

Biology, Ecology and Management of

# Scotch Broom

(*Cytisus scoparius* L.)



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## Table of Contents

Plant Biology .....	3
Identification .....	3
Life History .....	4
SpeedyWeed ID .....	5
Current Status and Distribution .....	6
Ecology .....	6
Habitat .....	6
Spread and Establishment Potential .....	7
Damage Potential .....	7
Management Alternatives .....	7
Prevention .....	7
Mechanical Control .....	8
Cultural Control .....	8
Biological Control .....	8
Prescribed Burning .....	9
Chemical Control .....	9
Integrated Weed Management (IWM) .....	9
Glossary .....	10
References .....	10
Additional Resources .....	11
Acknowledgements .....	11

Terms in bold can be found in the glossary on page 10.

- Cover photo by Eric Coombs, Oregon Department of Agriculture, bugwood.org  
 - Inset cover courtesy of Washington State Noxious Weed Control Board

Any mention of products in this publication does not constitute a recommendation by Montana State University Extension. It is a violation of Federal law to use herbicides in a manner inconsistent with their labeling.

Scotch broom (*Cytisus scoparius* L.) is a highly invasive perennial shrub. It can be recognized by its bright yellow flowers, clover-like leaves, and shrubby growth habit. This species was introduced to the United States in the 1850s to control soil erosion and as a landscape ornamental. Scotch broom spreads rapidly and frequently outcompetes other plant species, especially in disturbed sites, pastures, roadsides and open woods. Control is difficult once this species becomes established, with repeated treatments often required. Scotch broom is currently limited to Sanders and Lincoln Counties in northwestern Montana, therefore prevention and early detection are key to its management.

## PLANT BIOLOGY

### Identification

Scotch broom, a member of the pea family (Fabaceae), is a perennial **deciduous** shrub. It grows rapidly, attaining heights up to 13 feet (4 m), and produces main and lateral stems during the same growing season. The stems are green to woody, **angled**, with no woody spines. 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 (Figure 2). Upper leaves are **simple** and lack a stalk or petiole. The 1/5 to 1/3 inch (4-8 mm) long leaflets are typically egg-shaped and widest at the tip. Leaflet tips may be pointed or have a spine located at the tip. The leaflets of Scotch broom are sometimes hairy. Scotch broom has **nodulated** roots and is an efficient nitrogen fixer similar to other members of the pea family.



**FIGURE 1.** Scotch broom colony. (photo by J.S. Peterson, USDA Plants Database, 2009)



**FIGURE 2.** Alternate Scotch broom leaves. (photo by Timothy W. Miller, Minidoka County Noxious Weeds, Idaho, 2010)

Flowers occur either as long terminal **racemes** or may be solitary in the leaf axils. They are typically bright yellow, but may have red or purple petals, and are approximately  $\frac{3}{4}$  inch (2 cm) 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 (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 male and female flower parts. The flowers have a slender, strongly curved style, which is longer than the keel. Scotch broom flowers have ten stamens, with longer stamens above the ovary and shorter stamens below.

The fruit of Scotch broom is a flattened pod from  $\frac{3}{4}$  in to 2 inches (2-5 cm) in length that is green when young (Figure 4) and turns black at maturity. The pods are typically hairless, but the outer edges may be fringed with hairs. Each pod contains between five and nine seeds. Seeds are identifiable by a small crest-like growth at the **hilum**.

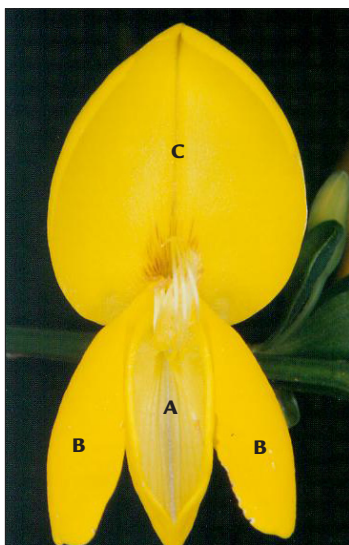
### Life History

Scotch broom is a long-lived perennial. It can grow up to 8 feet (2.5 m) within the first two years and may live 20 years or more. Plants reach their full height within 6 to 10 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. Seed dispersal occurs from mid-July to mid-August.

Reproduction occurs only by seed. Seed production can begin around two years of age and 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 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 cm).

**FIGURE 3.** A) keel petals, B) wing petals, and C) banner. (photo by Ted W. Anderson, Anderson Technologies, 2010)

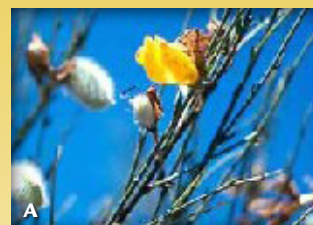


**FIGURE 4.** Young Scotch broom seed pods. (photo courtesy of Victorian Resources Online, 2010)

## SpeedyWeed ID

Scotch broom can be identified by its shrubby growth habit, bright yellow flowers, clover-like leaves, square stems, and smooth black fruits. Several other introduced shrubs could be mistaken for this species. These include: striate or Portuguese broom (*Cytisus striatus*) which has hairy seed pods and yellow flowers (Figures 5a and 5b), white Spanish broom (*Cytisus multiflorus*) which has hairy seed pods and white flowers (Figures 6a and 6b), and gorse (*Ulex europaeus*) which has shiny yellow flowers and spines (Figure 7). The following characteristics are common to Scotch broom:

- bright yellow pea flowers, sometimes with red or purple petals
- alternate clover-like leaves becoming simple at branch tips
- angled, spineless stems; green when young, woody when mature
- smooth black fruits (pods), hairy along the margins



**FIGURE 5.** A) Portuguese broom. (photo courtesy of Oregon State University) B) Portuguese broom seed pods. (photo courtesy of Francisco Oliveira, 2010)



**FIGURE 6.** A) White Spanish broom. (photo by Paulo V. Araujo, 2010) B) White Spanish broom seed pods. (photo courtesy of Aia Pagoeta Natural Park, 2010)

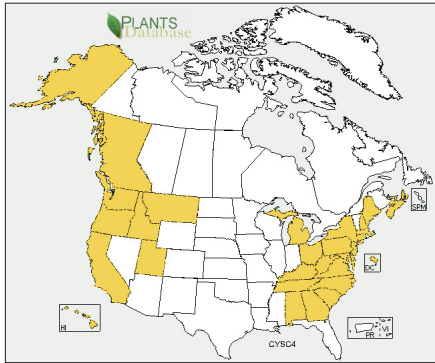


**FIGURE 7.** Gorse. (photo courtesy of Southern, Tasmanian Councils Authority, 2010)



## CURRENT STATUS AND 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 1850s. 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 several countries including Australia, New Zealand, Canada, and the United States. This species is found in 27 states in the United



**FIGURE 8.** Scotch broom state and province distribution map. (NRCS Plants Database, <http://plants.usda.gov/>)

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 (Figure 8). 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). Scotch broom has been listed as a Priority 1b noxious weed in Montana. This designation means prevention, education, and

eradication are the most cost-effective management strategies if this species is detected. As of 2010, it has only been reported in Sanders and Lincoln counties in Montana.

## ECOLOGY

### Habitat

Scotch broom prefers temperate areas with cool winters and warm summers, but it can tolerate very cold conditions as well. While found in areas with a wide range of soil moisture conditions, it prefers a soil pH of less than 6.5, and is rarely found on limestone-derived or 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 in elevation. It is also extremely shade tolerant, requiring as little as 10 percent ambient sunlight for seedling establishment, allowing for germination in shaded areas or under forest canopies.

## Spread and Establishment Potential

Seeds typically fall within 3 feet (1 m) of the parent plant. Ants are known to contribute to longer range dispersal of up to 15 feet (5 m). Seeds may also be spread over longer distances by animals, vehicles, and flooding. Humans also 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. Young plants are difficult to eradicate and are capable of re-sprouting from the root crown after cutting or burning. Even though burning is sometimes used to control Scotch broom, low to moderate fire temperatures have been shown to increase seed germination.

## Damage Potential

Scotch broom can contribute to reductions in plant community diversity by out-competing other species for light and nutrients. This allows Scotch broom to form dense **monospecific** stands. 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 percent.

Scotch broom is toxic to livestock due to the presence of the quinolizidine alkaloids sparteine and isosparteine, however it is rarely grazed. Livestock poisonings have been reported in Europe, but are very rare in the United States.

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 species.

## MANAGEMENT ALTERNATIVES

### Prevention

Because of its limited presence in Montana, prevention is the most important management strategy for Scotch broom. Preventing the spread of Scotch broom seeds by humans is critical, therefore vehicles and equipment should be regularly and thoroughly cleaned before being moved from infested to non-infested areas. Please contact your local county Extension agent or weed district coordinator if you think you have found Scotch broom. Proper identification, early detection, and control of Scotch broom in previously non-infested sites is the key to preventing the establishment of new colonies.

### **Mechanical Control**

Mowing or cutting Scotch broom plants at the end of summer has been shown to significantly reduce re-sprouting and can eventually reduce populations if done repeatedly. Do not cut the stems below the soil surface as this may disturb the soil and stimulate germination of seeds from the seed bank. Mowing with a rotary mower, 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.

### **Cultural Control**

The most effective way to prevent the invasion and establishment of Scotch broom is through proper management of existing vegetation. Disturbances (e.g. overgrazing, timber harvest) create gaps in vegetation and may favor the establishment of Scotch broom and other weeds. Proper management of forests, lawns, pastures, roadsides, and rangeland keeps desirable plants in a healthy condition and helps minimize habitat disturbance.

In areas of severe infestation, revegetation may be necessary. Herbicide application followed by reseeding or planting saplings may be required to aid in the establishment of desirable seeded species. Due to the persistence of this species in the seed bank, this process is very difficult and may require repeated treatments.

### **Biological Control**

Two insect species, a twig-boring moth (*Leucoptera spartifoliella*) and a seed weevil (*Exapion fuscirostre*) were released in the 1970s and 1980s as biocontrol agents for Scotch broom in California. The effectiveness of these insects has been very limited. 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. A third insect species, a broom seed beetle (*Bruchidius villosus*) is currently used as a biocontrol agent in Oregon. Adult insects feed on pollen, while larval insects feed on seeds within the seedpods. 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.

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. Sheep would not eat Scotch broom during a field trial in British Columbia.

### **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 two to three years later can provide 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 seedbank. This can result in increases in weed species.

### **Chemical Control**

Herbicide application followed by reseeding or planting saplings may be required to aid in the establishment of desirable species. Due to the persistence of this species in the seed bank, this process is very difficult and may require repeated treatments.

Chemical control of Scotch broom has been achieved with a variety of herbicides. Glyphosate (Roundup®) can be used as a foliar herbicide to control established plants during active growth after all leaves have opened. This herbicide should be applied with a non-ionic surfactant (based on label recommendations) at a rate of 1.25 to 1.5 percent solution. 2,4-D + triclopyr (Crossbow®) can be used as either a broadcast application (1.5 gal/acre) or high-volume foliar application (1 to 1.5 percent mixture) during active plant growth. Triclopyr (Garlon® 3A or 4) or picloram (Tordon 22K®) 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.

### **INTEGRATED WEED MANAGEMENT (IWM)**

- Prevention is key. Be able to identify Scotch broom so it can be detected and controlled before it can spread. 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.

- Monitor and clean vehicles and equipment to prevent transport of seeds between sites.
- Disturbance will facilitate weed establishment. Routinely monitor vegetation, especially after a disturbance, and remove weeds as soon as possible. Continue monitoring following removal.
- Small to moderate infestations may be controlled by cutting in combination with chemical treatment.
- Severe infestations may require repeated chemical treatment. Reseeding of infested areas may be necessary in cases of severe infestation (refer to *Dryland pastures in Montana* [EB0019], and *Revegetation Guidelines for Western Montana* [EB0170], for recommendations for revegetation species)

## GLOSSARY

**Angled** - square stemmed; not round.

**Banner** - largest petal of a pea flower.

**Deciduous** - losing its leaves at the end of the growing season.

**Glabrous** - without hairs.

**Hilum** - the 'eye' of a bean or other large seed.

**Keel** - two lower fused petals of a pea flower.

**Monospecific** - containing only one species.

**Nodulated** - having nodules, nitrogen-fixing nodes found on legumes.

**Ovate** - egg-shaped with attachment at broad end.

**Raceme** - unbranched inflorescence with stalked flowers from an elongate main stem.

**Simple** - single, not compound.

**Wing** - the two lateral separate petals of some pea flowers.

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