

Biological control of Yellow Starthistle, Russian thistle and French broom

San Benito Rancher Seminar, 12/8/21



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How to Control an Invader ?

Integrated Weed Management

- **Herbicides**
- **Controlled burns**
- **Mowing**
- **Grazing management**
- **Planting competitors**
- **Hand-pulling**
- **Biological control**

St. Johnswort / Klamathweed

1940s - toxic to cattle, 4 million acres infested

1948



flea beetle



1950



- Released 4 insects in 1940s-50s,
- extensive control
- still continuing

Dalmatian toadflax, *Linaria dalmatica* at Hungry Valley



stem weevils
Mecinus janthiniformis



Classical Biological Control - theory

- Alien plant is invasive in USA, but not in land of origin.
- Insects or diseases (natural enemies) control the plant in its native land.
- There are no natural enemies to control the plant in USA.
- Find foreign natural enemies to release in USA.
(test for safety, get state & federal approval)
- The biological control agents will multiply and spread, providing perpetual control of the weed.



United States
Department of
Agriculture

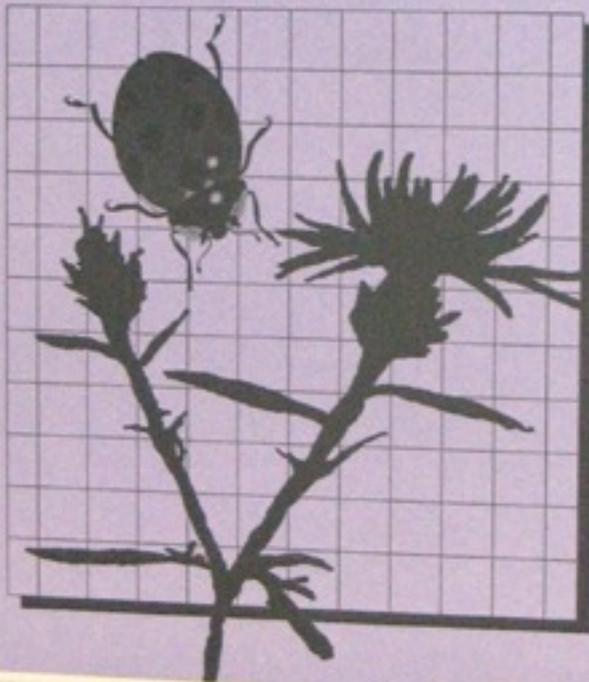
Marketing and
Regulatory
Programs

Animal and
Plant Health
Inspection
Service

Plant Protection
and Quarantine

Reviewer's Manual for the Technical Advisory Group for Biological Control Agents of Weeds

Guidelines for Evaluating the Safety of
Candidate Biological Control Agents



USDA- APHIS Review Process

TAG, 1987
NEPA 1969
Endangered
Species Act
1973

Successful Biological Control

Dalmatian toadflax – CA, Br. Columbia

Knapweeds (diffuse, spotted & squarrose) – CO, MT

Leafy spurge – MT, WY, ND

Mediterranean sage – CA

Puncturevine – CA

Purple loosestrife – NY to OR

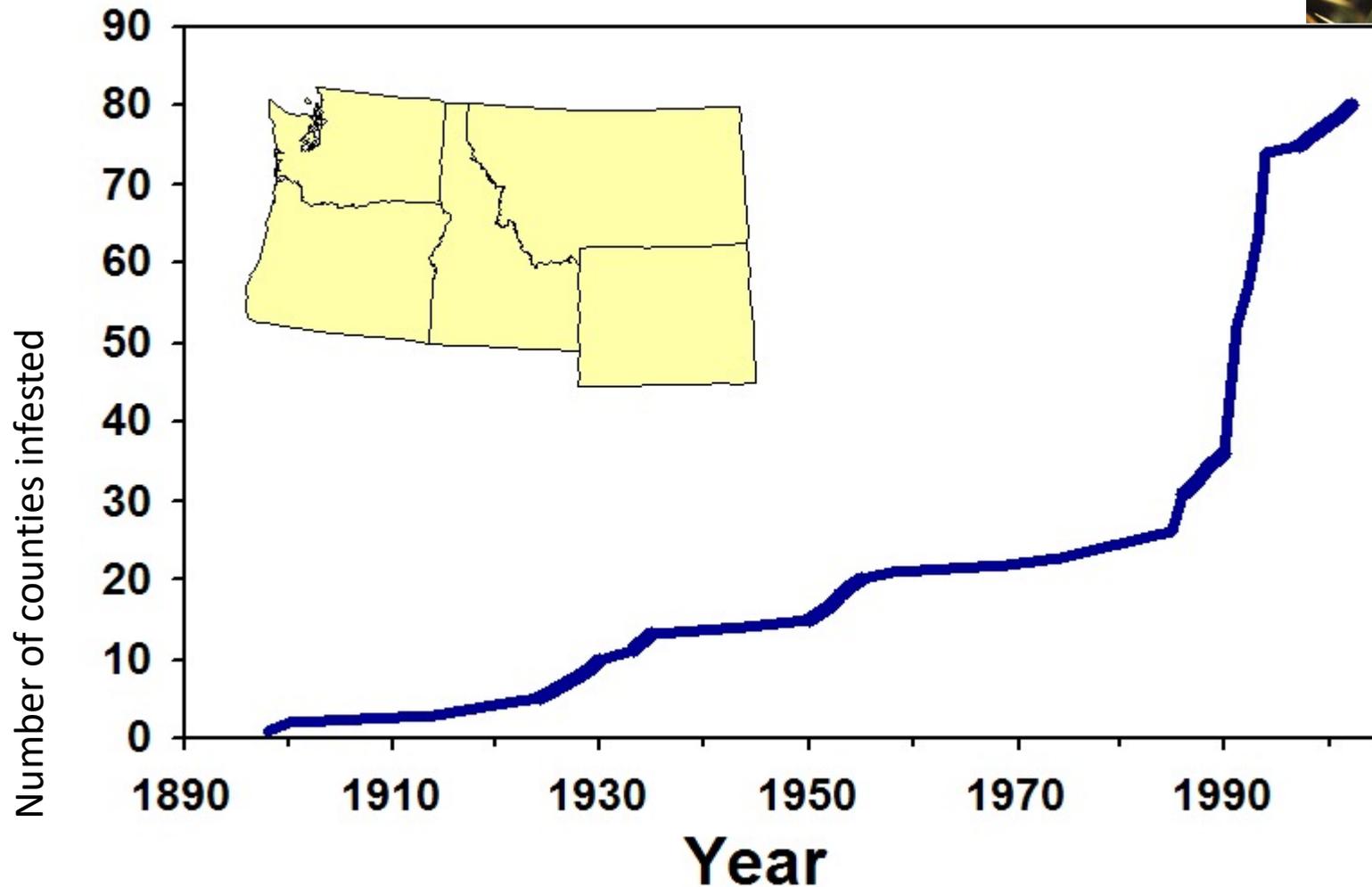
Rush skeletonweed – CA to WA

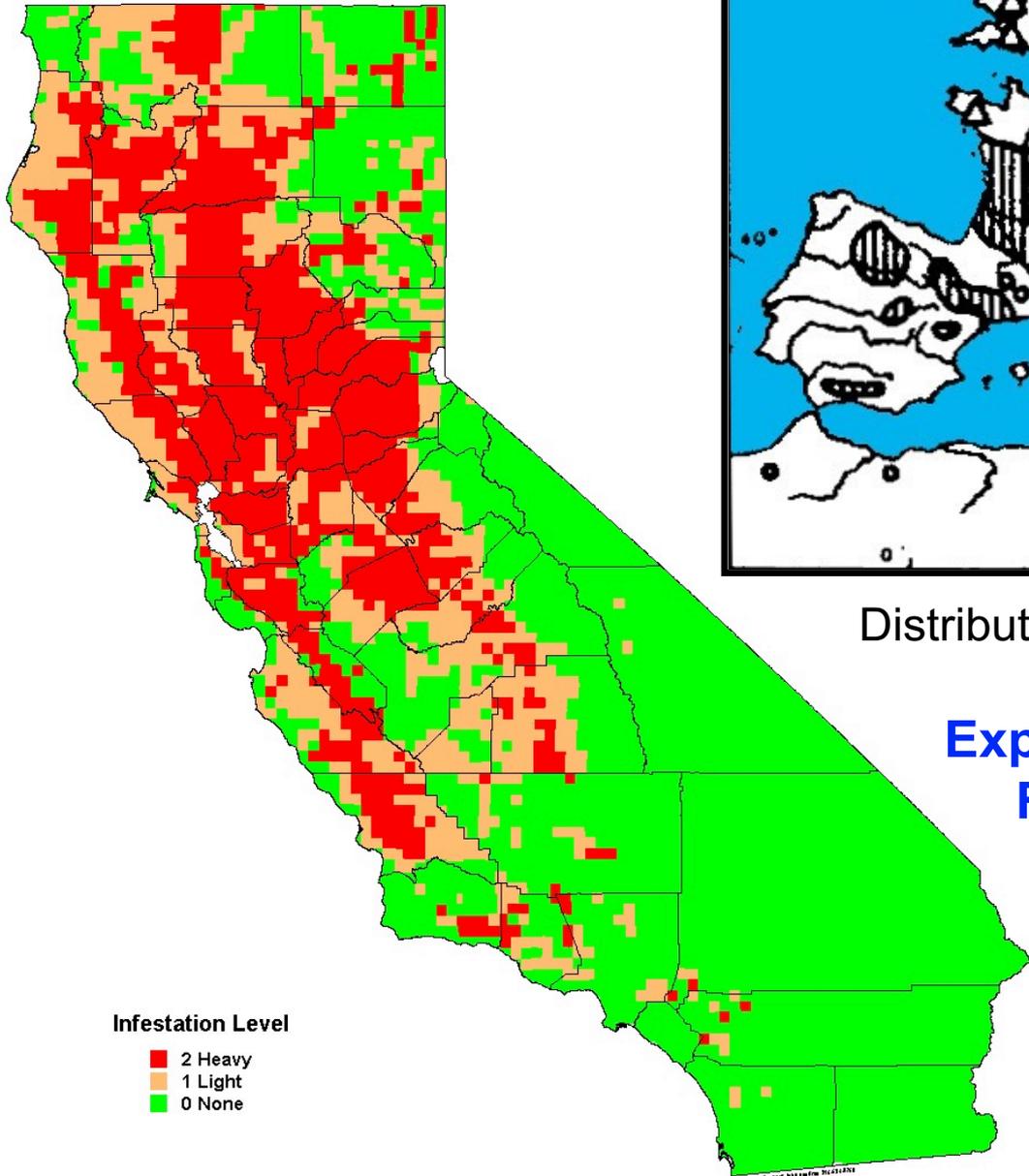
Saltcedar – CO, UT, AZ

St. Johnswort – CA, OR (since 1940s)

Tansy ragwort – OR

Spread of Yellow Starthistle in Pacific Northwest





Infestation Level

- 2 Heavy
- 1 Light
- 0 None



Distribution of Yellow Starthistle in Europe

**Exploration in Italy, Greece, Turkey,
France, Bulgaria, Russia**

**Imported insects from
Greece**

Status of Biological Control Agents of Yellow Starthistle

Biological control agent	Common name	First release	Status
<i>Urophora jaculata</i>		1969	Never established in USA.
<i>Urophora sirunaseva</i>	YST ¹ gall fly	1984	Widely established, present at most YST infestations in CA & OR; a few sites in WA, ID.
<i>Bangasternus orientalis</i>	YST bud weevil	1985	Widespread in CA, OR, WA & ID, but low numbers.
<i>Chaetorellia australis</i>	YST peacock fly	1988	Prefers bachelor button; established at a few sites in CA; widespread in OR, WA, ID.
<i>Eustenopus villosus</i>	YST hairy weevil	1990	Well established in CA; widespread in OR, WA; a few sites in ID, UT.
<i>Larinus curtus</i>	YST flower weevil	1992	Established at a few sites in CA, WA, ID; widespread in OR.
Unapproved accidental introduction:			
<i>Chaetorellia succinea</i>	YST false peacock fly	1991	Widely established in CA & OR, and spreading into WA, ID & NV. Currently being evaluated for nontarget impacts.

1 YST = yellow starthistle



Urophora sirunaseva



Bangasternus orientalis



Eustenopus villosus

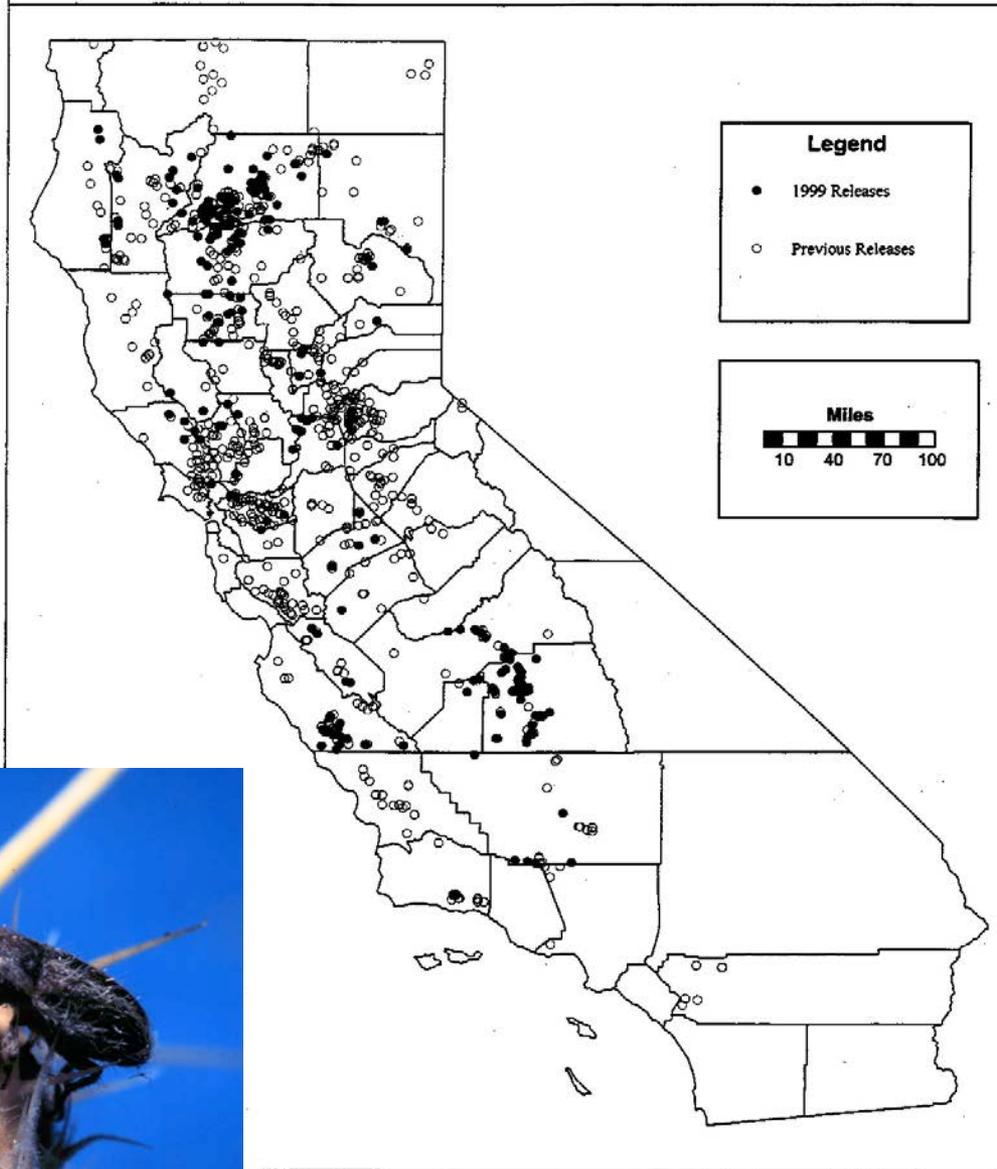


Larinus curtus



Chaetorellia succinea

Figure 1: Releases of the Hairy Weevil in California in 1990-1999
Biological Control Program, CDFA



Hairy weevil



False Peacock Fly



Hairy Weevil

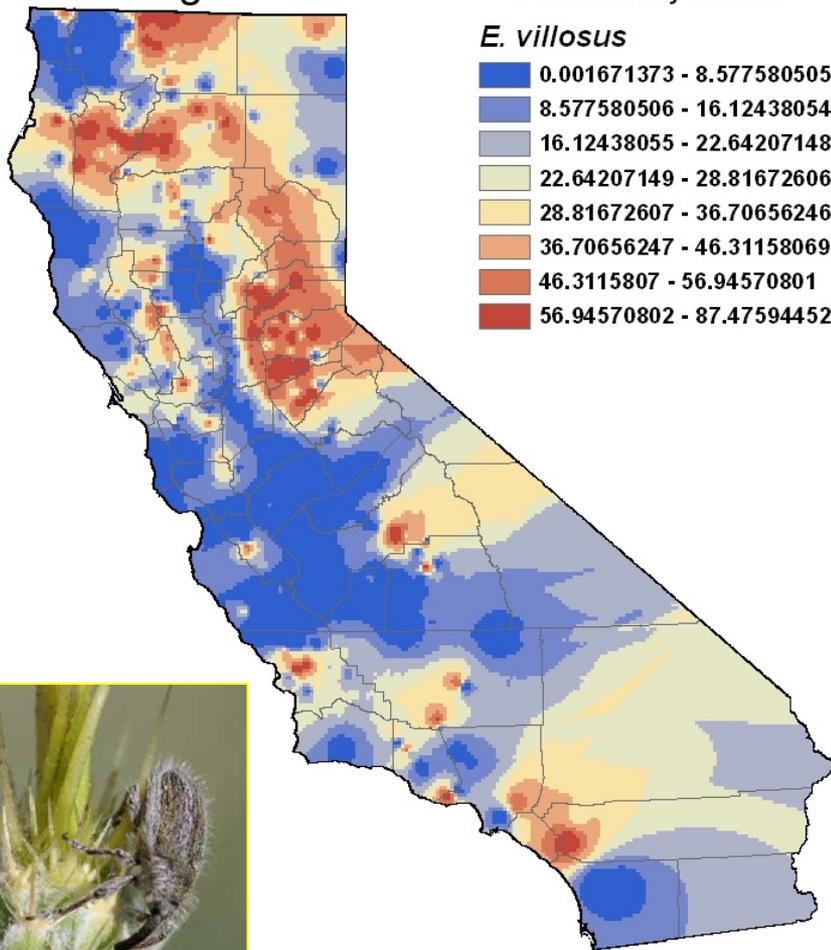
Recovered at 80% of locations

Mean attack rate: 25%

Range: 0 - 93%

Inverse Distance Weighted
Percent Attack Values
From Survey 2001-02

E. villosus



False Peacock Fly

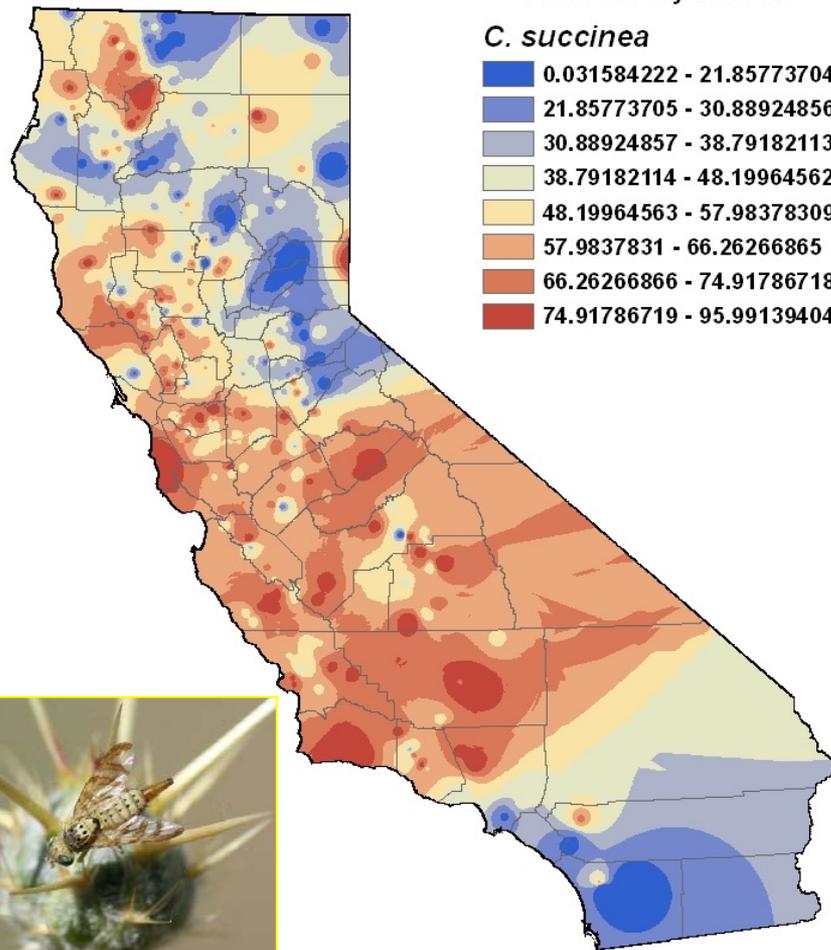
Recovered at 99% of locations

Mean attack rate: 53%

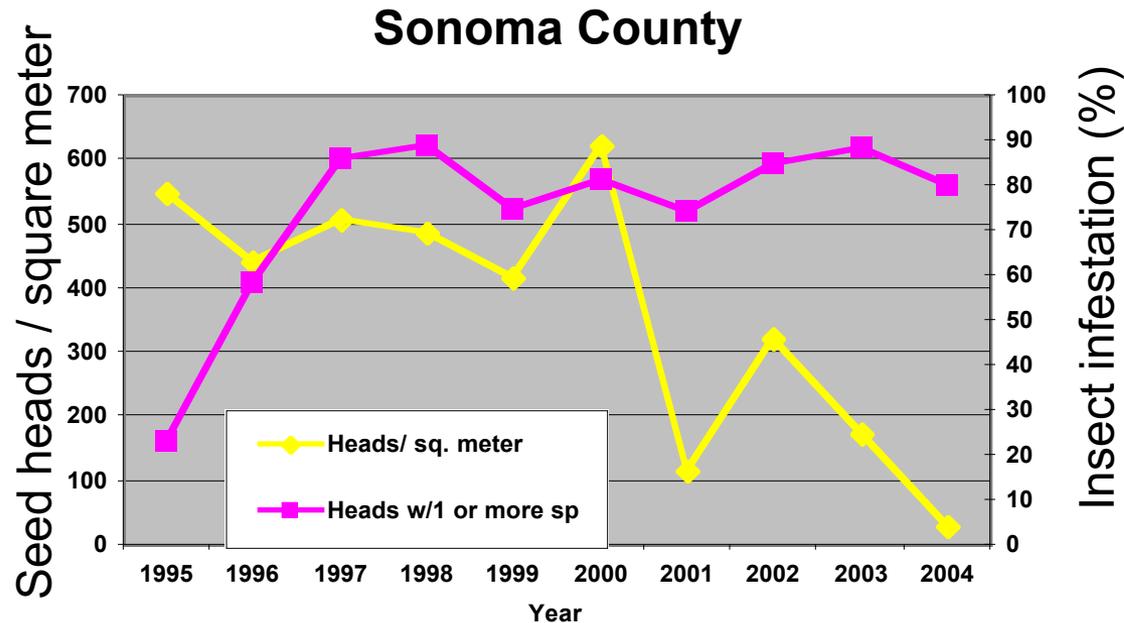
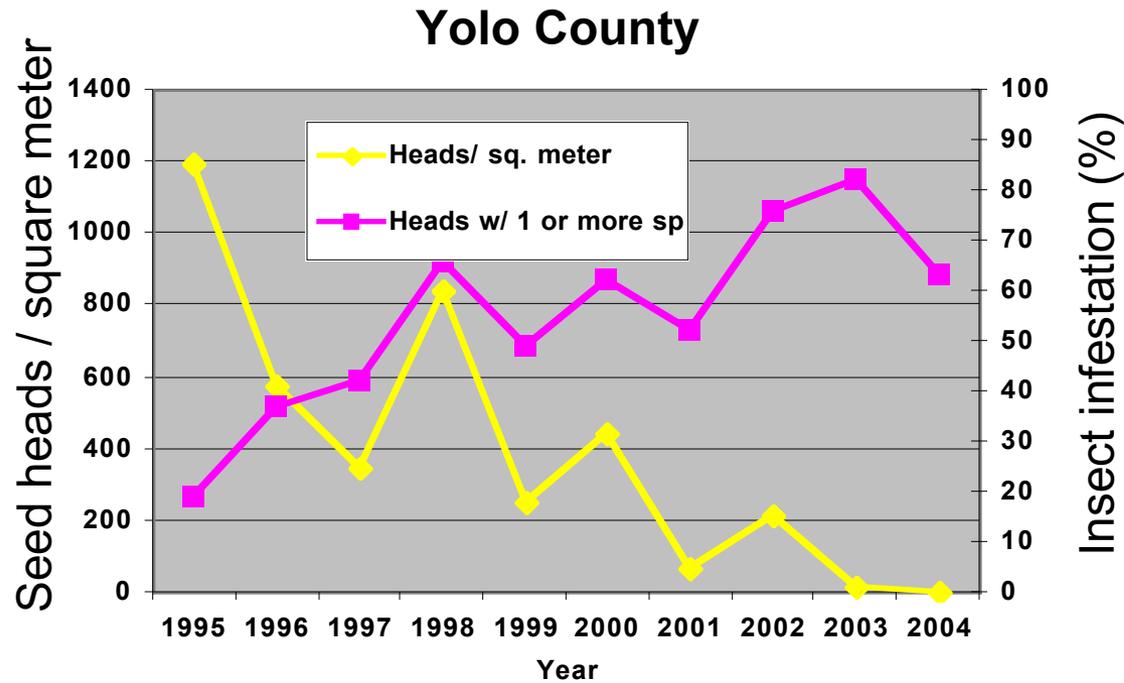
Range: 0 - 96%

Inverse Distance Weighted
Percent Attack Values
From Survey 2001-02

C. succinea



Effect of flower head insects on YST in California (no grazing)



Yellow Starthistle, Myrtle Creek, OR, 6/91



grazed by cattle

Yellow Starthistle, Myrtle Creek, OR, 7/95



Hairy weevil
(no grazing)

Rust Fungus

Puccinia jaceae var. *solstitialis*



yellow starthistle

- **Released by CDFA (2003-06)**
- Monitored 80 release sites
- Low establishment & impact

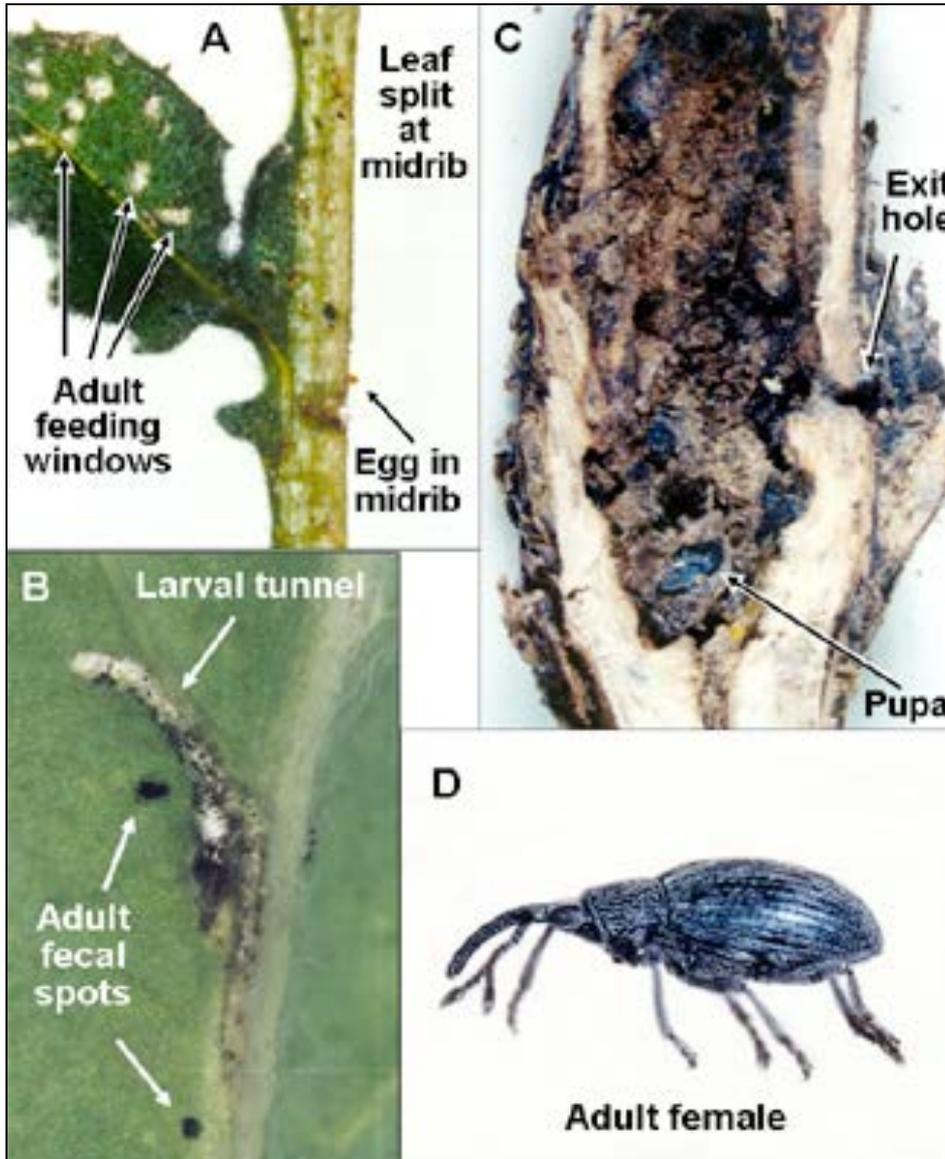
Dale Woods, CDFA
Alison Fisher, USDA-ARS
& cooperators

Rosette Weevil (*Ceratapion basicorne*)

New agent 2019

Life Cycle

- Oviposits in rosette leaf
- Larvae tunnel into upper root
- Pupates inside plant
- Adults emerge as plant bolts
- Adults in diapause until following spring



Evaluation of the rosette weevil, *Ceratapion basicorne*, a new biological control agent of yellow starthistle



Tested on 51 nontarget plant species



YST



American sawwort



Rothrock's basketflower



safflower

A new BC agent is available:

- **YST rosette weevil** (*Ceratapion basicorne*)
 - Approved in 2019
 - 1 generation per year; 9 months in diapause
- **Currently rearing on potted plants**
 - slow and labor intensive
- **How to increase production for release?**
 - break diapause using cold or hormones
 - artificial diet



Releases of Rosette Weevil



April 2020, Solano Co., CDFA

April 2021, El Dorado Co., BLM

Started colonies in:

Colorado: Palisades Insectary

Idaho: Nez Perce Biological Control Center

California: (CDFA needs staff)



More Information

- Best Management Practices for Non-Chemical Weed Control. Cal-IPC
<https://www.cal-ipc.org/resources/library/publications/non-chem/>
- Biology and Biological Control of Yellow Starthistle. FHTET-2016-08.
https://www.fs.fed.us/foresthealth/technology/pdfs/FHTET-2016-08_Biocontrol_Yellow_Starthistle.pdf
- Yellow Starthistle Management Guide. Cal-IPC Publication 2006-03.
<http://www.cal-ipc.org/ip/management/yst.php>

Field Characters to ID insects on YST

Hairy Weevil



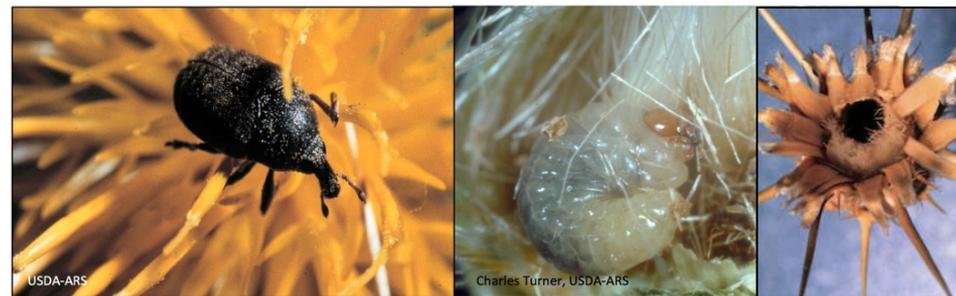
False Peacock Fly



Gall Fly



Flower Weevil



Russian thistle (*Salsola tragus*)



***Coleophora* release site, Coalinga, CA (July 1973)**

Status of Biological Control Agents of Russian Thistle

Stem Miner

Coleophora parthenica



Casebearer

Coleophora klimeschiella



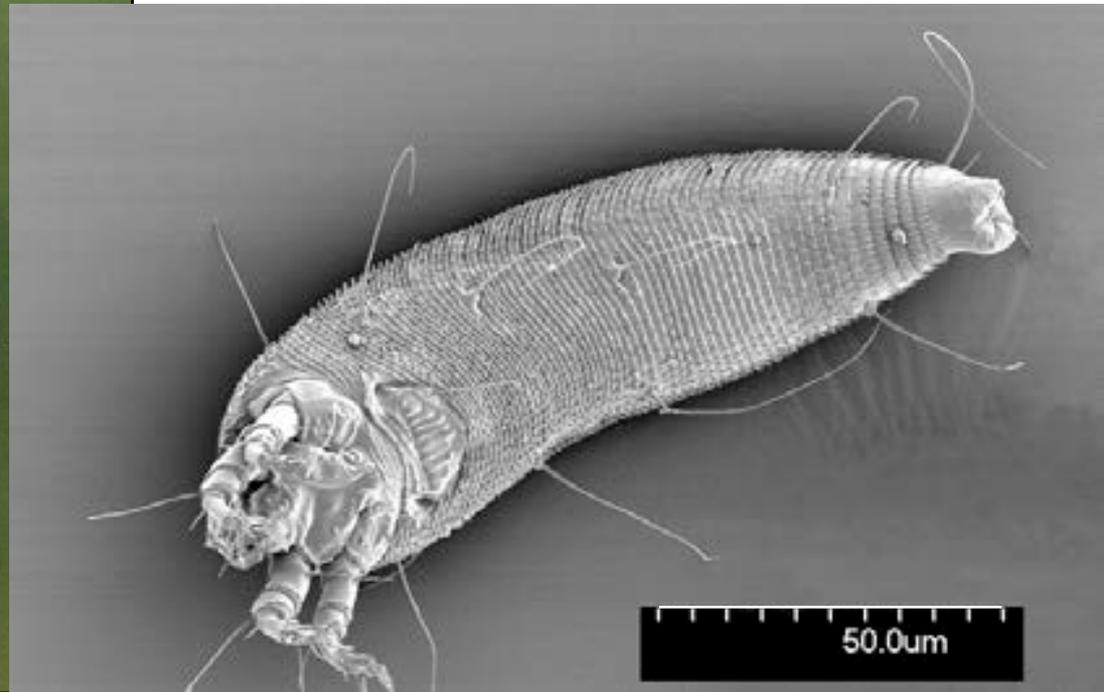
Russian Thistle Blister Mite

Aceria salsolae (Acari: Eriophyidae)

on human eyelash



scanning electron
micrograph



Impact of Mite on *Salsola tragus*

(Oct. 2007, Italy)

Inoculated

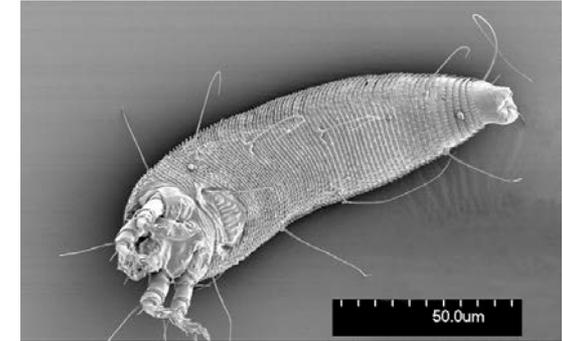


S. tragus
(292 mites / 10 cm)

Check



S. tragus
(5 mites / 10 cm)



**Petition submitted
Dec. 2004**

**TAG “approved”
8/5/08**

**APHIS denied
permit in 2009**

**Appealing for
release permit**



R. Sobhian, EBCL

Seed-eating moth *Gymnancyla canella* on Russian thistle



Testing in quarantine lab

French broom

(*Genista monspessulana*)



psyllid
Arytinnis
hakani

Evaluated for release in Australia.
Kills Fr. broom in Australia.
Can develop on some lupines.
Ongoing host specificity testing.



© Br. Alfred Brousseau, Saint Mary's College

seed-feeding weevil
(*Lepidapion nr argentatum*)



Larvae feed inside
seed pods or stem
galls.
Adults eat leaves.
Only found attacking
French broom

image from:
<http://www.gonhs.org/Lepidapionargentatum.htm>

French broom killed by psyllid (*Arytinnis hakani*) in Australia



4 Sept. 2009, A. Sheppard, CSIRO

More Information

- Best Management Practices for Non-Chemical Weed Control. Cal-IPC
<https://www.cal-ipc.org/resources/library/publications/non-chem/>
- Biology and Biological Control of Yellow Starthistle. FHTET-2016-08.
https://www.fs.fed.us/foresthealth/technology/pdfs/FHTET-2016-08_Biocontrol_Yellow_Starthistle.pdf
- Yellow Starthistle Management Guide. Cal-IPC Publication 2006-03.
<http://www.cal-ipc.org/ip/management/yst.php>