Manchia goats grazed Scotch broom on small field plots on Vancouver Island. Grazing by goats during active growth of Scotch broom has been used successfully in New Zealand, but requires several seasons for effective control. Native plant species are also at risk with this method since goats are non-selective grazers. Grazing by llamas has been used with some success at a few sites in California. No toxicity has been reported in goats or llamas.

^{1/} Any mention of specific products in this publication does not constitute a recommendation by the NRCS. It is a violation of Federal law to use herbicides in a manner inconsistent with their labeling.

Biological Control

Two insect species, a twig-boring moth (*Leucoptera spartifoliella*) and a seed weevil (*Apion fuscirostre*) were released in the 1970's and 1980's as biocontrol agents for Scotch broom in California. The effectiveness of these insects for controlling this species has been very limited however. The twig-boring moth is subject to insect parasitism. The seed weevil larvae consume seeds and may help reduce plant stands, but they have no impact on adult plants. These insects are not known to occur in Montana. Several new biocontrol insects are being tested for use in New Zealand and Australia, but are not currently available in the United States.

Integrated Pest Management (IPM)

1. Prevention is key. Maintain soils and desirable plant species at optimum quality levels. In the event Scotch broom plants are found, immediate treatment is necessary to prevent spread.
2. Monitor and clean vehicles and equipment to prevent transport of seeds between sites.
3. Disturbance will facilitate weed establishment. Routinely monitor vegetation, especially after a disturbance, and remove weeds as soon as possible. Continue monitoring following removal.
4. Small to moderate infestations may be controlled by cutting in combination with chemical treatment.
5. Severe infestations may require repeated chemical treatment. Re-seeding of infested areas may be necessary in cases of severe.

References

Harrington, T.B. 2009. Seed germination and seedling emergence of scotch broom (*Cytisus scoparius*). *Weed Science*. 57: 620-626.

Paynter, Q., P.O. Downey, and A.W. Sharp. 2003. Age structure and growth of the woody legume weed *Cytisus scoparius* in native and exotic habitats: implications for control. *Journal of Applied Ecology*. 40: 470-480.

Peterson, D.J. and R. Prasad. 1998. The biology of Canadian weeds. 109. *Cytisus scoparius* (L.) Link. *Canadian Journal of Plant Science*. 78: 497-504.

Potter, K.J.B., D.J. Kriticos, M.S. Watts, and A. Leriche. 2009. The current and future potential distribution of *Cytisus scoparius*: a weed of pastoral systems, natural ecosystems, and plantation forestry. *Weed Research*. 49: 271-282.

Wildland Fire in Ecosystems: Fire and Nonnative Invasive Plants. 2008. United States Department of Agriculture. Rocky Mountain Research Station. General Technical Report RMRS-GTR-42-Volume 6.