

Yellow Starthistle: Identification, Biology and Integrated Management

by Hilary Parkinson, MSU Research Associate, and Jane Mangold, MSU Extension Invasive Plant Specialist; Dept. of Land Resources and Environmental Sciences

Yellow starthistle invades rangelands, grasslands, agricultural areas and wild lands reducing forage, yield, and degrading habitat. It is a priority 1A species in Montana, meaning the management objectives are prevention, early detection and eradication.



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Origin and Distribution

Yellow starthistle (*Centaurea solstitialis*) is native to Eurasia (Asia Minor, the Middle East and south central Europe). Seed was introduced to the United States in the mid-1850s as a contaminant in alfalfa seed in California. Initially a weed of agricultural systems and roadsides, yellow starthistle began to spread to rangelands across northwestern states during the 1870s and 1880s. In the 1960s there was a rapid expansion of yellow starthistle throughout the West, attributed to extensive road building, expansion of ranching and disturbances associated with suburban development. The weed was estimated to be spreading at 7,000-20,000 acres per year in 1989, but reevaluation in 1994 doubled these estimates to 15,000 to 50,000 acres per year.

The first report of yellow starthistle in Montana was in 1958 in Ravalli County. The next report was in Gallatin County in 1982. Since then, nine additional counties have reported the presence of yellow starthistle (Figure 1). The most recent reports are from the following counties: Beaverhead (2009, two plants), Stillwater (2009, plants scattered over 10 acres), Gallatin (2010, one plant) and Missoula County (2013). At the time of this publication, all known patches in Montana have been small enough to eradicate within one to two years (shaded counties in Figure 1 represent historical records only and do not imply the weed is still present). Compared to infestations in California (17 million acres), Washington (1 million acres), Oregon (950,000 acres) and Idaho (800,000 acres), Montana is in a very good position to prevent the widespread establishment of yellow starthistle.

Prevention and early detection are top priorities for managing yellow starthistle. If you think you've found this plant, please call the Mont. Dept. of Agriculture, 406-444-3144, or your county weed coordinator or Extension agent.

Identification and Biology

Yellow starthistle belongs to the Asteraceae family and is a member of the genus *Centaurea*. It is an erect, branching plant that may grow one to five feet tall. Rosettes resemble dandelions with deeply lobed leaves (Figure 2). Lower leaves are up to three inches long and deeply lobed. Upper leaves are short and narrow with fewer lobes. Stems appear flattened, or winged, due to leaves that grow vertically along the stem (Figure 3). Foliage is grayish green due to tiny hairs. Bright yellow flowers grow singly at the ends of branches. When in bud, and during or after flowering, this plant is easy to recognize due to the long sharp spines ($\frac{3}{4}$ to 1 inch long, Figure 4) on the flower bracts. After

flowering and seed dispersal, a cottony white tuft remains on the receptacle, resembling a cotton swab (Figure 5).

Lifecycle

Yellow starthistle is a facultative winter annual, meaning it germinates in the fall, but may germinate in the spring. Following germination a long taproot grows rapidly, allowing plants to survive summer drought. Plants bolt in the spring or early summer. Flowering may occur from early summer to early fall until buds are killed by frost.

Spread

Seed production and spread can be prolific; a single plant may produce more than 150,000 seeds under ideal conditions. There are two types of seed, plumed and



FIGURE 1. Counties in Montana (shaded) where yellow starthistle has been reported. (Compiled from records in INVADERS Database System and EDDMapS West.)



FIGURE 2. Rosette of yellow starthistle. (Steve Dewey, Bugwood.org)



FIGURE 3. Flattened or winged stems. (Steve Dewey, Bugwood.org)



FIGURE 4. Yellow flowers with long spines ($\frac{3}{4}$ to 1 inch) on the receptacles. (Steve Dewey, Bugwood.org)

plumeless (Figure 6). Plumes are fluffy appendages that may facilitate dispersal by wind, exemplified by those on dandelion. By producing two seed types that differ in how and when they disperse, or their ideal conditions for germination, plants may increase their chances for new populations to establish.

Plumeless seeds are retained in the seed head longer, sometimes remaining through winter or until the plant decays. They typically fall immediately below the parent plant and comprise only 10 to 25 percent of the total number of seeds.

Plumed seeds comprise the majority and disperse immediately upon maturity. Plumed seeds are heavy relative to the size of the plume, so wind rarely disperses them more than two feet, but gusty winds may occasionally disperse seeds up to 16 feet. Besides wind, local dispersal is facilitated by the stiff, microscopic barbs on the plumes that easily adhere to clothing, fur and hair.

Long distance dispersal is primarily through human activities. Seed heads are caught in vehicles or in road maintenance equipment and transported in contaminated seed or soil. Birds such as pheasants, quail and finches feed heavily on yellow starthistle seed providing another mechanism for long distance dispersal.

Estimates on seed longevity are highly variable. Research in Idaho estimated plumed seeds live an average of 10 years, while plumeless seeds live an average of six years. However, research in California suggested 97 percent of seed germinates or decays within the first two to three years following dispersal.

Habitat

Yellow starthistle grows on rangelands, pastures, agricultural areas, along highways or roads, railroad tracks, and other transportation or communication lines. It is most common in sunny, disturbed areas. Seedling establishment is optimal in deep silt loam and loam soils with few coarse fragments, but seedlings can also establish on shallow, rocky soils.

Impacts

Yellow starthistle reduces wildlife habitat and is associated with a reduction in native plants. It also reduces land value and access to recreational areas. Sharp spines easily scratch the skin, impacting recreational opportunities where it grows in high densities.

Yellow starthistle reduces forage yield and degrades habitat in rangelands, grasslands, and agricultural areas. Cattle, sheep and goats will graze it in early spring up until the bolting stage, but livestock will not graze it once the spiny flower heads develop. Yellow starthistle causes chewing disease in horses, a neurologic disease that includes brain lesions and mouth ulcers. A lethal dose occurs when horses ingest quantities of yellow starthistle equivalent to 60 to 200 percent of their body weight over a one to two month period. Symptoms include drowsiness, difficulty in eating and drinking, twitching of the lips, tongue flicking, and involuntary chewing movements. There is no cure, and horses die of dehydration or starvation. Horses will select other forage when available, although there are some cases of horses acquiring a preference for yellow starthistle.

Management Options

While all available management options are presented here, prevention is emphasized; if isolated plants are found, hand pulling and herbicide are recommended, along with reporting the plants to your local Extension or weed district office.

Prevention

Because yellow starthistle is not currently established in Montana, ***prevention is the number one management strategy for this plant.*** The plant's dispersal and invasion are strongly associated with human activity. In Montana, the record of yellow starthistle in Stillwater County in 2009 occurred in a storage lot where construction equipment was stored. The majority of other records



FIGURE 5. Cottony tufts remaining after seed dispersal. (Richard Old, Bugwood.org)

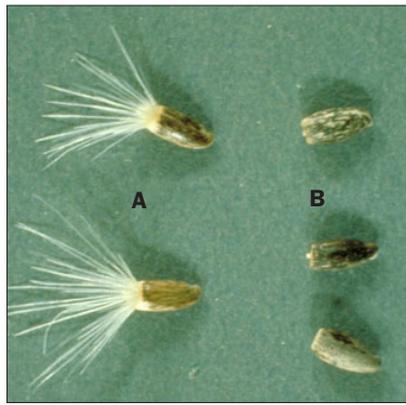


FIGURE 6. Plumed (A) and plumeless seeds (B). (Cindy Roche, Bugwood.org)

were associated with construction equipment, farming equipment, small patches that occurred along roads, or planting of contaminated seed. If construction is planned, all vehicles should be washed off-site in a designated area before being brought into the area. Landowners with large acreages are encouraged to establish a routine monitoring program that covers roads, trails and other vulnerable areas. Monitoring should coincide with the flowering period (approximately early summer), but before seed set, and be repeated in three to four week intervals. If a plant is found, hand pulling is recommended for small patches. Persistent pulling of small patches can lead to successful eradication. For slightly larger patches that preclude hand-pulling, chemical control is recommended.

Mechanical

Hand pulling is strongly recommended for small infestations and is best done after bolting and up to very early flowering. It is critical to pull plants before they produce viable seed, or bag plants that have already flowered to prevent seed dispersal.

Mowing has produced mixed results. It may be used for moderate infestation levels, but timing is critical, and it is most effective on plants with an upright growth habit. Mowing should be done when less than two percent of the population has developed flowers. Over a three year period, timely mowing twice per year led to 90 percent control in California. It is not recommended in areas with high forb diversity, as they will not recover as quickly from mowing compared to grasses (in which case mowing may increase yellow starthistle). For plants with a growth form that is not upright, but sprawling and highly branched, mowing will need to be repeated throughout the growing season, and efficacy is highly variable.

Tilling is partially effective and must be done in the early summer when roots can be easily detached from the shoots. Repeat after rainfall to target new seedlings.

Cultural

Revegetation with desirable species is moderately to highly effective. Yellow starthistle plants are not tolerant of shade. Revegetation is strongly recommended to prevent establishment in susceptible areas, such as following disturbances from construction. For existing patches, it is recommended in conjunction with other treatments that control yellow starthistle.

Fire can be moderately effective if the burn is complete and implemented during the very early flowering stage, when less than two percent of the plants have flowered. However, it may

be difficult to obtain a complete burn at that time (late spring, early summer).

Biological

Insects: Currently five biological control agents are available for yellow starthistle: *Bangasternus orientalis* (starthistle bud weevil), *Eustenopus villosus* (yellow starthistle hairy weevil), *Larinus curtus* (starthistle flower weevil), *Chaetorellia australis* (yellow starthistle peacock fly), and *Urophora sirunaseva* (the starthistle gallfly). The larvae feed on seeds and can reduce seed yield by at least 50 percent. Biocontrol insects are strongly recommended for large, widespread patches. Biocontrols are rarely successful on their own, but are highly recommended in combination with other treatments.

Additionally, *Chaetorellia succinea* (false peacock fly) was unintentionally introduced, but is considered highly effective, and the rust pathogen *Puccinia jaceae* var. *solstitialis* has been approved for release. Research continues additional agents.

Grazing with sheep, goats or cattle is considered partially to moderately effective. Graze sheep or cattle when plants begin to bolt until development of seed heads. Goats may graze it later into the season. Note: this plant is poisonous to horses (see Impacts, page 2), and may cause injury to other livestock if grazed during the spiny stage.

Chemical

There are many herbicides available for yellow starthistle (Table 1). Herbicides rated 'good' or 'excellent' by the Montana, Utah and Wyoming Weed Management Handbook are included in Table 1.

TABLE 1. Examples of herbicides to manage yellow starthistle. Consult herbicide labels for additional rate, application and safety information (available at www.greenbook.net).

Herbicide Active Ingredient (Trade Name)	Rate/acre	Timing	Notes and Herbicide Rating*
<i>Clopyralid</i> + 2,4-D (Curtail)	2-3 quarts. Use lower rate for light to moderate infestations under good growing conditions, higher rate for dense infestations or poor growing conditions (drought).	After rosette stage, before bud formation	Maximum use rate is 2 quarts per year in Conservation Reserve Program (CRP) land. Rated excellent.
<i>Aminopyralid</i> (Milestone)	3-5 oz	Rosette stage through bolting	Provides pre-emergent and post-emergent control. Rated excellent.
<i>Picloram</i> (Tordon 22K)	1-2 pints	Rosette stage through bud formation	Rated excellent.
<i>Clopyralid</i> (Transline)	½ - 1 pint. Use the lower rate for young, actively growing weeds. Use the higher rate under less favorable growing conditions or on dense weed stands and/or larger weeds.	Rosette stage to mid-bolt	Rates apply to application in rangelands and permanent grass pastures. See label for different rates to forest sites, including tree plantings. Rated excellent.
<i>Triclopyr</i> + <i>clopyralid</i> (Redeem R&P)	1.5 - 2 pints	Rosette stage to early flower or to fall regrowth. Optimum time is mid-bolt.	Rates in the lower end of the rate range are recommended only where grass response (competition) will help to suppress weed growth following treatment. Rated good.
<i>Chlorsulfuron</i> (Telar)	0.5-2.6 oz in combination with other herbicides registered for this use (such as "Transline," "Tordon 22K" or 2,4-D).	Apply pre-emergence.	Rainfall is needed following application to provide the preemergence control. Rated good.

* Ratings of Excellent and Good from "Weed Management Handbook 2006-2007" (Dewey et al 2007).

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