Biological Control Fieldguide for Utah

by
Amber Richman
USDA-APHIS-PPQ

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Bonneville CWMA

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Foreword:

This field guide is designed to provide as much information as possible in an accessible manner. Only the nine most common biological control candidates in Utah are discussed. Biological control can be successful on many other noxious weeds. Many resources are available to learn more about biological control. Much of the information in this field guide came from one such resource: Biological Control of Invasive Plants in the United States written by Eric Coombs et. al. and published by Oregon State University Press. One of the most beneficial resources for biocontrol and other weed control is your county weed supervisor. Contact for county weed supervisors is listed in the back of this field guide.

Most of the biological control agents in this field guide are free in Utah. To obtain these agents please contact your county weed supervisor.

Biological control is an important tool in the war against weeds, but it is not the only tool. Most biological control works best when used in an integrated pest management (IPM) strategy that incorporates several biological control agents, chemical and mechanical control. A successful weed control program also educates the public about invasive weeds. The final step to controlling weeds should include a program for revegetation and rehabilitation of weed infested areas.

Amber Richman
USDA-APHIS-PPQ
Biological Control
1860 W. Alexander St. #B
West Valley City, Utah 84119
usucowgirl@hotmail.com
435-830-4146

Frequently Asked Questions:

How long will a biocontrol take to control my weeds?
Biological control insects vary drastically. Sometimes you will see control of a site in only a few years. Most biocontrol takes 5 to 10 years to help control a noxious weed.

What is the difference between control and eradication?
Biological control is not used to eradicate a weed. For full eradication, other IPM strategies must be used. Biological control can give complete control of a weed. This means that the weed population is reduced below the economic threshold, giving other vegetation a chance to grow.

Will a biocontrol agent ever impact native species?
No, biocontrol agents are tested for a minimum of 3 to 5 years in a quarantine research facility. They are tested on plants closely related to or found in the same climate as the target invasive plant. If biocontrol agents are found to impact a native plant, they are not permitted for release into the United States.

Will a biocontrol agent ever harm my gardens or agricultural plants?
No, biocontrol agents are tested for a minimum of 3 to 5 years in a quarantine research facility. They are tested on agricultural and garden plants as well as any related endangered or sensitive plants. If biocontrol agents are found to impact any plant other than the target weed, they are not permitted for release into the United States.

What will happen after the biocontrol agent has controlled my weeds?

The population of the biocontrol agent will decline with the decline of its host species. It is now your responsibility to continue using IPM strategies to prevent new weeds from invading. One of the best ways to do this is to reseed and rehabilitate your land after noxious weeds are controlled.

Is biocontrol always the best answer to my weed problem?

No, sometimes biocontrol is the best solution to a weed problem. Other times, a weed can be controlled better using chemical or mechanical methods. An IPM approach is always the best. For more advice on how to best control your weeds, contact your county weed supervisor.

I had a biocontrol that didn't work. What happened?

Sometimes biocontrol doesn't work. There are many reasons. Biocontrol agents can be affected by climate, weather, and predation. If climate and weather are not favorable, a biocontrol agent may never work in a particular area. To help overcome predation, release more and different biocontrol agents. Some biocontrol agents are faster than others. Be patient and you may find that in a few years your biocontrol agent worked better than you had expected.

Once my biocontrol site is established, can I collect off of my own releases and share the biocontrol agents?

Yes, the best way to keep biocontrol working is to spread it to other areas. Once you have established a biocontrol, contact you county weed supervisor for assistance on spreading this biocontrol agent throughout your county.

Dalmatian Toadflax

Linaria genistifolia

OTHER COMMON NAMES: Broad-leaved toadflax

INTRODUCTION: Dalmatian toadflax was imported into the United States as an ornamental from Eurasia in 1874.

HABITAT: This plant grows on roadsides, overgrazed pastures, and disturbed ground, especially ground with coarse, textured soils and in cool, semi-arid climates.

DESCRIPTION: This broad leafed perennial exhibits a deep taproot with lateral roots. Plants grow from 1-3 feet tall. Waxy leaves are dark green, broad and heart-shaped. Bright yellow flowers are present from mid-May until August.

REPRODUCTION: Dalmatian toadflax reproduces both by lateral roots and by seed. A single plant can produce half a million seeds per year. Seeds remain viable in the soil for up to 10 years.

INTEGRATED PEST MANAGEMENT: Dalmatian toadflax can be difficult to kill with herbicide because of its waxy leaves. Biological control can be used instead of herbicides. Biological control and herbicides are best when used separately for control. Herbicide is more practical for small patches of dalmatian toadflax. For larger infestations, biological control may yield better results.

Photo Credit: M. Mendenhall

Photo Credit: M. Mendenhall

Mecinus janthinus

Toadflax stem boring weevil

TYPE OF AGENT: Insect: Beetle (Coleoptera: Curculionidae)

GENERATIONS PER YEAR: One

OVERWINTERING STAGE: Adult (inside pupal cell)

BIOLOGY: Adult *M. janthinus* emerge from stems in May, and reproduce until late June. Adults are appx. 4 mm long. Eggs are laid in cavities inside the stem. Eggs hatch in 7 days. Larvae development takes 20-30 days. Larvae are 1-2 mm long, cream colored and C-shaped with brown head capsules. Pupation occurs in stems. Adults overwinter in stems.

DESTRUCTIVE STAGE: Larvae (stem mining) and adult (feeding on foliage)

IMPACT TO HOST: Impact of weevils is most effective during drought years. Control is usually 60-75%, although several sites in Utah have collapsed after 6-7 years.

REDISTRIBUTION: Adults can be collected in May and June using a sweep net and aspirator or by picking insects directly off of plants. A typical release is 250-500 weevils. Releases should be made in dense infestations of dalmatian toadflax.

Photo Credit: Colorado Deptartment of Agriculture

Field Bindweed

Convolvulus arvensis

OTHER COMMON NAMES: Wild morning glory, creeping Jenny, European bindweed

INTRODUCTION: Field bindweed was imported with contaminated crop seed and was reported in Virginia as early as 1739.

HABITAT: Field bindweed can be found in nearly all types of ground from cultivated fields to waste areas. It is incredibly tolerant to freezing and drought and can be very difficult to control.

DESCRIPTION: This creeping perennial can grow up to 10 feet long with taproots extending another 10 feet into the soil. Trumpet shaped flowers are white to pink in color.

REPRODUCTION: Field bindweed can reproduce by seeds and rhizomes. Seeds can remain viable in the soil for up to 50 years.

INTEGRATED PEST MANAGEMENT: Field bindweed is difficult to control with chemical alone; however, biological control can be used along with chemical control. Biological control also responds well to mowing.

Photo credit: J. Caldwell

Photo Credit: M. Mendenhall

Photo Credit: M. Mendenhall

Aceria malherbae

Bindweed gall mite

TYPE OF AGENT: Mite (Acari: Eriophyidae)

GENERATIONS PER YEAR: Multiple

OVERWINTERING STAGE: Nymph and adult (on root buds)

BIOLOGY: *A. malherbae* are visible when viewed under a microscope. They are yellow to white in color. Nymphs are similar to adults. Mites are present in galls in the spring. During July, they move out of galls into the cool ground. Mites re-emerge in late August and are present until frost (usually late September).

DESTRUCTIVE STAGE: Nymph and Adult (gall forming)

IMPACT TO HOST: Mites form galls on leaves and stems causing stunted growth and reduced flowering. The mites are very slow movers and may take up to 10 years to impact an infestation of field bindweed, although in areas of Colorado, *A. malherbae* have exhibited outstanding control in acre plots over a 10 year period.

REDISTRIBUTION: Mites are collected by pulling field bindweed containing galls and transported in breathable paper bags. To release, wrap healthy field bindweed around galls. Release sites should be well drained. *A. malherbae* fails to establish when exposed to early fall frost or late spring frost. Releases under shade trees or near structures can provide protection. Studies have shown that the labeled amounts of 2,4-D can be sprayed where *A. malherbae* are present. Mowing helps to distribute mites. Roadsides are an excellent area for release.

Photo credit: USDA-ARS

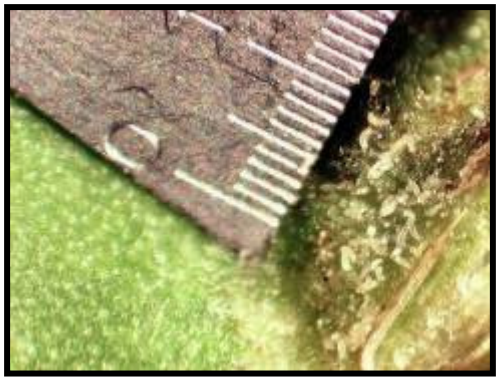

Photo credit: J. Littlefield

Photo credit: Tim Higgs

Diffuse Knapweed

Centaurea diffusa

OTHER COMMON NAMES: None

INTRODUCTION: Diffuse knapweed seeds were introduced in alfalfa seed in 1907 from the Mediterranean region.

HABITAT: Diffuse knapweed infests dry, sunny, well drained areas and disturbed areas such as roadsides.

DESCRIPTION: Diffuse knapweed is a biennial with a deep taproot. Plants are gray-green and grow up to 2 feet. Flowers are white, pink, or lavender. Each floral bract is covered in slender spines. Flowering occurs from July to September.

REPRODUCTION: Diffuse knapweed reproduces exclusively by seed.

INTEGRATED PEST MANAGEMENT: An integrated pest management method is the best way to fight knapweeds. Several options are available including mechanical control (i.e. pulling or digging), chemical control, grazing, and biological control. Biological control is best used on large, difficult to manage infestations of knapweeds. Grazing can be implemented using sheep or goats at the same time as biological control and usually with chemical control according to chemical labeling.

Photo credit: M. Mendenhall

Photo Credit: M. Mendenhall

Spotted Knapweed

Centaurea maculosa

OTHER COMMON NAMES: None

INTRODUCTION: This plant arrived in the United States from Eurasia as a contaminant in alfalfa seed.

HABITAT: Spotted knapweed prefers more moist areas than diffuse knapweed (20 to 200 cm of rain per year). Spotted knapweed occurs in disturbed sites such as roadsides and overgrazed fields.

DESCRIPTION: Spotted knapweed is an aggressive biennial, growing up to 5 feet tall. Plants are pale green with pink or purple flowers. Floral bracts possess a distinct spine at the tip.

REPRODUCTION: Spotted knapweed only reproduces through seed. A single plant can produce up to 30,000 seeds.

INTEGRATED PEST MANAGEMENT: An integrated pest management method is the best way to fight knapweeds. Several options are available including mechanical control (i.e. pulling or digging), chemical control, grazing and biological control. Biological control is best used on large, difficult to manage infestations of knapweeds. Grazing can be implemented using sheep or goats at the same time as biological control and usually with chemical control according to chemical labeling.

Photo credit: M. Mendenhall

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Photo Credit: M. Mendenhall

Squarrose Knapweed

Centaurea virgata

OTHER COMMON NAMES: None

INTRODUCTION: Squarrose knapweed was introduced in wool from the eastern Mediterranean area.

HABITAT: Squarrose knapweed is well adapted to harsh growing conditions such as cold temperatures and drought. It grows well in desert areas in western-central Utah and thrives on overgrazed rangeland.

DESCRIPTION: Squarrose knapweed is a taprooted perennial with a woody crown. Plants appear more bush-like than spotted or diffuse knapweed. Flowers are urn-shaped and purple to pink in color with spiny bracts.

REPRODUCTION: Squarrose knapweed reproduces only by seed.

INTEGRATED PEST MANAGEMENT: An integrated pest management method is the best way to fight knapweeds. Several options are available including mechanical control (i.e. pulling or digging), chemical control, grazing and biological control. Biological control is best used on large, difficult to manage infestations of knapweeds. Grazing can be implemented using sheep or goats at the same time as biological control and usually with chemical control according to chemical labeling.

Photo credit: J. Caldwell

Photo Credit: S. Dewey

Photo Credit: M. Mendenhall

Cyphocleonus achates

Knapweed root weevil

TYPE OF AGENT: Insect: Beetle (Coleoptera: Curculionidae)

GENERATIONS PER YEAR: One

OVERWINTERING STAGE: Larvae (in the root)

BIOLOGY: *C. achates* adults emerge from June to September. They are large (14-15mm long) and live for 2-3 weeks. Females lay one egg at a time in the root crown just below the soil. A female will mate and lay eggs over 100 times. Larvae undergo 4 instars. The fourth instar overwinters and pupates in June.

DESTRUCTIVE STAGE: Larvae (root feeding and root galling)

IMPACT TO HOST: First and second instar larvae reduce root mass and stress plants. Third and fourth instar larvae form swelling and galls in roots, causing even further damage to plants. *C. achates* can kill knapweed plants in a single year, but populations are not usually dense enough to reduce entire stands of knapweed. *C. achates* will be most effective when released with other knapweed biological control agents listed in this field guide.

REDISTRIBUTION: Adults can be collected by picking them directly off of plants in the middle of the day in July. A release is typically 50-75 *C. achates*.

SPECIES OF KNAPWEED ATTACKED: Spotted knapweed is the preferred host, but also attacks diffuse knapweed.

Photo credit: CABI Bioscience

Photo credit: SCNWCB

Photo credit: USDA-ARS

Larinus minutus

Lesser knapweed flower weevil

TYPE OF AGENT: Insect: Beetle (Coleoptera: Curculionidae)

GENERATIONS PER YEAR: One

OVERWINTERING STAGE: Adult (in soil)

BIOLOGY: Adults are active from May to September. They are 4 to 5 mm long. Females produce 30-130 eggs in their lifetime. Up to 5 eggs are deposited in the flower head of each knapweed plant. Larvae hatch in 3 days and then spend 4 weeks in the seed head before pupating. Pupation takes 1 week. Adults drop off of plants in September and overwinter in the soil.

DESTRUCTIVE STAGE: Larvae (feeding on seed head) and adult (leaf and seed feeding)

IMPACT TO HOST: Damage can reduce stands density and provide excellent control. *L. minutus* will be most effective when released with other knapweed biological control agents listed in this field guide.

REDISTRIBUTION: Adult *L. minutus* can be collected using a sweep net or by picking them off of plants in June and July. A typical release is 150-250 adult insects.

SPECIES OF KNAPWEED ATTACKED: Diffuse knapweed, spotted knapweed, squarrose knapweed.

Photo credit: B. Nowerski

Photo credit: USDA-ARS

Photo credit: USDA-ARS

Sphenoptera jugoslavica

Bronze knapweed root borer

TYPE OF AGENT: Insect: Beetle (Coleoptera: Buprestidae)

GENERATIONS PER YEAR: One

OVERWINTERING STAGE: Larvae (in root)

BIOLOGY: Adults emerge in July. The adult *S. jugoslavica* is 8-10 mm long and metallic brown in color. Eggs are laid on leaves in July and August. Larvae hatch in 4-5 days and begin boring into roots where they feed and overwinter. Larvae are white with a wide, flat head. Pupation occurs in the root from June through September and lasts for 9 days.

DESTRUCTIVE STAGE: Larvae (root feeding and galling)

IMPACT TO HOST: Larvae feed on roots and form galls usually resulting in death of the infested knapweed plant. *S. jugoslavica* will be most effective when released with other knapweed biological control agents listed in this field guide.

REDISTRIBUTION: Adults can be collected with a sweep net in the early evening in July. A typical release is 100-150 adult *S. jugoslavica*.

SPECIES OF KNAPWEED ATTACKED: Diffuse knapweed, spotted knapweed, squarrose knapweed.

Photo credit: N. Rees

Photo credit: P. Harris

Photo credit: USDA-ARS

Urophora affinis

Banded gall fly

TYPE OF AGENT: Insect: Fly (Diptera: Tephritidae)

GENERATIONS PER YEAR: 1-2

OVERWINTERING STAGE: Larvae (in seed head)

BIOLOGY: The first generation of adult flies emerges in June or July. Adults are 4-5 mm long with faint wing bands. Eggs are laid on flower heads and hatch in 3-4 days. Larvae form galls in the seed head to overwinter. Pupation occurs in May and lasts 14 days. Flies often undergo a second generation that emerges from August to September.

DESTRUCTIVE STAGE: Larvae (gall forming)

IMPACT TO HOST: Galls reduce flowering. Flies are well established throughout most of Utah. *U. affinis* will be most effective when released with other knapweed biological control agents listed in this field guide.

REDISTRIBUTION: Flies are very difficult to collect in the field. The larvae-infested seed heads can be collected in the spring and taken to new sites for release. These are also available commercially.

SPECIES OF KNAPWEED ATTACKED: Diffuse knapweed, spotted knapweed, squarrose knapweed.

Photo credit: J. Story

Photo credit: University of Idaho Archives

Urophora quadrifasciata

Knapweed seed head fly

TYPE OF AGENT: Insect: fly (Diptera: Tephritidae)

GENERATIONS PER YEAR: Two

OVERWINTERING STAGE: Larvae (in seed head)

BIOLOGY: The first generation of adult flies emerges from June to July. Adults are 4-5 mm long with distinct dark bands forming 2 “U” shaped patterns on each wing. Eggs are laid on flower heads and hatch in 3-4 days. Larvae overwinter in galls formed in the seed head. Pupation occurs in May and lasts 14 days. Flies often undergo a second generation that emerges in August and September.

DESTRUCTIVE STAGE: Larvae (gall forming)

IMPACT TO HOST: Galls reduce flowering. Flies are well established throughout most of Utah. *U. quadrifasciata* are most effective when released with other knapweed biological control agents listed in this field guide.

REDISTRIBUTION: Flies are very difficult to collect in the field. The larvae-infested seed heads can be collected in the spring and taken to new sites for release. These are also available commercially.

SPECIES OF KNAPWEED ATTACKED: Diffuse knapweed, spotted knapweed, squarrose knapweed.

Photo credit: USDA-ARS

Photo Credit: USDA-ARS

Photo Credit: USDA-ARS

Leafy Spurge

Euphorbia esula

OTHER COMMON NAMES: Faitour's grass

INTRODUCTION: Brought to the Unites States in oats from Europe in 1827.

HABITAT: Leafy spurge can be found in pastures and grazing land throughout the western United States. It aggressively outcompetes native vegetation. Financial losses due to leafy spurge exceed $100 million per year.

DESCRIPTION: Leafy spurge is a deep rooted perennial that can grow as tall as 3 feet. The taproot can extend 20 feet into the soil. Plants can regenerate from root growth. Stems contain milky latex that is poisonous to some livestock and is an irritant to humans causing blistering, skin irritation and blindness. Flowers are yellow and arranged in clusters subtended by large yellow-green bracts.

REPRODUCTION: Leafy spurge can reproduce by seed, rhizomes, and regeneration from taproots.

INTEGRATED PEST MANAGEMENT: Leafy spurge is difficult to control with herbicide. It can purge chemicals at the top 10 inches of root leaving many feet to regenerate. Sheep and goats feeding on leafy spurge exhibit good to excellent control. The best control of leafy spurge incorporates the use of sheep or goats, herbicide, and biological control. Herbicides should be used on dense infestations while biological control is released around edges or on less dense patches.

Photo Credit: M. Mendenhall

Photo Credit: M. Mendenhall

Photo Credit: M. Mendenhall

Apthona czwalinae

Black leafy spurge flea beetle

TYPE OF AGENT: Insect: Beetle, flea beetle (Coleoptera: Chrysomelidae)

GENERATIONS PER YEAR: One

OVERWINTERING STAGE: Larvae (in soil near roots)

BIOLOGY: Adults are found on plants from May through July. They are black with enlarged hind femurs. Females lay eggs in the ground from July to September. Eggs hatch in 16-17 days. Larvae undergo 3 instars. The larvae are small (1-5 mm long) and white with a brown head. Third instar larvae overwinter and pupate in the soil in late spring.

DESTRUCTIVE STAGE: Mature larvae (feeding on root fibers) and adults (leaf feeding)

IMPACT TO HOST: Adult feeding reduces photosynthetic capability. Larval feeding reduces the ability of leafy spurge to take in nutrients. Impact can be significant and when used with an integrated pest management strategy, leafy spurge infestations can be controlled in 5-7 years.

REDISTRIBUTION: Adults can be collected in sweep nets from May – July. Releases should be made on small thin stands of leafy spurge or on the edge of a large infestation. Ant predation can be a problem in establishing this biological control. If this agent fails to establish after one year, purchase pure collections commercially and treat your release site for ants in the fall before releasing biological control agents the following spring.

Photo Credit M. Mendenhall

Apthona flava

Copper leafy spurge flea beetle

TYPE OF AGENT: Insect: Beetle, flea beetle (Coleoptera: Chrysomelidae)

GENERATIONS PER YEAR: One

OVERWINTERING STAGE: Adult and larvae

BIOLOGY: Adults are found on plants from May through July. They are copper with enlarged hind femurs. Females lay eggs in the ground from July to September. Eggs hatch in 16-17 days. Larvae undergo 3 instars. The larvae are small (1-5 mm long) and white with a brown head. Third instar larvae overwinter and pupate in the soil in late spring.

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Photo Credit: M. Mendenhall

Photo Credit: R. Hansen

Apthona nigriscutis

Black dot leafy spurge flea beetle

TYPE OF AGENT: Insect: Beetle, flea beetle (Coleoptera: Chrysomelidae)

GENERATIONS PER YEAR: One

OVERWINTERING STAGE: Adult and larvae

BIOLOGY: Adults are found on plants from May through July. They are copper with a black dot behind the thorax and enlarged hind femurs. Females lay eggs in the ground from July to September. Eggs hatch in 16-17 days. Larvae undergo 3 instars. The larvae are small (1-5 mm long) and white with a brown head. Third instar larvae overwinter and pupate in the soil in late spring.

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Photo Credit: M. Mendenhall

Oberea erythrocephala

Red-headed leafy spurge stem borer

TYPE OF AGENT: Insect: Beetle, (Coleoptera: Cerambycidae)

GENERATIONS PER YEAR: One (often 1 in two years)

OVERWINTERING STAGE: Larvae (inside stem)

BIOLOGY: Adults are long and slender (10-12 mm) with long black antennae, red heads, and grey bodies. They are active fliers. Adults lay eggs in June and July. Females girdle the stems and deposit one egg per shoot. Females can produce 60 eggs in their lifetime. Eggs hatch in 7-10 days. Larvae mine the stem and overwinter in the root crown. Larvae are obviously segmented and up to 20 mm long. Pupation occurs in the root crown in May with adult emergence in June.

DESTRUCTIVE STAGE: Larvae (stem boring)

IMPACT TO HOST: Adults girdle stems, causing minor damage. Larvae can kill an entire plant by root and stem mining. When used with *Apthona* spp. The red-headed stem borer shows excellent control.

REDISTRIBUTION: Adults can be collected in sweep nets from along with *Apthona* spp. in June and July. A collection of only 50 beetles will be effective in a leafy spurge patch.

Photo Credit: R. Hansen

Photo Credit: R. Hansen

Purple loosestrife

Lythrum salicaria

OTHER COMMON NAMES: Purple lythrum

INTRODUCTION: Introduced in ship ballasts in early 1800's. Also brought into the United States on sheep wool.

HABITAT: This invasive plant infests waterways and other aquatic sites displacing native plants and reducing wildlife habitat.

DESCRIPTION: Purple loosestrife is an aquatic perennial. It can grow up to 7 feet tall. The taproot is woody and robust. Stems are square with opposite, entire, elongate leaves. Purple flowers are arranged in a tall spike.

REPRODUCTION: Reproduction is primarily by seed, but can spread by sprouting from cut stems and generating from fragmented roots. A single plant can produce up to 2 million seeds per year.

INTEGRATED PEST MANAGEMENT: Herbicide control can be very effective, but care must be taken and herbicide must be labeled for aquatic use. Biological control can be used at the same time as herbicide.

Photo Credit: M. Mendenhall

Galerucella calmariensis

Black-margined loosestrife beetle

TYPE OF AGENT: Insect: Beetle, (Coleoptera: Chrysomelidae)

GENERATIONS PER YEAR: One

OVERWINTERING STAGE: Adult (in the soil)

BIOLOGY: Adults emerge from soil in April and June. Adults are 3-5 mm long and orange with brown stripes along the wings. Eggs are laid from May–September on stems and leaves in clusters of 3-6. Females produce up to 400 eggs. Eggs hatch in 12 days. Larvae feed on buds and leaves for 14 days. Larvae are small (3-4mm) and light green with brown to black spots. Pupation takes 7 days and occurs in the soil or in the spongy tissue of stems in standing water.

DESTRUCTIVE STAGE: Adults and larvae (feeding on buds and leaves)

IMPACT TO HOST: Adult and larval feeding results in stunted plants and reduced seed production. In some areas of Utah, complete control of purple loosestrife has been attributed entirely to biological control.

REDISTRIBUTION: Adults can be collected in sweep nets or by picking adults off of plants. A typical release is 250 adults. Collection is best in late April or early May. Adults overwinter in the ground so continuously flooded areas are not ideal for release. Also, beetles are very susceptible to insecticides used for mosquito abatement. If sprayed, most beetles will die.

Photo credit: USDA-ARS

Photo credit: D. Hamilton

Galerucella pusilla

Golden loosestrife beetle

TYPE OF AGENT: Insect: Beetle, (Coleoptera: Chrysomelidae)

GENERATIONS PER YEAR: One

OVERWINTERING STAGE: Adult (in the soil)

BIOLOGY: Adults emerge from soil in April and June. Adults are 3-5 mm long and orange. Eggs are laid from May–September on stems and leaves in clusters of 3-6. Females produce up to 400 eggs. Eggs hatch in 12 days. Larvae feed on buds and leaves for 14 days. Larvae are small (3-4mm) and light green with brown to black spots. The larvae undergo 3 instars before pupating. Pupation takes 7 days and occurs in the soil or in the spongy tissue of stems in standing water.

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Photo credit: Oregon Department of Agriculture

Before release (2001)

After release (2005)

Hylobius transversovittatus

Loosestrife root weevil

TYPE OF AGENT: Insect: Beetle, (Coleoptera: Curculionidae)

GENERATIONS PER YEAR: One

OVERWINTERING STAGE: Egg, larvae, pupae or adult

BIOLOGY: Adults emerge in late summer and live for up to 3 years. Adults are 8-12 mm long. Eggs are laid from June – August. Adults lay 1-3 eggs per day. Eggs are deposited in soil and hatch after 11 days. Larval stages may last for 1-2 years.

DESTRUCTIVE STAGE: Adult (leaf feeding) and larvae (root mining)

IMPACT TO HOST: Larvae mine roots while adults feed on foliage. Small roots can be destroyed within two years while large roots may die after several years of infestation.

REDISTRIBUTION: Adults are nocturnal and must be collected at night. Night collection can be difficult. Some laboratories rear *H. transversovittatus* on artificial diets. These are available free by contacting Amber Richman (435-830-4146). Adults can be released on plants or eggs can be released on roots. A typical release is 100-200 weevils. These should be used with *Galerucella* spp. for maximum control.

Photo credit: USDA-ARS

Photo credit: L. T. Kok

Photo credit: Oregon Department of Agriculture

Saltcedar

Tamarix spp.

OTHER COMMON NAMES: Tamarisk, tamarik, tamarix

INTRODUCTION: Saltcedar was introduced from Eurasia as an ornamental plant in the 1850's.

HABITAT: This invasive plant infests stream banks and riparian areas reducing water supplies. It can outcompete native vegetation in pastures and rangeland.

DESCRIPTION: Saltcedars are deciduous shrubs or small trees. The deep rooted perennials can grow from two to twenty feet tall. This hearty plant survives severe weather from drought to flooding as well as highly saline soils.

REPRODUCTION: Lavender to pink flowers produce up to 500,000 windblown seeds per tree in one year.

INTEGRATED PEST MANAGEMENT: Tamarisk trees can be controlled mechanically (using a timber axe) or by burning. Trees are traditionally treated with herbicide following these control methods. Do not burn areas where biological control insects are present. Biological control insects can be released on the regrowth of tamarisk following mechanical control or burning.

Photo Credit: M. Mendenhall

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Diorhabda elongata

Saltcedar leaf beetle

TYPE OF AGENT: Insect: Beetle (Coleoptera: Chrysomelidae)

GENERATIONS PER YEAR: 2-4

OVERWINTERING STAGE: Adult (in leaf litter on ground)

BIOLOGY: Adults emerge from May to June and begin lying round yellow eggs in clusters of 7-10. Eggs hatch in 5-6 days. There are 3 larval instars. First instar larvae are black and 2 mm long. Second instar is 4 mm long with yellow lateral spots. The 3rd instar is 9 mm long with yellow lateral stripes. Larval development takes 21 days. Pupae develop in the ground in 7 days. Adults are 5-6 mm long with yellow bodies and two dark green stripes on each elytra. Adults live for 15-20 days.

DESTRUCTIVE STAGE: Larvae and adult (leaf feeding)

IMPACT TO HOST: In some areas of Utah, *D. elongata* are defoliating up to ½ mile per week. Insects will defoliate trees causing enough stress to kill saltcedar in 5-7 years.

REDISTRIBUTION: Adults can be collected from July 1st to September 1st. Collectable areas are either in Delta, Utah (Contact Amber Richman 435-830-4146) or Moab, Utah (Contact Tim Higgs 435-259-1369). To collect beetles, shake infested branches into a cardboard box or 5 gallon bucket. A successful release should contain 10,000 beetles and should be done twice a year per release site.
*** Redistribution of *D. elongata* is restricted to State, county and private land only. Releases are not permitted on federal land without appropriate NEPA documentation.

Yellow Starthistle

Centaurea solstitialis

OTHER COMMON NAMES: St. Barnaby's thistle

INTRODUCTION: Yellow starthistle was first seen in Oakland, CA in 1869. It was most likely imported in contaminated alfalfa

HABITAT: This pest invades roadsides, rangelands, pastures, vineyards, and croplands. Yellow starthistle can grow in a variety of soils. It grows best in intense sunlight in habitats with over 15 cm of rainfall per year.

DESCRIPTION: Yellow starthistle is a winter annual. It grows up to 4 feet tall. Plants are gray-green with bright yellow flowers in the summer. This plant produces a toxin making it poisonous to horses.

REPRODUCTION: The only mode of reproduction is by seed. A plant can produce up to 30,000 seeds per year. Seeds are viable in the soil for up to 3 years.

INTEGRATED PEST MANAGEMENT: Methods of control include prescribed burns, mowing, plowing, grazing, and chemical control. Avoid mowing or burning areas where biological control is established. It is recommended to use herbicide treatment at the same time as biological control. Grazing can also be used. Sheep and cattle will eat yellow starthistle in the early flowering stages. Goats will eat it even after spines have developed on the flowers. Avoid overgrazing an area as that will only leave more disturbed sites for yellow starthistle to infest.

Photo credit: J. Caldwell

Photo Credit: J. Caldwell

Photo Credit: M. Mendenhall

Eustenopus villosus

Yellow starthistle hairy weevil

TYPE OF AGENT: Insect: Beetle, (Coleoptera: Curculionidae)

GENERATIONS PER YEAR: One

OVERWINTERING STAGE: Adult (in soil)

BIOLOGY: Adults emerge from soil in late May and are present through August. They are hairy and brown with white stripes. Adults are 4-6mm long. Eggs are laid in early to mid-summer. Females bore a hole into the seed head and deposit eggs. Eggs hatch in 3 days. Larvae feed on the seed head until larval development is complete (appx. 16 days). Pupation occurs in the seed head and lasts 8-13 days.

DESTRUCTIVE STAGE: Larvae and adult (seed head feeding)

IMPACT TO HOST: Larvae destroy seed heads. Adults feed on mature buds. Larvae can reduce seed production as much as 90-100% and reduce an infestation of yellow starthistle in 5 years.

REDISTRIBUTION: Adults can be collected in late June and early July using sweep nets or by picking adults off of plants. A typical release is 250 adults. *E. villosus* can be released on any size infestation from several meters to several miles.

Photo credit: M. Mendenhall

Photo credit: J. Connett

Photo credit: USDA-ARS

Utah's County Weed Supervisors:

Beaver
Kevin Whicker
105 E Center
Beaver, UT 84713
435-438-6461

Box Elder
Rick Kent
5730 W 8800 N
Trementon, UT 84337
435-729-5258

Cache
Joel Merritt
626 N 1000 W
Logan, UT 84321
435-755-1562
jmerritt@utahweed.org

Carbon
Mike Johnson
120 E Main St.
Price, UT 84501
435-636-6270

Daggett
Chad Reed
95 N 100 W
PO Box 219
Manilla, UT 84046
435-784-3218

Davis
Brandon Hunt
1500 E 650 S
Fruit Heights, UT 84037
801-444-2230

Duchesne
Ron Johnson
PO Box 1081
Duchesne, UT 84021
435-738-2745

Emery
James Nielson
PO Box 629
Castle Dale, UT 84513
435-381-2933

Garfield
Brian Bemner
PO Box 77
Pangutich, UT 84759
435-676-1119

Grand
Tim Higgs
125 E Center St.
Moab, UT 84532
435-259-1369

Iron
J.R. Williams
370 S 200 W
Cedar City, UT 84720
435-586-6909

Juab
Robert Garrett
160 N Main
Nephi, UT 84648
435-623-1593

Kane
Kent Crofts
76 N Main
Kanab, UT 84741
435-644-5312

Millard
Thayne Henry
PO Box 187
Delta, UT 84621
435-864-2467

Morgan
Reid Wild
48 W Young St.
Morgan, UT 84050
435-829-3360

Piute
Verl Bagley
550 N Main
Junction, UT 84750
435-577-2901

Rich
PO Box 218
Randolph, UT 84064
435-793-5575

Salt Lake
Phil McCraley
7125 S 600 W
Midvale, UT 84047
801-562-6466

San Juan
Dave Kentron
PO Box 61
Monticello, UT 84535
435-587-3230

Sanpete
Steve Keller
160 N Main
Manti, UT 84642
435-835-6442

Sevier
Steven Rowley
541 W 600 N
Richfield, UT 84701
435-896-6636

Summit
Jack Marchant
1755 S Hoytsville Rd.
Coalville, UT 84017
435-336-3970

Tooele
Jerry Caldwell
47 S Main
Tooele, UT 84074
435-830-7273

Uintah
Milton Billings
1483 E 335 S
Vernal, UT 84078
435-789-1073

Utah
Craig Searle
2885 S State
Provo, UT 84606
801-851-8638

Wasatch
Richard Jones
805 W 100 S
Heber City, UT 84032
435-657-3276

Washington
Paul Sudweeks
197 E Tabernacle
St. George, UT 84770
435-634-5702

Wayne
Rex Griffiths
PO Box 41
Loa, UT 84747
435-836-2682

Weber
Jim Parks
2222 S. 1900 W.
Ogden, UT 84401
801-399-8356