

# Hoary Cress (Whitetop)

by Roger L. Sheley and Jack Stivers,  
revised by Kim Goodwin\*



*Figure 1. Land infested with whitetop.*

---

*\*Montana State University Extension noxious weed specialist; Lake County Extension agent; and MSU-Bozeman project specialist, respectively*



**G**lobe-podded whitetop (*Cardaria pubescens*), lens-podded whitetop (*C. chalapa*) and heart-podded whitetop (*C. draba*) are three closely related exotic weeds invading Montana. These weeds are well adapted to moist habitats, especially sub-irrigated pastures, hay fields, rangeland, roadsides and ditch banks. Like many noxious weeds, these species dramatically reduce biodiversity and forage production and displace native plant and animal communities. They also invade cropland, especially alfalfa.

## Origin, History and Distribution

Globe-podded whitetop is native to the former USSR, northern Iran and Afghanistan and can be found in Argentina and North America. Lens-podded whitetop is native to the former USSR and is common in Pakistan, northern India, Afghanistan, Iran, Iraq, Syria and Israel. It has been introduced into England, Argentina and North America. Heart-podded whitetop is native to the Balkan peninsula, Armenia, Turkey, Israel, Syria, Iraq and Iran. Heart-podded whitetop has been introduced onto every continent in the world.

These weeds probably arrived in North America in contaminated alfalfa seed. In the United States, globe-podded whitetop, lens-podded whitetop and heart-podded whitetop were first collected at Ypsilanti, Michigan in 1919; Chino, California in 1918; and Long Island, New York in 1862. In Montana, heart-podded whitetop was first identified in Gallatin County in 1916. Heart-podded whitetop has been introduced in all but two of Montana's 56 counties and infests about 84,000 acres. Infestations of the other two species are rare in Montana, but are becoming more common.

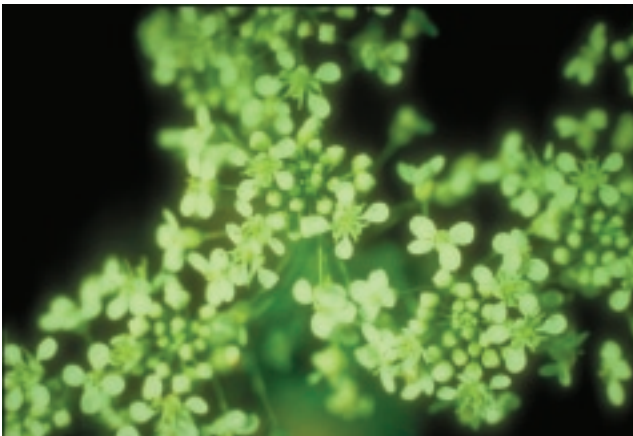


Figure 2. Whitetop has snowy-white flowers with four petals.



*Figures 3 and 4. Whitetop crowds out native and forage plants.*

## Impacts

### Detrimental

On rangeland and pastures, whitetop can form dense monocultures (see Fig. 1) similar to other noxious weeds, such as leafy spurge (*Euphorbia esula*). Noxious weeds displace native plant species, reduce biodiversity, wildlife habitat and forage production and are a serious threat to the cattle and tourism/recreation industries. Whitetop contains glucosinolates which can be toxic to cattle. In some states, these weeds are problems in small grains, alfalfa, peas, onions, sugar beets and other crops as well as in fallow cropland enrolled in the Conservation Reserve Program. In Montana, whitetop is predominantly found in alfalfa, pastures, rangeland and small grain fields.

### Identification

The three species of whitetop are members of the mustard family. The flowers have four petals and six stamens (Figure 2). Individual white flowers ( $\frac{1}{8}$ – $\frac{1}{4}$  inch) are borne on slender stalks about a half inch long. Dense blooming stands look very much like a patch of late-melting snow. (Figures 3 and 4)

These species can be distinguished from each other by seed pod shape. Globe-podded whitetop has small, purplish, globe-shaped seed pods. The seed pod of lens-podded whitetop is flat and round. Heart-podded has a heart-shaped, broad, flat seed pod. In all species, the seed pod is tipped with a “beak” which is rare for the mustard family. Each pod is oval, reddish brown and a half inch long containing two or four seeds.

The plants normally grow from 10 to 24 inches tall. They have both basal and stem leaves. Basal leaves taper to a short stalk that attaches to the crown near the ground. Stem leaves are grayish green, arrowhead shaped, with smooth and occasionally finely toothed edges. All leaves have a covering of soft white hairs. They range from  $\frac{3}{4}$  to 3 inches in length and are arranged alternately along the stem. The base of each leaf clasps around the stem at the point of attachment.

### Life Cycle

All three whitetop species are herbaceous, relatively long-lived and rhizomatous perennial weeds. They begin their life-cycle in the fall with seed germination and seedling establishment. Occasionally, seeds germinate in the spring. Seed leaves grow very rapidly and lateral roots develop within three weeks. Seedlings overwinter as rosettes.

Established plants and first year rosettes initiate growth very early each spring. These species frequently bloom in April and May and begin producing seeds about a month later. After blooming, the plants continue to grow until frost. If conditions remain suitable, they will flower and produce a second crop of seeds late in the summer.



Figure 5. Small infestations can spread by rhizomes, which are underground stems capable of producing shoots.

## Biology and Ecology

### Habitat and Associated Plants

All three whitetop species grow in open, unshaded areas. These weeds are generally found in disturbed areas dominated by other exotic species, such as smooth brome grass (*Bromus inermis*) and Russian knapweed (*Centaurea repens*). Native species associated with these weeds are aster (*Aster ericoides*), common yarrow (*Achillea millifolium*), fringed sagebrush (*Artemisia frigida*), rose (*Rosa* spp) and snowberry (*Symphoricarpos albus*).

All three species grow in a variety of soil and range types. They require moderately moist sites (12 to 16 inches of precipitation annually) and are best adapted to alkaline soils which are wet during late-spring. However, alkaline soils are not a requirement for invasion. Sites susceptible to invasion are mainly sub-irrigated pastures, rangeland, ditch banks, roadsides and waste areas. Invasion of arid rangeland by whitetop is unlikely.

These weedy species are also well-adapted to cropland, especially under irrigation. Whitetop is a serious problem in small grains, stubble and fallow fields, alfalfa, peas, onions, sugar beets and several other crops.

### Seed Dispersal

Seeds are spread by wind, along waterways and irrigation systems, on vehicles and machinery (especially during cultivation) and in hay and crop seed. Small infestations spread via rhizomes which are underground stems capable of producing shoots (Figure 5). A single plant can spread to an area 12 feet in diameter in its first year of growth. Subsequent radial increases range from 2 to 5 feet per year. The rate of perimeter expansion appears to be related to the competitive ability of the vegetation surrounding a patch of whitetop.



*Figure 6. Lateral roots produce buds which develop into new shoots.*

## **Roots**

Root systems are very similar to those of leafy spurge. Root growth is rapid, reaching 12 to 30 feet by the second or third growing season. The root system consists of a vertical taproot which develops several lateral roots. Lateral roots eventually turn down to become vertical roots which often reach greater depths than the parent roots. In some cases, whitetop can place their roots directly into the water table. Both the vertical and lateral roots produce adventitious buds, which develop into rhizomes and shoots. The deep root system and its ability to reproduce vegetatively make these weeds very difficult to control.

## **Shoots**

All these species are capable of producing many shoots. Shoot development tends to occur at or just above the point where lateral roots bend downward and become vertical. However, buds can form on any part of the root system. Under experimental conditions, without competition, a single plant produced over 450 shoots in a single year. With competition, they rarely produce more than 50 shoots per square yard.

## **Seed Production and Longevity**

A single plant of these species can produce from 1,200 to 4,800 seeds each year. Heart-podded whitetop is the most prolific and can produce as many as 850 seeds per flowering stem.

Buried seeds live for about three years in soil. In one study, germination of 1-year-old, 2-year-old and 3-year-old whitetop seeds were 84, 31 and 0 percent, respectively. Heart-podded whitetop is capable of germinating in salt stressed environments.

## Managing Whitetop

Successful management of whitetop requires integrated weed management. Integrated weed management includes combining strategies to prevent the movement of these weeds, contain existing infestations and integrating control methods to reduce weed infestations to tolerable levels.

### Preventing Invasion

The most cost-effective method for managing these weeds is to prevent their invasion and establishment. Prevent establishment by frequently monitoring management areas to detect and eradicate new plants early.

In order to reduce possibility of invasion, their seed dispersal must be limited. It is important to limit seed dispersal by refraining from driving vehicles and machinery through infested areas during the seeding period and by washing the undercarriage of vehicles and machinery before leaving infested areas. Livestock should not graze weed infested areas during flowering and seed-set, or they should be transported to a holding area from 10 to 14 days after grazing pastures to allow time for seed digestion and excretion of seeds.

In cropping systems, it is important to avoid whitetop patches during culti-

vation to prevent spreading root fragments throughout the field. Similarly, going around small weed infestations during harvesting will limit the spread of weed seeds in hay and crop seed. Furthermore, screening irrigation water before applying it to the field will minimize seeds spread through ditches and irrigation canals.

Recreationists, including campers, hikers, off-road vehicle enthusiasts and horseback riders, spread weed seeds. They should be careful to brush and clean their equipment and animals and place discards in a hot fire before leaving an area. They should use weed-seed free forage.

Proper livestock grazing management is essential to maintain competitive grass plants to slow or prevent weed encroachment. A grazing plan should be developed for any management unit involved in a weed prevention program. This management plan should include a grazing



*Figure 7. Upper leaves of whitetop have two lobes that clasp the stem.*

system which alters the season of use, rotates livestock to allow plants to recover before being grazed and promotes litter accumulation.

### **Containing Infestations**

An integral part of any integrated weed management program is the commitment to contain existing weed infestations. Generally, this includes a long-term program of annual border spraying of the outside perimeter of the infestation with herbicides.

### **Early Detection and Small-Scale Eradication**

Detecting satellite infestations and implementing eradication programs is an important step in integrated weed management. Local systematic surveys along roadways, railways and waterways to detect weed infestations as early as possible are important. Once an infestation is found, a small-scale eradication plan, consisting of control treatments, control schedule, revegetation, follow-up monitoring and costs should be designed and implemented.

## **Control**

### **Mechanical Control**

Diligent hand pulling or grubbing can provide control of very small infestations. Hand pulling of above ground plant parts is ineffective. Successful hand pulling or digging requires complete plant removal within 10 days after weed emergence throughout the growing season for two to four years. Hand pulling and digging can be a useful method for controlling new introductions of whitetop in riparian areas and around the home. Removing whitetop is best accomplished when the soil is moist.

Successful eradication on arable land by cultivation is difficult since it requires exhausting the root reserves. Cultivation six inches deep must be repeated within 10 days of weed emergence throughout the growing season for two to four years.

Mowing to ground level during flowering reduces biomass and seed production, but does not provide long-term control. However, preliminary research results indicate that mowing integrated with an appropriate herbicide about a month later can be effective.

### **Cultural Control**

Planting competitive legumes, such as alfalfa, can reduce whitetop in crop-pasture rotations. Extremely dense stands of legumes can successfully compete for soil moisture and shade the weeds.

Flooding can be a useful method for controlling whitetop, but is of limited use since this will permanently damage desired plants, and only a few acres are suited for flooding. Flooding is useful in areas with soil texture heavy enough to hold water without excessive seepage and where fertility loss following pro-

longed submersion and drainage is minimal. Successful flooding to control these weeds requires continuous submersion from May until September in most cases.

### **Biological Control**

No natural enemies for use as biological controls are available in the United States at this time.

### **Chemical Control**

Whitetop species can be controlled using herbicides, although it is difficult. Successful control usually depends on an aggressive reapplication program. On rangeland, roadsides and waste areas apply Escort® (metsulfuron) at ranges from 0.5 to 1 ounce of product per acre to actively growing rosettes early in the spring, to regrowth before bud stage, or to fall regrowth before the first killing frost. Treatment after bloom is generally less effective. It is important to apply this chemical with at least 10 gallons of water per acre and to use a nonionic surfactant at a rate of 2 quarts per 100 gallons of solution. Nitrogen fertilization can enhance the vigor of grasses which will slow the rate of re-invasion.

Although 2,4-D is somewhat effective, Tordon 22K, a broad spectrum herbicide which provides excellent control of many rangeland weeds, is ineffective on whitetop species.

In cereal grains, Ally® applied at  $\frac{1}{10}$  ounce of product per acre provides reasonable control of whitetop species. Higher rates will injure the crop. These weeds can be effectively controlled in stubble and fallow, but it is important to wait the period stated on the label before planting.

There are no herbicides registered for use on alfalfa, peas and sugar beets that control whitetop. These weeds should be controlled during another part of the crop rotation.

## Integrated Weed Management

No single treatment provides effective long-term control of the whitetop species. Managing these noxious weeds requires an integrated strategy. The first line of defense is to prevent introductions of these weeds. Systematic surveys, early detection and implementation of an eradication program on small infestations is the second step. Once the weed becomes established, integrating various combinations of competitive plantings, crop rotations, sheep grazing, herbicides and possibly fertilizers can reduce whitetop to manageable levels. A key component of any integrated weed management program is sustained effort, constant evaluation and the adoption of improved strategies.

## REFERENCES

- Corns, W. G. and C. Frankton. 1952. Hoary cresses in Canada with particular reference to their distribution and control in Alberta. *Sci. Agric.* 32:484-495.
- Kiemnec, G. and L. Larson. 1990. Germination of whitetop (*Cardaria draba* L.) and diffuse knapweed (*Centaurea diffusa* Lam.) as influenced by osmotic and salt stress. *Northwest Sci.* 64:107.
- McInnis, M.L., L.L. Larson and R.F. Miller. 1990. First year defoliation effects on whitetop. *Northwest Sci.* 64:107.
- McInnis, M.L., L.L. Larson and R.F. Miller. 1993. Nutrient composition of whitetop. *J. Range Manage.* 46:227-231.
- Miller, T.W. and R.H. Callihan. 1991. Hoary cress and related whitetops. *PNW Ext. Pub.* 359:1-4.
- Mulligan, G.A. and J.N. Findlay. 1973. The biology of Canadian weeds. 3. *Cardaria draba*, *C. Chalepensis* and *C. Pubescens*. *Can. J. Plant Sci.* 54:149-160.
- Selleck, G.W. 1964. An ecological study of lens and globe podded hoary cresses in Saskatchewan. *Weeds* 12:1-5.
- Whitson, T.D., A. Mooney and M. Griswold. 1989. Control of hoary cress (*Cardaria draba*) with various herbicides. *Res. Prog. Report, West. Soc. Weed Sci.* p. 39-41.

