

BIOLOGICAL CONTROL OF NOXIOUS WEEDS IN OREGON

A guide to common biological control agents found in Oregon



WHAT IS BIOLOGICAL WEED CONTROL?

Invasive noxious weeds in Oregon cost millions of dollars in economic and environmental damage. Biological control is a tool vegetation managers employ to help naturally suppress weed infestations. This pamphlet shows many of the common biological agents you may encounter in Oregon.

Classical biological control is the use of selected natural enemies to control targeted weeds. Most of our worst noxious weeds originated from other continents. Prospective biocontrol agents are thoroughly tested to ensure they will be safe to release in North America. Once approved, they are released at nursery sites where they can establish resident populations. Surplus bioagents are later harvested and released at other infestations throughout Oregon. It may take several years for their populations to reach levels that effectively control the target weeds.

Biocontrol agents rarely eradicate entire infestations. The goal is to weaken weeds so desirable vegetation can compete and suppress the weeds below an economically or environmentally damaging level. Biocontrol works best when integrated with land management practices that improve desirable competitive vegetation. Even after control, some weed infestations may rebound. Generally resident biocontrol agent populations regain control after several years. Biological control requires a long-term commitment to weed management and may not be suitable at all infestations.

Biocontrol agents affect weeds by either directly targeting plant tissues through their removal or destruction, or indirectly by causing galls, that interfere with tissue functions and stress the plants.

Benefits of biological control include: host specific to target weed, self-perpetuating populations, synchronization with target weed lifecycle, ability to locate host plants in variable environments, and economic feasibility on low-value lands.

Some of the disadvantages of biological control include: slow rate of impact, dependence on minimum weed density, fluctuating availability of agents, and limited efficacy in variable environments.

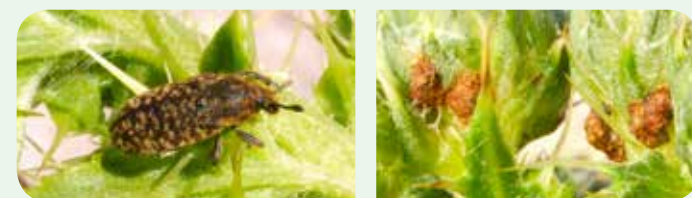
It is important to make sure the correct species of biocontrol agents are released, to use the most effective species, and to document the release and establishment of weed biocontrol agents.

Since 1947, 77 species of biocontrol agents have been released in Oregon against 32 species of targeted weeds. A total of 67 species are established. The majority of the bioagents are insects (71), plus three mites, one nematode, and two pathogens. Successful projects can generate 15:1 benefit to cost ratios. There are a number of non-approved natural enemies found on some weeds. Biocontrol agents are listed here under host weed, type of agent, and scientific name.

Generally, the Oregon Department of Agriculture (ODA), the USDA Animal Plant Health Inspection Service (APHIS), and cooperators can provide needed biocontrol agents at no cost. Whenever approved biocontrol agents are shipped across state lines, a PPQ 526 permit from APHIS is required. Parties interested in implementing biocontrol are encouraged to contact ODA or APHIS to determine the availability and need for biocontrol agents of specific weeds.

NONTARGET IMPACTS

Most weed biocontrol agents are safe to use throughout Oregon. However, the thistle seed head weevil *Rhinocyllus conicus* (see below) was found to attack native thistles a decade after its introduction in 1979. It is therefore not recommended for use as a biocontrol agent of thistles. ODA curtailed redistribution of this weevil in 1989 due to its impact on native thistles. USDA APHIS restricted interstate movement of the weevil in 2000. Current protocols for host specificity testing would have prevented the introduction of this weevil. The weevil is widespread and commonly found on bull, Canada, Italian, milk, musk, and slenderflower thistles. It has however, significantly controlled weedy thistles at various locations in Oregon.



Adult weevil and egg sites (brown bumps) on thistle bracts (R).

KEY TO BIOCONTROL AGENT STATUS

The following general information is provided for each biocontrol agent.

YEAR: Year of introduction.

DISTRIBUTION: Distribution of agent in host infested counties.
Widespread >50% **Limited** <50%

ATTACK RATE: Percent of plants attacked.
Heavy >70% **Medium** >30% **Light** >10% **Slight** <10%

CONTROL: Observed reduction of weed density or seed production.

Poor: little change <10% **Fair:** noticeable change >10% **Good:** significant control <90% **Excellent** >90% control

COLLECTABILITY: Availability of agents for redistribution.

Mass—available for mass collection.
Limited—available in limited numbers or difficult to collect.
N/A—not available at this time.

RELEASE NUMBER: Recommended minimum number to establish a new colony.

TIMING: Optimum time of year to redistribute.

LIFE STAGE: Life stage of biocontrol agent best suited for collection and establishment.

METHOD: Preferred method to collect agents from well-established populations.

Sweep net—heavy duty canvas net to dislodge agents from vegetation, can be used in conjunction with a racquet.

Aerial net—lightweight net for fragile flying insects.

Aspirate—special aspirator to suck insects into a vial.

Beating sheet—knock insects off plants with a racquet onto canvas sheet and collect with aspirator.

Hand pick—collect by hand.

Light trap—UV light to attract night flying insects to white sheet or funnel trap.

Vacuum—motorized vacuum to suck insects from plants.

Harvest—collect infested plant materials (i.e. galls, seed heads, roots which can be released or rear agents out).

DALMATIAN TOADFLAX

Linaria dalmatica



DALMATIAN TOADFLAX STEM WEEVIL

Mecinus janthiniformis

Year: 2001 **Distribution:** Widespread
Attack rate: Heavy **Control:** Excellent
Collectability: Mass **Release No.** 100
Timing: May–Jun **Method:** Sweep net/racquet
Stage: Adult **Comment:** Stand reductions at many sites. A sibling species *M. janthinus* attacks yellow toadflax.

FIELD BINDWEED

Convolvulus arvensis

FIELD BINDWEED GALL MITE

Aceria malherbae

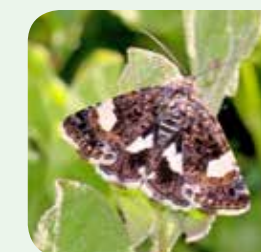
Year: 1999
Distribution: Widespread
Attack rate: Heavy
Control: Good
Collectability: Mass
Release No. 1000
Timing: Jun–Sep
Method: Harvest
Stage: All
Comment: Mostly in Northeastern Oregon. Use about one sandwich bag of infested plant material. Look for gnarled leaves.



FIELD BINDWEED MOTH

Tyta luctuosa

Year: 1998
Distribution: Limited
Attack rate: Light
Control: Poor
Collectability: Limited
Release No. 50
Timing: Jun–Sept **Method:** Aerial net **Stage:** Adult
Comment: Flush adults and sweep net, one to two adults per vial. Mostly in Willamette Valley.



GORSE

Ulex europaeus

GORSE SEED WEEVIL

Exapion ulicis

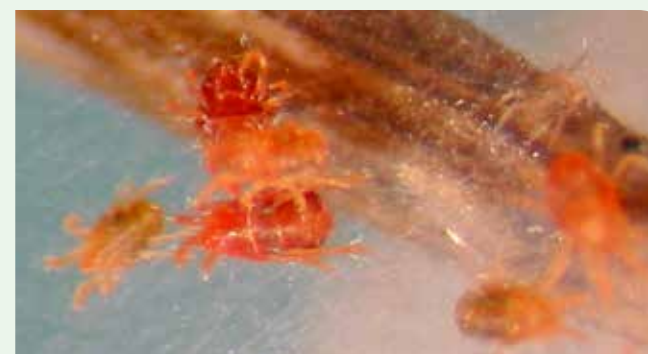
Year: 1956 **Distribution:** Widespread
Attack rate: Heavy **Control:** Good
Collectability: Mass **Release No.** 100
Timing: Apr–May **Method:** Sweep net/racquet
Stage: Adult **Comment:** No need for redistribution.



GORSE SPIDER MITE

Tetranychus lintearius

Year: 1994
Distribution: Widespread
Attack rate: Light
Control: Poor
Collectability: Limited
Release No. 500
Timing: Aug–Sep
Method: Harvest infested plant material
Stage: All
Comment: Ineffective due to predatory mite. Multiple generations per year.



FOR MORE INFORMATION

Oregon Department of Agriculture (ODA)

Noxious Weed Control Program
635 Capitol St. NE
Salem, OR 97301
www.oregon.gov/ODA
(503) 986-4621

ODA biocontrol projects

http://go.usa.gov/39rkG

Biocontrol release form

http://go.usa.gov/39rkz

USDA APHIS PPQ

Airport Business Center
6135 NE 80th Ave. Suite A-5
Portland, OR 97218
(503) 326-2814

USDA APHIS PPQ permit 526

http://go.usa.gov/cSMGk

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KNAPWEED, DIFFUSE

Centaurea diffusa

KNAPWEED, MEADOW

Centaurea jacea x nigra = C. moncktonii

KNAPWEED, SPOTTED

Centaurea stoebe = C. maculata

SULFUR KNAPWEED ROOT MOTH

Agapeta zoegana

Year: 1987
Distribution: Widespread
Attack rate: Heavy
Control: Good
Collectability: Limited
Release No. 50–100
Timing: July
Method: Light trap **Stage:** Adult
Comment: Hard to collect in sufficient number.



BROAD-NOSED KNAPWEED SEED HEAD WEEVIL

Bangasternus fausti

Year: 1989
Distribution: Widespread
Attack rate: Heavy
Control: Good
Collectability: Mass
Release No. 100
Timing: Jun–Jul
Method: Sweep net/racquet **Stage:** Adult
Comment: Best when flowers are in bud stage.



Method: Sweep net/racquet **Stage:** Adult
Comment: Best when flowers are in bud stage.



KNAPWEED PEACOCK SEED FLY

Chaetorellia acrolophi

Year: 1993
Distribution: Limited
Attack rate: Light **Control:** Fair
Collectability: Limited
Release No. 100 **Timing:** Jun–Jul
Method: Aerial net **Stage:** Adult
Comment: Gently sweep during bud stage, aspirate from net. Best at moister sites.

KNAPWEED ROOT WEEVIL

Cyphocleonus achates

Year: 1993
Distribution: Limited
Attack rate: Heavy
Control: Fair
Collectability: Mass
Release No. 50–100
Timing: Aug–Sept
Method: Hand pick
Stage: Adult
Comment: Collect adults under rosettes. Disperse upon release.



LESSER KNAPWEED FLOWER WEEVIL

Larinus minutus

Year: 1992
Distribution: Widespread
Attack rate: Heavy
Control: Excellent



Collectability: Mass **Release No.** 100

Timing: Jun–Jul **Method:** Sweep net/racquet
Stage: Adult **Comment:** Best at 20% bloom. Best control on diffuse knapweed.

BLUNT KNAPWEED FLOWER WEEVIL

Larinus obtusus

Year: 1942
Distribution: Widespread
Attack rate: Heavy
Control: Excellent
Collectability: Mass
Release No. 100
Timing: Jun–Jul
Method: Sweep net/racquet
Stage: Adult
Comment: Best at 20% bloom. Abundant on meadow knapweed.



KNAPWEED SEED HEAD MOTH

Metzneria paucipunctella

Year: 1981
Distribution: Widespread
Attack rate: Light **Control:** Fair
Collectability: Limited
Release No. 200
Timing: March
Method: Harvest seed heads
Stage: Larva/pupa
Comment: Displaced by seed head weevils. Ineffective, often parasitized.



KNAPWEED ROOT BEETLE

Sphenoptera jugoslavica

Year: 1980
Distribution: Widespread
Attack rate: Heavy
Control: Fair
Collectability: Limited
Release No. 100
Timing: Jun–Jul **Method:** Sweep net **Stage:** Adult
Comment: Low density, hard to collect. Larva most commonly encountered.



GREEN KNAPWEED SEED FLY

Terellia virens

Year: 1993
Distribution: Limited
Attack rate: Medium
Control: Good
Collectability: Limited
Release No. 100
Timing: Jun–Jul **Method:** Aerial net **Stage:** Adult
Comment: Gently sweep during bud stage, aspirate from net. Best at moister sites.



BANDED KNAPWEED SEED GALL FLY

Urophora affinis

Year: 1975
Distribution: Widespread
Attack rate: Heavy
Control: Good
Collectability: Mass
Release No. 100
Timing: Jun–Aug **Method:** Aerial net
Stage: Adult **Comment:** Little need for redistribution. Produces hard gall.



UV KNAPWEED SEED GALL FLY

Urophora quadrifasciata

Year: 1975
Distribution: Widespread
Attack rate: Heavy
Control: Good
Collectability: Mass
Release No. 100
Timing: Jun–Aug
Method: Aerial net
Stage: Adult
Comment: Little need for redistribution. Produces soft gall.



KNAPWEED, RUSSIAN

Acroptilon repens = Rhapanticum repens

RUSSIAN KNAPWEED GALL WASP

Aulacidea acroptilonica

Year: 2014
Distribution: Limited
Attack rate: Slight
Control: Unknown
Collectability: N/A
Release No. 50
Timing: May–Aug
Method: Harvest **Stage:** Pupa
Comment: Collect bouquets of infested plants. All female species. May become available soon.



RUSSIAN KNAPWEED GALL MIDGE

Jaapiella ivannikovi

Year: 2011
Distribution: Limited
Attack rate: Medium
Control: Fair
Collectability: Mass
Release No. 20–50
Timing: May–Aug
Method: Harvest **Stage:** Pupa
Comment: Collect bouquets of infested plants with mature galls.



LEAFY SPURGE

Euphorbia esula

BLACK LEAFY SPURGE FLEA BEETLE

Aphthona lacertosa

Year: 1993
Distribution: Widespread
Attack rate: Heavy
Control: Excellent
Collectability: Mass
Release No. 500
Timing: Jun–Jul
Method: Sweep net
Stage: Adult
Comment: Mixed with similar species *A. czwalinae*. Best at wetter sites.



BLACK-DOT LEAFY SPURGE BEETLE

Aphthona nigricutis

Year: 1989
Distribution: Widespread
Attack rate: Heavy
Control: Excellent
Collectability: Mass
Release No. 500
Timing: Jun–Jul
Method: Sweep net
Stage: Adult
Comment: Best at dry sites. Often mixed with other species *A. cyarissiae* and *A. flava*.



Photo: UGA 5083047

REDHEADED LEAFY SPURGE BORER

Oberea erythrocephala

Year: 1982
Distribution: Widespread
Attack rate: Heavy
Control: Good
Collectability: Mass
Release No. 100
Timing: Jun–Jul
Method: Sweep net
Stage: Adult
Comment: Look for dying upper stems. Attacks larger plants.



SCOTCH BROOM

Cytisus scoparius



SCOTCH BROOM SEED BEETLE

Bruchidius villosus

Year: 1998
Distribution: Widespread
Attack rate: Heavy
Control: Good
Collectability: Mass
Release No. 100
Timing: May–Jun
Method: Sweep net/racquet
Stage: Adult
Comment: Little need for redistribution. Also attacks French broom. Look for eggs on seed pods.



SCOTCH BROOM SEED WEEVIL

Exapion fuscirostre

Year: 1983
Distribution: Widespread
Attack rate: Heavy
Control: Good
Collectability: Mass
Release No. 100
Timing: Apr–May
Method: Beating sheet
Stage: Adult
Comment: Aspirate from beating sheet. May be displaced by seed beetle.



MEDITERRANEAN SAGE

Salvia aethiops

MEDITERRANEAN SAGE CROWN/ROOT WEEVIL

Phrydiuchus tau

Year: 1971
Distribution: Widespread
Attack rate: Heavy
Control: Good
Collectability: Mass
Release No. 100
Timing: Jul, Oct–Nov
Method: Sweep net, aspirate
Stage: Adult
Comment: Sweep at 50% bloom or aspirate from fall rosettes.



PUNCTUREVINE

Tribulus terrestris

PUNCTUREVINE SEED WEEVIL

Microlarinus lareynii

Year: 1963
Distribution: Limited
Attack rate: Medium
Control: Fair
Collectability: Mass
Release No. 100
Timing: Aug–Sep
Method: Aspirate
Stage: Adult
Comment: Not cold winter hardy. Common in Rogue Valley. Look for oval feeding scars under stems and pitting on goatheads.



PURPLE LOOSESTRIFE

Lythrum salicaria

BLACK-MARGINED LOOSESTRIFE LEAF BEETLE

Galerucella californiensis

Year: 1992
Distribution: Widespread
Attack rate: Heavy
Control: Excellent
Collectability: Mass
Release No. 500
Timing: May and Jul
Method: Sweep net/racquet
Stage: Adult
Comment: Collect during breeding. May be mixed species. Release at one spot.



GOLDEN LOOSESTRIFE LEAF BEETLE

Galerucella pusilla

RUSH SKELETONWEED

Chondrilla juncea

RUSH SKELETONWEED ROOT MOTH

Bradyrrhoa gilveolella

Year: 2005
Distribution: Limited
Attack rate: Light
Control: Unknown
Collectability: Limited
Release No. 50–100
Timing: Jun–Aug
Method: Aerial net
Stage: Adult
Comment: Import from Idaho. Flush adults and net.



RUSH SKELETONWEED GALL MIDGE

Cystiphora schmidti

Year: 1978
Distribution: Widespread
Attack rate: Heavy
Control: Good
Collectability: Mass
Release No. 250
Timing: Jun–Aug
Method: Harvest
Stage: Pupa
Comment: Collect bouquets of galled plants. Heavily parasitized. Plants may appear purple.



RUSH SKELETONWEED BUD GALL MITE

Eriophyes chondrillae

Year: 1978
Distribution: Widespread
Attack rate: Heavy
Control: Excellent
Collectability: Mass
Release No. 1000
Timing: Jun–Aug
Method: Harvest
Stage: All
Comment: Collect bouquets of galled plants. Inoculate with infested sprigs.



RUSH SKELETONWEED RUST FUNGUS

Puccinia chondrillina

Year: 1978
Distribution: Widespread
Attack rate: Heavy
Control: Good
Collectability: Mass
Release No. 1 bouquet
Timing: May–Jun
Method: Harvest
Stage: Spore
Comment: Collect bouquets of infested plants.



PURPLE LOOSESTRIFE ROOT WEEVIL

Hylobius transversovittatus

Year: 1992
Distribution: Widespread
Attack rate: Heavy
Control: Good
Collectability: Limited
Release No. 100
Timing: Jul–Aug
Method: Handpick
Stage: Adult
Comment: Difficult to collect. Adults are nocturnal. Best reared from infested roots.



PURPLE LOOSESTRIFE SEED CAPSULE WEEVIL

Nanophyes marmoratus

Year: 1994
Distribution: Widespread
Attack rate: Medium
Control: Fair
Collectability: Mass
Release No. Mass
Timing: Jul
Method: Sweep net/beating sheet
Stage: Adult
Comment: Collect from flowering plants. May be limited by leaf beetle competition.

ST. JOHNSWORT

Hypericum perforatum



ST. JOHNSWORT ROOT BORER

Agrilus hyperici

Year: 1986
Distribution: Limited
Attack rate: Heavy
Control: Excellent
Collectability: Mass
Release No. 50–100
Timing: Jun–Jul
Method: Sweep net/racquet
Stage: Adult
Comment: Collect at >50% bloom. Best at drier sites. Spotty availability.

ST. JOHNSWORT LOOPER

Aplocera plagiata

Year: 1989
Distribution: Widespread
Attack rate: Medium
Control: Poor
Collectability: Mass
Release No. 100–200
Timing: Jun–Jul
Method: Sweep net/racquet
Stage: Larva
Comment: Release 2–3 larvae per square yard.



ST. JOHNSWORT LEAF BEETLES

Chrysolina hyperici

Year: 1947
Distribution: Widespread
Attack rate: Heavy
Control: Excellent
Collectability: Mass
Release No. 100
Timing: Jun–Jul
Method: Sweep net
Stage: Adult
Comment: Most common in Western Oregon. May be mixed with *C. quadrigemina*.



ST. JOHNSWORT LEAF BEETLES

Chrysolina quadrigemina

Year: 1948
Distribution: Widespread
Attack rate: Heavy
Control: Excellent
Collectability: Mass
Release No. 100
Timing: Jun–Jul
Method: Sweep net
Stage: Adult
Comment: Most common in Eastern Oregon. May be mixed with *C. hyperici*.

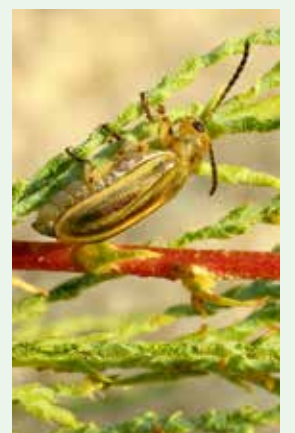
SALT CEDAR

Tamarix ramosissima

SALT CEDAR BEETLE

Diorhabda carinulata

Year: 2003
Distribution: Widespread
Attack rate: Heavy
Control: Excellent
Collectability: Mass
Release No. 500
Timing: Jul–Aug
Method: Sweep net/racquet
Stage: Adult
Comment: Release in one spot. Adults congregate. Interstate shipment prohibited. Originally released as *D. elongata*. Two generations per year.



SCOTCH BROOM

Cytisus scoparius

TANSY RAGWORT

Senecio jacobaea = *Jacobaea vulgaris*

TANSY RAGWORT SEED HEAD FLY

Botanophila seneciella

Year: 1966
Distribution: Widespread
Attack rate: Light
Control: Poor
Collectability: Mass
Release No. 100
Timing: Aug
Method: Harvest
Stage: Pupa
Comment: Little need for further redistribution. Look for spittle on seed heads. Use bouquets of infested seed heads.



THISTLE, BULL

Cirsium vulgare

BULL THISTLE SEED HEAD FLY

Urophora stylata

Year: 1988
Distribution: Widespread
Attack rate: Heavy
Control: Good
Collectability: Mass
Release No. 50
Timing: Nov–Mar
Method: Harvest
Stage: Pupa
Comment: Collect galls in fall. Spread out at new site.



THISTLE, CANADA

Cirsium arvense

CANADA THISTLE STEM WEEVIL

Ceutorhynchus litura

Year: 1981
Distribution: Limited
Attack rate: Heavy
Control: Good
Collectability: Mass
Release No. 100
Timing: Apr–May
Method: Aspirate
Stage: Adult
Comment: Collect when plants are 2–4 inches. Best in Eastern Oregon.



CANADA THISTLE GALL FLY

Urophora cardui

Year: 1980
Distribution: Widespread
Attack rate: Heavy
Control: Fair
Collectability: Mass
Release No. 50
Timing: Oct–Nov
Method: Harvest
Stage: Pupa
Comment: Collect galls after killing frost, scatter widely at site. Stunts plants, reduces flowering.



THISTLE, ITALIAN

Carduus pycnocephalus

THISTLE, MUSK

Carduus nutans

THISTLE, SLENDERFLOWER

Carduus tenuiflorus

THISTLE SEED HEAD WEEVIL

Rhinocyllus conicus

Year: 1979
Distribution: Widespread
Attack rate: Heavy
Control: Good
Collectability: Mass
Release No. 100
Timing: May–Jun
Method: Sweep net/racquet
Stage: Adult
Comment: Not recommended, attacks many native thistles. Interstate shipment prohibited. Common on all weedy thistles.



THISTLE CROWN/ROOT WEEVIL

Trichosiromalus horridus

Year: 1994
Distribution: Limited
Attack rate: Heavy
Control: Good
Collectability: Mass
Release No. 100
Timing: Mar and Jul

Method: Sweep net/racquet
Stage: Adult
Comment: Found on musk, Italian, and slenderflower thistles. May attack native thistles. Aspirate in spring on rosettes on musk thistle.



YELLOW STAR THISTLE

Centaurea solstitialis

YELLOW STAR THISTLE BUD WEEVIL

Bangasternus orientalis

Year: 1985
Distribution: Widespread
Attack rate: Light
Control: Poor
Collectability: Limited
Release No. 100
Timing: May–Jun
Method: Sweep net
Stage: Adult
Comment: Has been mostly displaced by other biocontrol agents. Best at bud stage.



YELLOW STAR THISTLE SEED FLY

Chaetorellia australis, *C. succinea*

Year: 1988
Distribution: Widespread
Attack rate: Heavy
Control: Excellent
Collectability: Mass
Release No. 100
Timing: May–Jun
Method: Aerial net
Stage: Adult
Comment: Aspirate from net. Adventive sibling species *C. succinea* most common (pictured).



YELLOW STAR THISTLE SEED HEAD WEEVIL

Eustenopus villosus

Year: 1990
Distribution: Widespread
Attack rate: Heavy
Control: Excellent
Collectability: Mass
Release No. 100
Timing: Jun–Jul
Method: Sweep net
Stage: Adult
Comment: Best at 5–10% bloom. Most effective agent.



YELLOW STAR THISTLE FLOWER WEEVIL

Larinus curtus

Year: 1992
Distribution: Widespread
Attack rate: Heavy
Control: Excellent
Collectability: Mass
Release No. 100
Timing: Jul–Aug
Method: Sweep net
Stage: Adult
Comment: Limited in Western Oregon. May be diseased, interstate movement prohibited.



YELLOW STAR THISTLE SEED HEAD GALL FLY

Urophora sirunaseva

Year: 1985
Distribution: Widespread
Attack rate: Light
Control: Poor
Collectability: Limited
Release No. 100
Timing: May–Jun
Method: Aerial net
Stage: Adult
Comment: Has been mostly displaced by other agents. Produces hard gall.



Photo: UGA 0022065

YELLOW TOADFLAX

Linaria vulgaris

YELLOW TOADFLAX STEM WEEVIL

Mecinus janthinus

Year: 2011
Distribution: Limited
Attack rate: Heavy
Control: Excellent
Collectability: Limited
Release No. 100
Timing: May–Jun
Method: Sweep net
Stage: Adult
Comment: Emerging success. Specific to yellow toadflax.

