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# **Cooperative Agricultural Pest Survey (CAPS)**

## **Annual Report Colorado FY2012**

**Compiled by:  
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Colorado Department of Agriculture  
Plant Industry Division**

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# **Colorado Cooperative Agricultural Pest Survey 2012**

This is a report of the activities and surveys accomplished in Colorado for the CAPS program in 2012 (funding year March 1, 2012 to February 28, 2013). The cooperators for this year's work include Colorado State University (CSU), Colorado State Forest Service (CSFS), and the United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine (USDA, APHIS, PPQ).

CSU cooperators carried out the following surveys: Small Grains Commodity-Based Survey, Karnal Bunt Survey and Grape Commodity-Based Survey. CSFS conducted surveys for Gypsy Moth and Emerald Ash Borer. CDA and CSU also performed work for biological control of noxious weeds. USDA, APHIS, PPQ set traps for the Emerald Ash Borer survey. CDA conducted the Pine Commodity-Based Survey, Potato Cyst Nematode Survey, Exotic Detection of Plant Pests in Rail and Container Yards and a Farm Bill funded survey of Honey Bee Health.

## **Infrastructure/CORE Activities**

The Infrastructure funding provided through the CAPS program is essential to conducting the pest detection surveys in Colorado, as well as increasing public awareness and communication of the threats posed by non-native, invasive species. The nine survey projects and two biological control projects carried out in the past year in Colorado could not have been conducted without this support. In addition to coordinating the cooperative efforts of the institutions involved in CAPS, the following activities were completed:

- John Kaltenbach, State Survey Coordinator, chaired the Colorado Firewood Task Force.

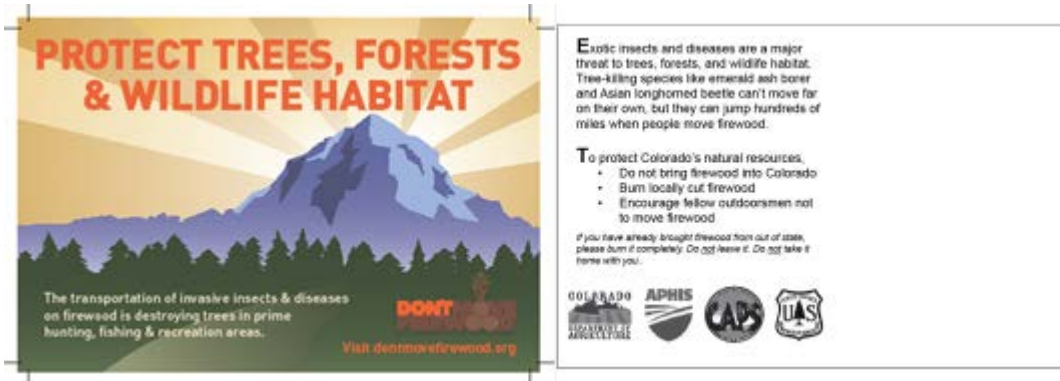
- Held two meetings of the Colorado Firewood Task Force; participants include representatives from the following institutions, Colorado Department of Agriculture, Colorado State University, Colorado State Forest Service, Colorado State Parks, Rocky Mountain National Park, US Forest Service, Bureau of Land Management, Jefferson County, Adams County, City of Fort Collins. The Task Force has and continues to work on getting the “Don’t Move Firewood” message out to Colorado businesses, institutions and the general public.
- Presentations were given to the Intermountain West Pest Management Meeting and the at the Pest Management Workshop held by the Western Colorado Research Center.

### **Outreach materials developed and activities**

Set up and maintained a booth with a Don’t Move Firewood theme and materials at the Sportsmen’s Expo in Denver, January 5-8, 2012. We borrowed the Don’tMoveFirewood.Org EAB Costume that was worn and was effective in bringing traffic to the booth. Attendance at the Expo is estimated to be above 20,000.



In coordination with Elizabeth Brown (Colorado Parks and Wildlife) Postcards were printed and mailed to 3,066 out-of-state licensed hunters and anglers. In addition postcards were mailed to all Colorado in-state recreational vehicle licensees.



“Don’t Move Firewood” postcards and bookmarks were distributed to numerous cooperators. Approximately 10,000 of each have been given out for further distribution at venues throughout Colorado.



Put up a booth with Don't Move Firewood theme at the Colorado State Fair, August 25 to September 5, 2012.

The Colorado State CAPS committee held a meeting in January, 2012, to go over the results of the surveys for 2011, and a conference call was held in June to provide updates and planning opportunities, as well as to develop survey plans for the following year.

Printed and distributed over 2,000 "Buy It Where You Burn It" 8.5 in. X 11 in. posters, of which 500 were given to the USFS to be put in Colorado campgrounds.



**BUY IT WHERE YOU BURN IT!**

**DON'T TRANSPORT FIREWOOD**

100 million elm killed by Dutch elm disease

Millions of hardwoods killed by gypsy moth

Over 50 million ash killed by emerald ash borer

Millions of pines threatened by European wood wasp

**Transporting firewood can spread insects and diseases that KILL TREES.**

**It is unlawful to transport pests\***

**Please...buy firewood where you camp.**

If you have firewood from out of state, please **BURN IT IMMEDIATELY.**  
Our forests thank you!

For more information contact:  
Colorado Department of Agriculture at 303-220-4160,  
Colorado State Forest Service at 970-481-6283, or  
USDA APHIS PPE at 303-271-3255.  
\*Colorado Revised Statute 28-6-108.

Logos: COLORADO DEPARTMENT OF AGRICULTURE, Colorado State Forest Service, US Forest Service, APHIS, and others.

# PEST DETECTION SURVEY

## Small Grains Commodity Survey

Project Coordinators: Dr. Louis Bjostad and Janet Harden (CSU)

### Objective

The purpose of this project was to conduct an early detection commodity-based survey in grain fields in Colorado. Pheromone traps were set at wheat and barley fields in 2011 to survey for the following moth species:

### Target Pests

1. Old World Bollworm (*Helicoverpa armigera*)
2. Cotton cutworm (*Spodoptera litura*)
3. Egyptian Cottonworm (*Spodoptera littoralis*)
4. Silver Y Moth (*Autographa gamma*)
5. European grapevine moth (*Lobesia botrana*)

In observance of newly updated survey guidelines, plastic bucket traps were used for all moth species except *Lobesia botrana*; delta traps were used for *Lobesia*. Traps were attached to fences (if available) or to metal stakes, placed either in the borrow pit area between road and crop or adjacent to power poles where soil was usually more penetrable with the stakes. This placement was used to prevent traps interfering with harvest or weed mowing equipment. Visual and sweep surveys were also conducted for New Zealand Wheat Bug (*Nysius huttoni*) in grain fields adjacent to the moth traps. Surveys were conducted in Kiowa, Cheyenne, Kit Carson, Yuma and Washington counties, the five counties



producing the highest volume of wheat in Colorado. However, due to unanticipated delays in funding, traps were not placed until July 1, which did not leave time for an interim trap servicing trip prior to harvest. Additional trap sets were made at wheat and barley fields in Larimer County (where harvest occurs later in the season) for a total of 25 sites. Grains were harvested and traps taken down in late July to early August. No New Zealand Wheat Bugs were found. No individuals of *Lobesia botrana* or *Spodoptera spp.* were found.



Plastic bucket traps deployed near Burlington, Kit Carson County. Photo by Janet Hardin

Because traps for *Autographa gamma* and *Helicoverpa armigera* typically attract native species that are very nearly identical in outward appearance to the target species, genitalic dissections were done of all captured individuals in the genera *Autographa* and *Helicoverpa* to be certain that neither of the exotic target species were collected. A total of 2,403 moths were dissected, none of which belonged to the target species. While dissections revealed only a few occurrences of *Helicoverpa zea*, the *Autographa* traps attracted an extraordinary number of moths, despite being deployed for only one month. One trap contained over 500 moths. In such a situation a great many scales are lost from the wings, making visual identification of other incidentally caught noctuid genera problematic. The overwhelming majority of dissected moths were *Autographa californica* (the native Alfalfa Looper), with an occasional *Rachiplusia ou* (known to also respond to the lure for *A. gamma*) and rare occurrences of *Anagrapha falcifera* or *Trichoplusia ni*.





Wheat harvest in progress, Kiowa County.  
Photo by Janet Hardin

Survey location data and results were submitted to the State Survey Coordinator by the requested deadlines. The exception was submission of the final total of moth dissections, due to the time involved and the unanticipated volume of moths caught in the traps.

In addition to the extraordinary number of moths, the bucket traps used this year captured and killed a surprising number of incidental insect species, primarily hymenoptera. This result is most likely attributable to the fact that the traps were yellow and white, colors known to be attractive to a wide variety of insects. In fact, both yellow and white pan traps are frequently used as a sampling technique to assess the bee fauna in a given area. As trap contents were processed the non-target bees and wasps were retained for enumeration and identification, to be done subsequent to the dissections of moth genitalia. Following some basic identification and enumeration this bycatch will be given to Boris Kondratieff at the Gillette Museum of Arthropod Diversity, Colorado



Preparing moth specimens from one bucket trap (*Autographa gamma* lure) for dissection in the laboratory. Photo by Janet Hardin

State University, for accession of appropriate specimens into the collection.

A preliminary examination was made of the non-target contents of traps from one location in Cheyenne County and insects were identified to the following morphospecies:

| <u>Order</u> | <u>Family</u> | <u>Genus/Descrip.</u>     | <u># Individuals</u> |
|--------------|---------------|---------------------------|----------------------|
| <Arachnida>  | Salticidae    | irid blue                 | 1                    |
| Coleoptera   | Cerambycidae  | spotted                   | 1                    |
| Coleoptera   | Cerambycidae  | small, broken             | 1                    |
| Coleoptera   | Coccinellidae | unspotted red-orange      | 1                    |
| Coleoptera   | Dermestidae   | brown                     | 4                    |
| Coleoptera   | Meloidae      |                           | 1                    |
| Coleoptera   | Meloidae      | <i>Epicauta</i> (gray)    | 1                    |
| Coleoptera   | Scarabaeidae  | <i>Phyllophaga</i>        | 7                    |
| Diptera      | Muscidae?     | multiple spp.             | 10                   |
| Diptera      | unknown       | irid blue                 | 1                    |
| Diptera      | Sarcophagidae | <i>Sarcophagus?</i>       | 2                    |
| Hymenoptera  | Anthophoridae | anthophorid A             | 103                  |
| Hymenoptera  | Anthophoridae | anthophorid B             | 70                   |
| Hymenoptera  | Apidae        | <i>Bombus</i> sp. #1      | 13                   |
| Hymenoptera  | Apidae        | <i>Bombus</i> sp. #2      | 9                    |
| Hymenoptera  | Apidae        | <i>Bombus</i> sp. #3      | 2                    |
| Hymenoptera  | Apidae        | long-horned bee           | 4                    |
| Hymenoptera  | Apidae        | resembling vespid wasp    | 10                   |
| Hymenoptera  | Halictidae    | tiny gray bee sp.         | 56                   |
| Hymenoptera  | Halictidae    | irid green-blue           | 4                    |
| Hymenoptera  | Halictidae    | striped abdomen           | 26                   |
| <u>Order</u> | <u>Family</u> | <u>Genus/Descrip.</u>     | <u># Individuals</u> |
| Hymenoptera  | Formicidae    | red ant                   | 1                    |
| Hymenoptera  | Ichneumonidae | black                     | 1                    |
| Hymenoptera  | misc unknown  | multiple spp.             | ++                   |
| Hymenoptera  | Pompilidae    | tarantula hawk            | 1                    |
| Hymenoptera  | Sphecidae?    | black                     | 14                   |
| Hymenoptera  | Tiphiidae     |                           | 3                    |
| Hymenoptera  | unknown wasp  | blk-tipped orange wings   | 4                    |
| Hymenoptera  | Vespidae      | <i>Pollistes fuscatus</i> | 1                    |
| Hymenoptera  | Vespidae      | <i>Pollistes</i> sp.?     | 2                    |
| Lepidoptera  | Noctuidae     | various                   | 3                    |
| Lepidoptera  | unknown       |                           | 1                    |

Although they were frequently found elsewhere, no grasshoppers were encountered in traps at this location. Also, in support of a grant proposal being written by colleagues at Colorado State University, bee specimens from the same trap site were taken to Virginia Scott, a regional expert on bees, at the University of Colorado at Boulder for preliminary identification. She made a very quick determination and described the following:



Contents of a bucket trap during trap take-down, Cheyenne County. No moths were found in this particular trap. Photo by Janet Hardin

| <u>Genus</u>                    | <u>Species</u>       |
|---------------------------------|----------------------|
| <i>Agapostemon</i>              | <i>angelicus</i> ?   |
| <i>Agapostemon</i>              | <i>texanus</i> ?     |
| <i>Anthophora</i>               | <i>montana</i>       |
| <i>Anthophora</i>               | sp. 2                |
| <i>Augochlorella</i>            | sp.                  |
| <i>Bombus auricomis</i> ?       |                      |
| <i>Bombus nevadensis</i>        |                      |
| <i>Bombus pensylvanicus</i>     |                      |
| <i>Halictus</i>                 | sp.                  |
| <i>Lasioglossum (Dialictus)</i> | 10 – 15 spp.         |
| <i>Megachile</i>                | sp. 1                |
| <i>Megachile</i>                | sp. 2                |
| <i>Melissodes</i>               | sp. 1                |
| <i>Melissodes</i>               | sp. 2                |
| <i>Nomada</i>                   | sp.                  |
| <i>Perdita</i>                  | sp. [one individual] |
| <i>Sphecodes</i>                | sp.                  |
| <i>Svastra</i>                  | sp.                  |
| <i>Triepeolus</i>               | sp. 1                |
| <i>Triepeolus</i>               | sp. 2                |

Total: 13 genera,  $\geq$  16 spp. (V. Scott indicated perhaps as many as 26-30 spp.)

No honey bees (*Apis mellifera*) were captured in any of the traps, which is not too surprising given that habitats in the areas of the traps were primarily occupied by wind-pollinated crops or cattle pastures consisting of mostly native vegetation, and no managed hives were observed except at one location in Larimer County. For future surveys we would like to obtain bucket traps that are solid green in color, and hope that this will help minimize such levels of incidental capture of native pollinators and beneficial predator species.

## Pine Commodity-Based Survey

Project Coordinator: John Kaltenbach (CDA)

### Objective

The objective of this project was to conduct an early detection trapping survey of non-native bark beetles and conifer infesting moths in sprawling rural forest communities of Colorado.

### Target Pests

1. Pine shoot beetle  
(*Tomicus destruens*)
2. Siberian silk moth  
(*Dendrolimus superans*)
3. Pine-tree lappet  
(*Dendrolimus pini*)
4. Small white-marmorated  
longhorned beetle  
(*Monochamus sutor*)
5. Sakhalin pine sawyer  
(*Monochamus saltuarius*)
6. Red-haired pine bark beetle (*Hylurgus ligniperda*)
7. Lesser spruce shoot beetle (*Hylurgops palliates*)
8. Sirex Woodwasp (*Sirex noctillo*)



Lindgren funnel trap. Photo by John Kaltenbach

## **Target Areas**

Traps were placed in four mountain communities in Colorado; Conifer, Evergreen, Woodland Park, and Estes Park.

## **Summary**

Beginning in June, 4 Lindgren funnel traps baited with alpha-pinene and ethanol were placed in each town for the Pine Shoot beetle and Red-haired pine bark beetle. Two Lindgren funnel traps were placed in each town baited with lure for Sirex wood wasp. Thirty traps were placed in each town for Pine tree lappet and 30 traps for Siberian Silk moth. Traps were checked every two to four weeks through October. Collections were taken from the Lindgren traps every two weeks and the moth traps were checked once a month. Samples were screened by Colorado State University and no target species were found.

## **Early Detection at Rail and Container Yards Survey**

Project Coordinator: John Kaltenbach (CDA) and Wyatt Williams (CSU)

## **Objective**

The objective of this project was to conduct an early detection survey of container storage and transfer yards, rail depots and rail yards, which are pathways through which Exotic Plant Pests (EPPs) could be introduced and could also act as "beachheads" at which EPPs could become established.

## **Target Pests**

*Anoplophora chinensis*, Citrus longhorned beetle – not established in North America – CAPSPPL

*Pyrrhalta viburni*, Viburnum leaf beetle – in E North America and southern British Columbia and northwestern Washington state –

*Diabrotica speciosa*, Cucurbit beetle, AHPPPL #38



*Diaprepes abbreviatus*, Diaprepes root weevil – in southern California and Florida -

*Naupactus leucoloma*, Whitefringed beetle – in southeastern USA and southern California

*Pseudocneorhinus bifasciatus*, Twobanded Japanese weevil – in E USA –

*Agriotes sputator*, a European wireworm – northeastern North America –

*Agriotes ustulatus*, a European wireworm – not known from North America

*Anomala orientalis*, Oriental beetle – E North America -

*Heteronychus arator*, Black maize beetle – not known from North America  
– CAPSPPL

*Popillia* spp. other than japonica – Japanese beetles – not known from North America

*Rhizotrogus majalis*, European chafer – E North America, southern British Columbia

*Nysius huttoni*, New Zealand wheat bug – not known from North America  
– AHPPPL

*Linepithema humile*, Argentine ant – E and SW USA

Copitarsia moths – CAPSPPL

*Scirtothrips dorsalis*, Chili thrips – not known from North America –  
CAPSPPL

*Achatina fulica* – not known to be established in North America (N.A.) –  
AHPPPL #13

*Cernuella cisalpinia* – AHPPPL (#45 as Cernuella spp.)

*Cernuella virgata* – AHPPPL (#45 as Cernuella spp.)

*Cochlicella* spp. – AHPPPL (#46 as Cochlicella spp.)

*Sarasinula plebeia* – Previously on AHPPPL

Any other exotic invasive terrestrial plant pests not known to occur in Colorado.



## **Target Areas**

Rail and Container yards and surrounding areas with vegetation in the Denver Metro area.

## **Summary**

### **Lindgren funnel trap baited with ethanol lure**

At each site one Lindgren funnel trap was hung approximately 2 m above the ground. Ethanol lures were attached to the trap and replaced mid-way through the season. The collection jar was filled with biodegradable propylene glycol. Samples were collected and the propylene glycol replenished once per week.

### **Sweep net and visual surveys**

At each site, approximately 100 sweeps of the standing vegetation were made. Contents of the sweep net were emptied into a kill jar with ethyl acetate. After 5-10 minutes, the contents of the kill jar were emptied onto a white tray where the insects were picked out and deposited into a sample jar (see below). Visual surveys of surrounding structures (e.g. semi-truck trailers, dead trees) were conducted every week at each site. Interesting specimens that were caught were placed in the sweep net sample jar.

### **Pitfall traps**

At two sites (BNSFRR and Heron Pond), one pitfall trap was placed in the ground. A one-quart plastic container was buried completely, a small collecting jar filled with propylene glycol was placed in the bottom of the container, and a medium-sized funnel was placed over the entire apparatus. The lip of the funnel

was level with the surrounding soil. Samples were collected and the propylene glycol replenished once per week.

### **Malaise trap**

At two sites (BNSFRR and Heron Pond), a small, portable malaise trap was set. The collection jar was filled with biodegradable propylene glycol. Samples were collected and the propylene glycol replenished once per week.

### **Results**

All samples were screened by Colorado State University and no target pests were found. Ten potential locations were identified that either receive or store shipping containers. Of those locations, only three were suitable for survey work due to either access, safety or any vegetation or environment suitable to insects for mollusks. Location for 2012 should include more parks and natural areas in the areas adjacent to the rail and container storage areas.

## Karnal Bunt Survey

Project Coordinators: Dr. Louis Bjostad and Janet Hardin (CSU)

### Objective

Colorado State University collected grain samples at elevators across eastern Colorado for karnal bunt testing. Karnal bunt surveys were done by visiting granary locations and collecting wheat grain samples to be sent on to Olney, Texas for optical scanning.

### Summary

Ten grain elevators located in the eastern plains of Colorado were targeted for this survey and grain samples were taken from 6 total counties. Thirty eight total samples were taken from Washington, Kit Carson, Lincoln, Yuma, Morgan and Weld counties. No target organisms were detected.



Trucks in line to transfer newly harvested wheat to the Roggen elevator, Weld County. Photo by Janet Hardin

# Potato Cyst Nematode Survey

Project Coordinator: John Kaltenbach (CDA)

## Objective

The objective of this survey was to detect any presence of the Potato Cyst Nematode in the soil of potato fields in Colorado.

## Target Pests

1. Potato Cyst Nematode (*Globodera pallida*)
2. Golden Nematode (*Globodera rostochiensis*)

## Target Areas

For the PCN National Survey, all of the sampling was done in the San Luis Valley potato seed production occurs.

## Summary

Sampling for the Potato Cyst Nematode (PCN) was conducted in September, 2011 and a total of 1,286 samples were taken. All of the sampling has been completed and lab has been completed at the USDA Idaho PCN lab.



PCN soil samples in paper bags, labeled and boxed for shipment to PCN Lab in Idaho. Photo by John Kaltenbach

All of the samples were negative for the presence of *Globodera pallida* and *G. rostochiensis*.

The sampling was performed by contracting with Biel Crop Consulting Inc. and Smith Environmental and Engineering.

## Emerald Ash Borer Survey

Project Coordinators: Sky Stephens (CSFS), Lisa Peraino (PPQ), and John Kaltenbach (CDA)

### Objective

The objective of this project was to conduct an early detection trapping survey of emerald ash borer in high risk areas of Colorado.

### Target Pests

Emerald ash borer (*Agrilus planipennis*)

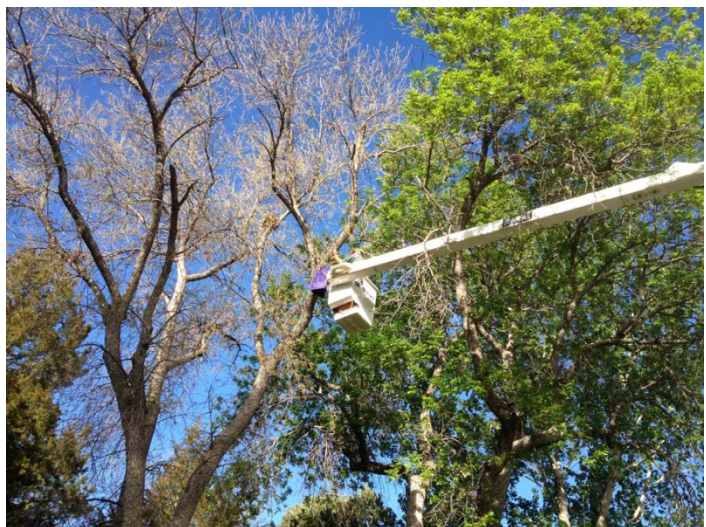
### Target Areas

High risk areas are defined by having significant concentrations of host trees, nursery stock and firewood, typically urban and recreation areas.

### Summary

A total of 139 emerald ash borer prism traps were deployed, monitored and collected by Colorado's APHIS PPQ office, Colorado Department of Agriculture and the Colorado State Forest Service. Traps were deployed throughout the state with focus on Front Range. The CDA deployed 20 traps in Colorado Springs and Pueblo and USDA, APHIS, PPQ deployed 84 traps in the Denver metro area. Colorado State Forest Service surveyed 52 sites and deployed 40 traps.

Visual surveys were also conducted for the predatory wasp



Hanging an EAB trap high in an ash tree. Photo by John Kaltenbach

*Cerceris fumipennis*. This wasp has been found to predate EAB as well as other buprestids. Using the methods outlined at <http://www.cerceris.info/>, five sites were visited and surveyed for suitable *Cerceris* habitat and presence. There are historical records of *Cerceris fumipennis* in Colorado, however no wasps were found. Of the 5 sites, all one had suitable habitat that warrant further visual surveys in 2012.

No emerald ash borer specimens were identified during 2011.

## **Gypsy Moth Detection Survey**

Project Coordinator; Sky Stephens (CSFS)

### **Objective**

The objective of this project was to conduct an early detection trapping survey of gypsy moth in every county of Colorado.

### **Target Pests**

1. European gypsy moth (*Lymantria dispar*)
2. Asian gypsy moth (*Lymantria dispar* spp.)

### **Target Areas**

High risk areas are defined by having significant concentrations of host trees in close association with human activities, typically urban areas, other settlements and recreation areas. Uninhabited native forest, agricultural and range lands and all lands above 10,000 feet above sea level are excluded.

### **Summary**

A total of 950 gypsy moth delta traps were deployed, monitored and collected in 2011. Traps were deployed throughout the state in June and July with a higher density of traps set in and around Boulder, Denver, Jefferson,



Larimer and El Paso counties. Additional delimitation traps were set around the 2010 positive catch locations in Longmont. The traps were taken down in October and screened for gypsy moths.

No male gypsy moths were detected in 2011.

## **FARM BILL FUNDED SURVEY**

### **Lobesia/Grape Commodity-Based Survey**

Project Coordinators: Dr. Louis Bjostad and Janet Hardin (CSU)

#### **Objective**

Colorado State University conducted an early detection pheromone trap/visual survey for the following grape associated pests:

1. European Grape Vine Moth (*Lobesia botrana*)
2. Passionvine Mealybug (*Planococcus minor*)
3. Cotton Cutworm (*Spodoptera litura*)
4. Summer Fruit Tortrix moth (*Adoxophyes orana*)
5. False Codling Moth (*Thaumatotibia leucotreta*)
6. Egyptian Cottonworm (*Spodoptera littoralis*)
7. Cotton Seed Bug (*Oxycarenus hyalinipennis*)

#### **Summary**

Traps were set for the listed moth species at vineyards in Mesa, Delta and Montrose counties by Bob Hammon and in Montezuma County by Tom Hooten. Janet Hardin set traps at one vineyard in Larimer County. Traps were set up in

May-June and taken down in September-October 2011. Visual and sweep surveys were conducted for Passionvine Mealybug and Cotton Seed Bug at each vineyard. In addition, visual surveys were conducted for the Fruit Piercing Moth (*Eudocima fullonia*) in Mesa, Delta and Montrose counties. No target species were caught in any traps or observed during visual surveys.

## **National Honey Bee Health Survey**

Project Coordinator: John Kaltenbach (CDA)

### **Objective**

This survey is part of a National Honey Bee Survey to document the presence or absence of bee diseases, parasites and/or pests of honey bees. One of the main goals is to establish the absence of the parasitic mite *Tropilaelaps* in the US as well as other exotic honey bee pests such as *Apis cerana* and Slow Paralysis Virus.

### **Summary**

Following the protocol established by the USDA ARS Bee Research Lab, composite samples of live adult honey bees, honey bees in alcohol and the wash from brood frame knocking were collected from 25 apiaries in 12 different counties in Colorado (Alamosa, Delta, Dolores, El Paso, Fremont,



Opening a hive to take samples. Photo by John Kaltenbach

Garfield, Jefferson, Kit Carson, Larimer, Montrose, Mesa and Pueblo counties). The goal of sampling at 25 apiaries may not be reached as winter has arrived, but resumed in spring on 2012. All 25 apiaries were

Live bee samples were shipped on the day they are taken via priority mail to the USDA Bee Research Lab in Beltsville, MD. Reports are that most samples arrived with 100% survivorship. The samples of bees in alcohol, and the wash taken from knocking the brood frames, have been mailed separately. The results from the Bee Research Lab will be available in 4 to 6 months.



Live bees packaged for shipment. Photo by John Kaltenbach

# BIOLOGICAL CONTROL

## **Re-introduction of *Rhinusa linariae* for Yellow Toadflax Control.**

Project Coordinator: Dr. Andrew Norton (CSU)

### Accomplishments:

1) Remodeled containment space in E102 Plant Sciences for rearing *R. linariae* through 1 critical life stage. My permit for importing the weevil requires that adults oviposit onto plants in containment, reared in containment until the eggs hatch and then may be moved outside. I did not anticipate that this would need to be done in containment, but the work is now complete and the facility has been inspected and approved.

2) Completed field collections of yellow toadflax for evaluation of susceptibility to the weevil. We have in culture 97 genotypes representing 4 Colorado populations of yellow toadflax. I received 20 Swiss susceptible genotypes in mid-November. All Colorado and Swiss material has been planted in the rearing pots and awaits arrival of the weevils.

3) Completed field surveys of existing Colorado *R. linariae* release sites. We performed extensive surveys of old *R. linariae* release sites and confirmed that there is no evidence that the weevils established.

4) Constructed 200 cages for containment rearing of *R. linariae*.

5) Arranged for field collections of *R. linariae* from France and Germany in spring, 2012. The window for collection of *R. linariae* is late April – through the end of May. In 2011 we did not have funding or commitments of funds until the end of June, too late to collect adults.

6) Made 4 field releases of *Mecinus janthinus* onto yellow toadflax populations in Boulder and Douglas counties. Each release was of 200 adults from the 'strain' that is adapted to yellow toadflax. At each release site we installed permanent transects and executed our baseline data collection protocol. This protocol determines the density of toadflax and all other plants by species in a 12 m<sup>2</sup> area and the incidence of plant species (for estimating plant diversity) within a 700 m<sup>2</sup> area, centered at the release point.

We were unable to collect and introduce *R. linariae* this year. We did not receive approval that the project would be funded until June 17, and Colorado State accounting rules prevent me from spending funds dedicated to other projects on this one. Adults of the species are found from late April through the end of May and we decided that shipping larvae or pupae within root galls was too risky: The insects would emerge in containment in August, and then would need to be overwintered in containment until next April. Given that *R. linariae* is rare in the Rhine Valley, we decided that waiting until spring was the best option.

## **Weed Survey and Biocontrol**

Project Coordinator: Dan Bean (CDA)

### **Yellow Toadflax**

Field releases and monitoring of *Mecinus janthinus* for the control of yellow toadflax, *Linaria vulgaris*, continued into the third season with overwinter establishment seen at 3 of the 5 previous release sites. After the initial caged release of 200 adults at Oak Ridge Wildlife Area near Meeker, CO in 2009 we have seen 2 years of successful overwintering. This site is located in Rio Blanco County with coordinates of N 39° 57.267 and W° -107 41.1 and an elevation of approximately 6,775 feet. At two of the four release sites for 2010 we saw successful overwintering of the weevils, at Upper Burro Mountain near Meeker,

CO located in Rio Blanco County with a release of approximately 200 adults and at Minturn, CO in Eagle County with a caged release of 200 adults and 2 “bundles” of weevil-containing stems. The Upper Burro Mountain, coordinates are N 39° 55.513 and W -107° 37.313 with an estimated elevation of 8,551 feet and the Minturn site coordinates are N 39° 06.156 and W -106 °26.178 with an estimated elevation of 8,059 feet. The two sites where we did not recover overwintering beetles were Burro Mountain (lower), N° 39 56.122 and W °-107 37.472 with an estimated elevation of 8,500 feet, and Vail, CO North Trail in Eagle County, N° 39 07.399 and W° -106 25.606 with an estimated elevation of 8,300 feet.

The two 2010 release sites where beetles were recovered were monitored in 2011 using a macro plot protocol that measures stem density within 16 m<sup>2</sup> around the release site and frequency along 6x50 m transects radiating out from the release site. Plant community composition is also measured. The protocol is available upon request and we will only report toadflax stem counts within the 16 m<sup>2</sup> area. At the upper Burro site the total stem count was 895 non-flowering stems and at the Minturn site the total stem count was 1,472 non-flowering stems. There were no flowering stems at either site.

Seven more release sites were added for the 2011 season bringing the number of Colorado sites to twelve. In Crested Butte, CO, Gunnison County, two releases were made. At the first site, coordinates N 38° 54.169 and W -106° 59.072 with an estimated elevation of 8,885 feet, 200 adults were released and a baseline of 378 non-flowering stems was calculated using Macro Plot Protocol. At the second site, 200 adults were released and the site was monitored using a USFS monitoring protocol (coordinates, elevation and map are pending).

Two releases were made near Telluride, CO, in San Miguel County. The first was at Priest Lake where 400 adults were released. Coordinates are N 37 °50.130 and W -107° 52.986 with an estimated elevation of 9,500 feet. This was an incredibly dense stand of toadflax, one of the densest surveyed this season. At this site 2,791 non-flowering stems and 614 flowering stems were counted. Hopefully this will become a collection site as the meadow would allow easy



access with a heavy infestation of host plants. The second release was made on Milk Run at Telluride Ski Resort where 200 adults were released. Coordinates are N 37° 55.952 and W -107 °49.675 with an estimated elevation of 9,800 feet. This was a fairly light infestation and due to the steep grade on the ski run, only a stem count was applied with 407 non-flowering stems and 167 flowering stems.

The largest yellow toadflax infestation was in Archuleta County at Pagosa Springs, CO. The release site was along the East Fork of the San Juan River with a release of 200 adults. A total of 2,011 non-flowering stems and 1,778 flowering stems were counted. Coordinates are N 37° 16.17 and W -106° 0.58 with an elevation of 7,079 feet. This site holds promise for subsequent releases as it is quite large and the area holds many more toadflax infestations.

In Delta County along the Gunnison River, a release was made with 200 adults. The coordinates for this release are N 38 ° 46.526 and W -107° 53.779 with an elevation of 5,000 feet which made it our lowest elevation yellow toadflax site. Toadflax patches followed the river but the site itself was densely populated with willows. Field data stem counts have not yet been calculated.

In Montrose County 400 adults were released at the 25 Mesa Forest Service Ranger Station. The coordinates for this site are N 38° 29.773 and W - 108° 21.074 and an elevation of 8,200 feet. This was a low density infestation with 83 non-flowering stems and 56 flowering stems in the 16 m2 plot. Chemical control has been used in the area with some success.

We released 300 root galling weevils *Rhinusa linariae* at two locations in 2008 and continue to monitor one location. We dug up and inspected the roots of two yellow toadflax plants and sweep-sampled all plants at the Oakridge site and failed to find either adult beetles or root galls. We will continue to survey the area for one more year but it appears that the beetles have not established.

### **Dalmatian toadflax**

The CDA continued to monitor five *M. janthiniformis* Dalmatian toadflax release sites in western Colorado. At two of the sites beetle presence and

density was monitored while at three of the sites we monitored for beetle presence as well as for impact on Dalmatian toadflax and change in vegetation composition. Beetles continued to spread out from release sites and declines in Dalmatian toadflax were noted at three of the sites.

### **Russian Knapweed**

We had overwintering of the Russian knapweed gall flies, *Jaapiella ivannikovi*, in the Insectary garden. In the spring of 2011 we counted 200 galls formed from overwintered flies. Throughout the season we had a steady stream of new gall formation which allowed us to make 5 open field releases. We had four open field releases in Mesa County and one release in Garfield country. Releases were made by cutting off galls, putting the stems into water and setting them out at release sites. In addition to galls from the Insectary garden we also received galls from Richard Hansen of USDA APHIS PPQ and these were released at the five sites. Our total release number was 319 galls. In addition we supplied 23 galls and they were released in the Canyons of the Ancients National Monument in Montezuma County, CO.

We monitored the sites for gall establishment and failed to find any newly formed galls at any of the five sites.

### **Leafy Spurge**

The CDA monitored 16 leafy spurge sites in Rio Blanco County for beetle density, stem density and vegetation responses to biocontrol.

### **Other Targets and Agents**

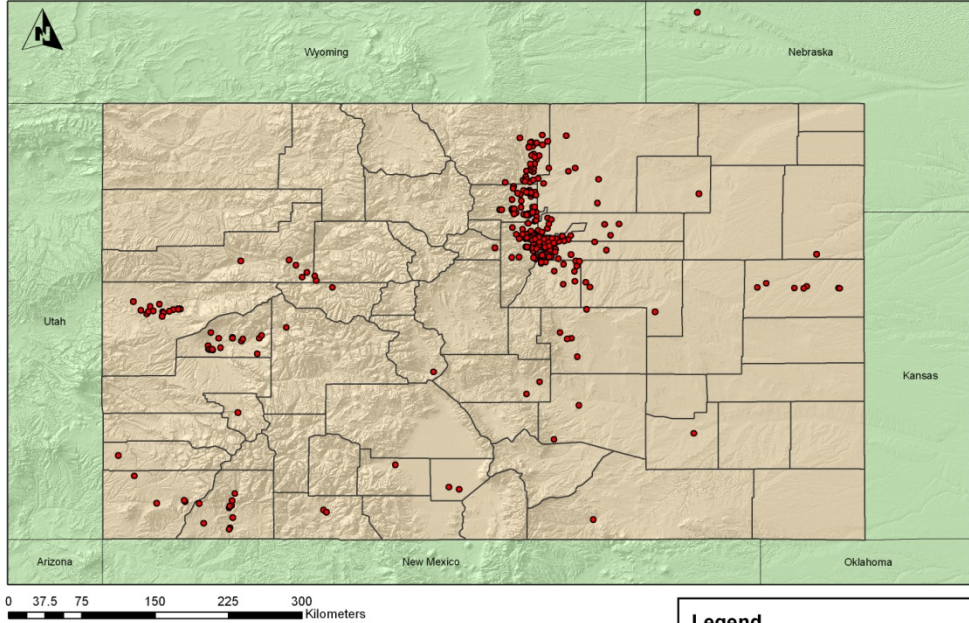
The Insectary continued to distribute the bindweed gall mite *Aceria malherbae* with approximately 305 releases made in Colorado with assistance provided for many more releases made through county weed managers. There were also 76 releases of larvae of the bindweed moth, *Tyta luctuosa*. *T. luctuosa*

adults were recovered in the Grand Valley for the 7th consecutive season indicating a well-established population.

There were 13 releases of the stem boring weevil, *Mecinus janthiniformis* (formerly *M. janthinus*), on Dalmatian toadflax and we made 22 releases of larvae of the toadflax feeding moth *Calophasia lunula* in 2011. There were 62 releases of *Aphthona* spp. made and 2 releases of *Oberea erythrocephala* made from insects collected in the field in Colorado. We made 92 Canada thistle gall flies and 28 releases of puncturevine weevils, *Microlarinus* spp. *Cyphocleonus achates* (10 releases) and *Larinus minutus* (52 releases) were released on spotted and diffuse knapweed in Colorado. We continued to produce *Hylobius transversovittatus* the root boring weevil for use against purple loosestrife. We ship these beetles to cooperators throughout the US and we remain one of the few sources for them. We made releases of the rosette weevil *Trichosirocalus horridus* on musk thistle. We also continued to rear and release *Macrocentrus ancylivorus* for use against the Oriental fruit moth, a major pest of peaches. This past season we reared over one million wasps for release in the Grand Valley. We also have a pheromone-based monitoring program for Oriental fruit moth and we continue to find moths in the valley.

| <b>Table 2: 2011 Weed biological control releases</b>   |                    |                           |                     |                    |
|---|--------------------|---------------------------|---------------------|--------------------|
| <b>Agent</b>  | <b>Target</b>      | <b>Number of Releases</b> | <b>Total Agents</b> | <b>Map on Page</b> |
| <i>A. malherbae</i>   | Field bindweed     | 305                       | 450,000             | 31                 |
| <i>Tyta luctuosa</i>  | Field bindweed     | 76                        | 38,355              | 31                 |
| <i>Aphthona</i> spp.  | Leafy spurge       | 62                        | 97,000              | 32                 |
| <i>Oberea erythrocephala</i>  | Leafy spurge       | 2                         | 120                 | 32                 |
| <i>L. minutus</i>   | Knapweeds          | 52                        | 13,000              | 33                 |
| <i>C. achates</i>   | Knapweeds          | 10                        | 1,323               | 33                 |
| <i>Jaapiella ivannikovi</i>   | Russian Knapweed   | 9                         | 319                 | 34                 |
| <i>Calophasia lunula</i>  | Toadflax           | 22                        | 19,912              | 34                 |
| <i>Mecinus janthinus</i>  | Yellow toadflax    | 7                         | 1,819               | 35                 |
| <i>Mecinus janthiniformis</i>   | Dalmatian toadflax | 13                        | 3,407               | 35                 |
| <i>Rhinusa linariae</i>   | Yellow toadflax    | 2                         | 300                 | NA                 |
| <i>Microgaster</i> spp.   | Puncturevine       | 28                        | 7,400               | 36                 |
| <i>T. horridus</i>  | Musk thistle       | 52                        | 7,200               | 36                 |
| <i>U. carduii</i>   | Canada thistle     | 92                        | 9,500               | 37                 |
| <i>Tetrastichus incertus</i>  | Weevil, Alfalfa    | 8                         | 8,000               | NA                 |
| <p>“# of Releases” is the total number of shipments for release and may represent more than one release site. The number in the column “Total Agents” is the number of adults, galls or mites depending on the agent.</p> |                    |                           |                     |                    |

Biocontrol Species: *Aceria malherbae*  
Target Species: *Convolvulus arvensis*  
State of Colorado

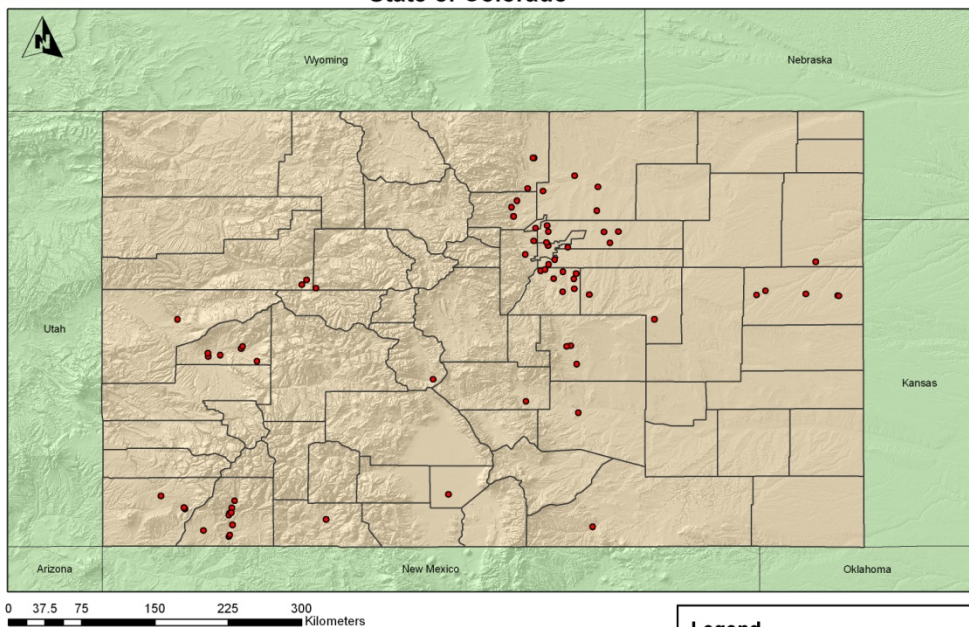


1 cm = 39 km

Legend

- 2011 Field Bindweed Mite Releases

Biocontrol Species: *Tyta luctuosa*  
Target Species: *Convolvulus arvensis*  
State of Colorado



1 cm = 39 km

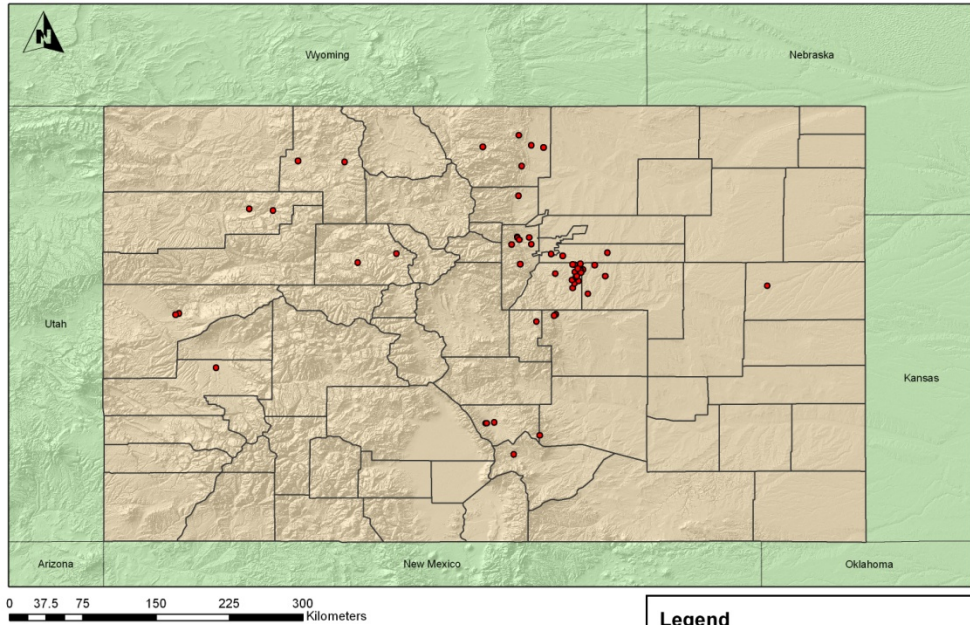
Legend

- 2011 Field Bindweed Moth Releases





Biocontrol Species: *Aphthona* spp.  
Target Species: *Euphorbia esula*  
State of Colorado



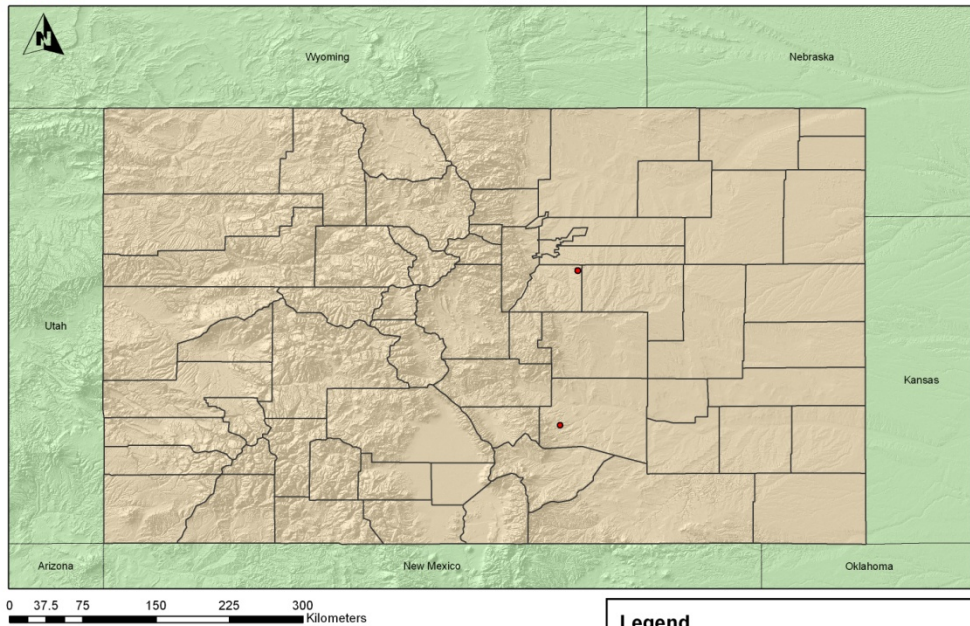
1 cm = 39 km

**Legend**

- 2011 Leafy Spurge Flea Beetle Releases



Biocontrol Species: *Oberea erythrocephala*  
Target Species: *Euphorbia esula*  
State of Colorado

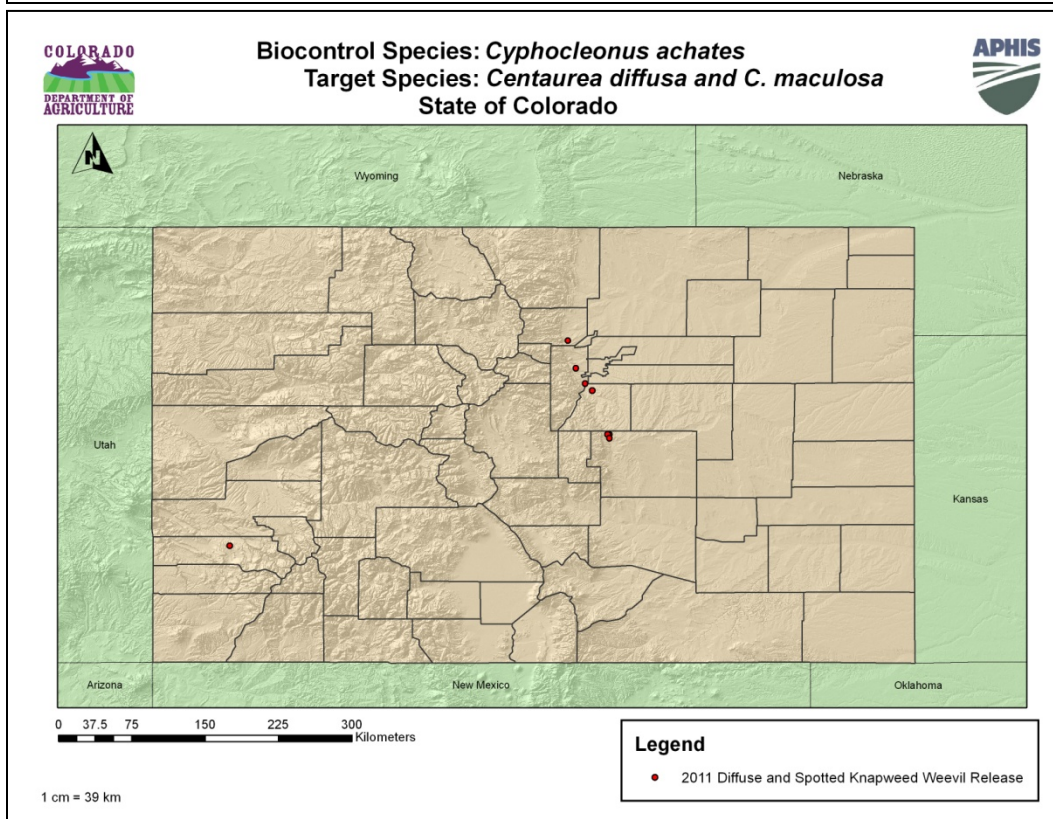
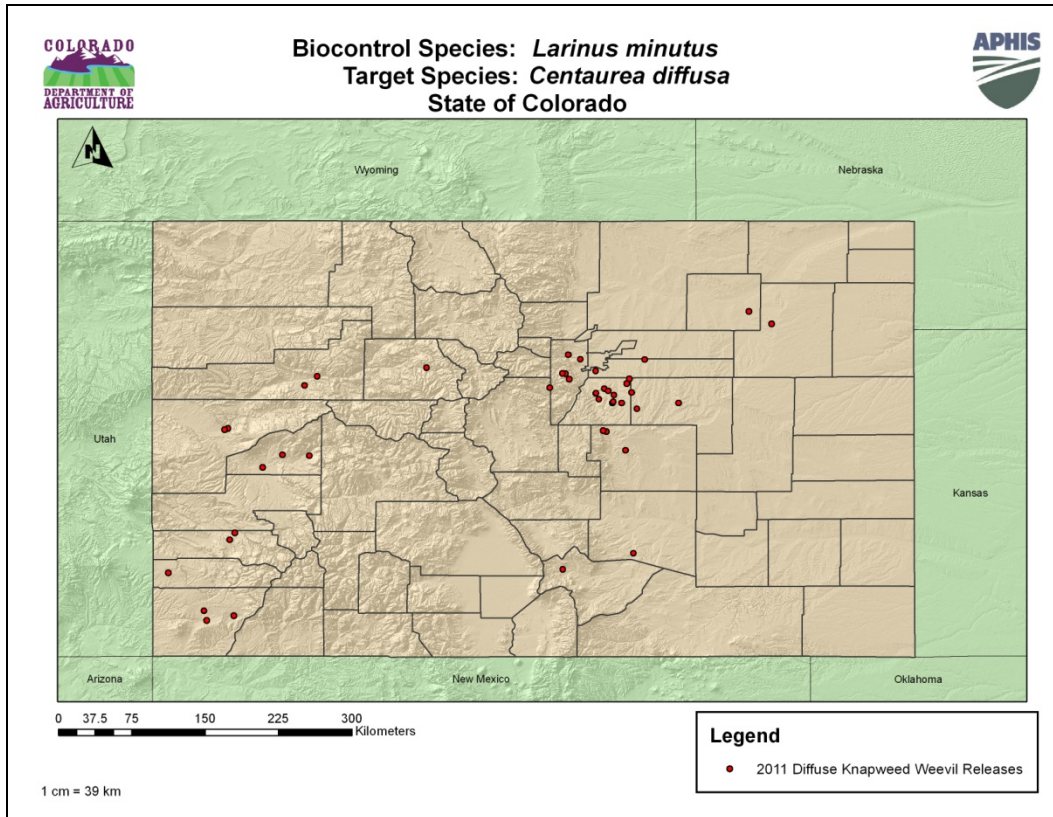


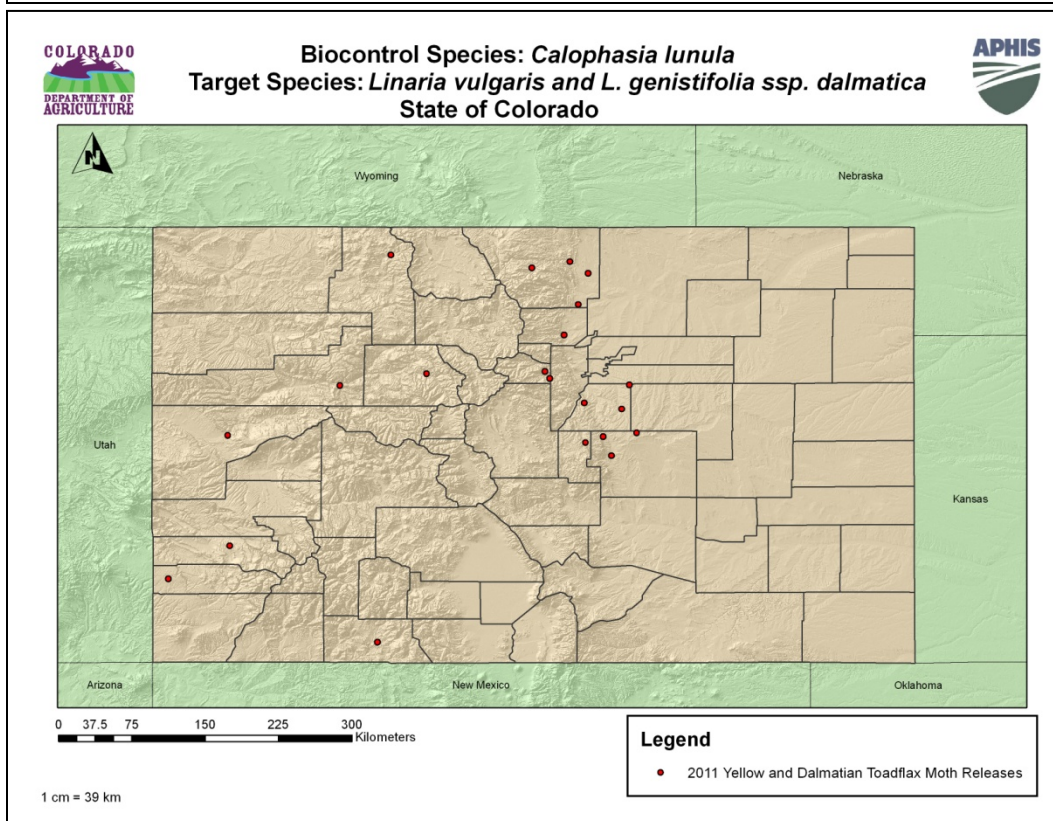
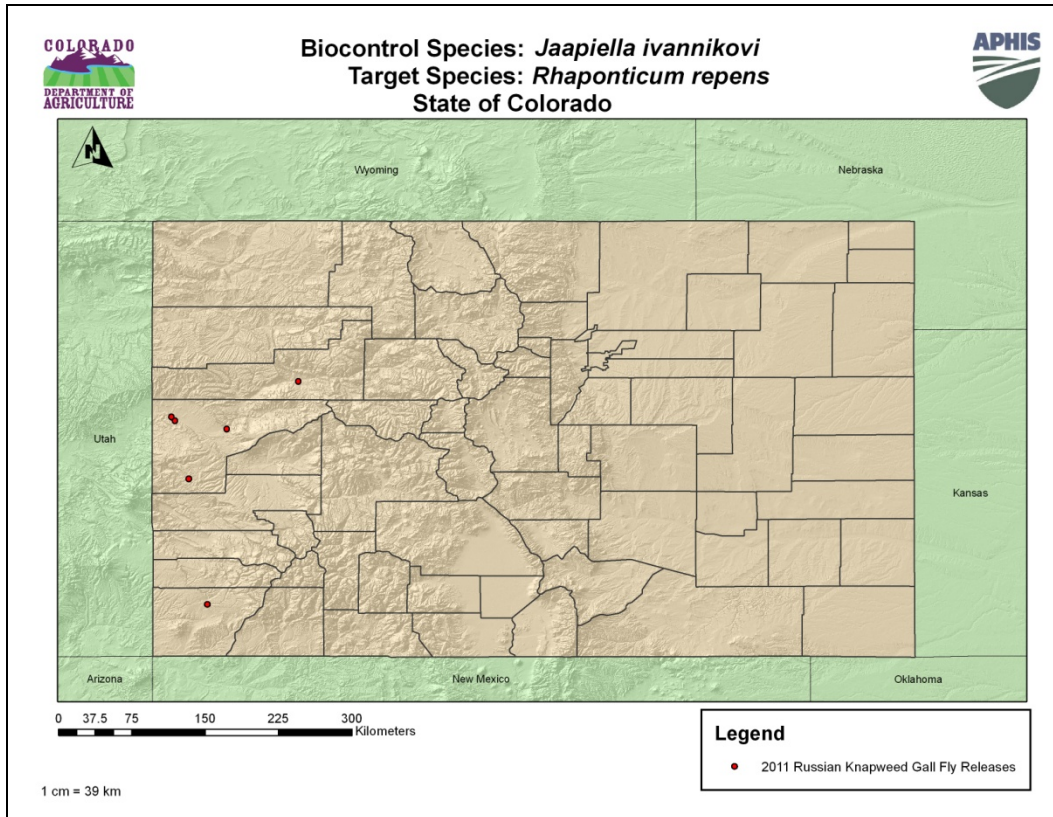
1 cm = 39 km

**Legend**

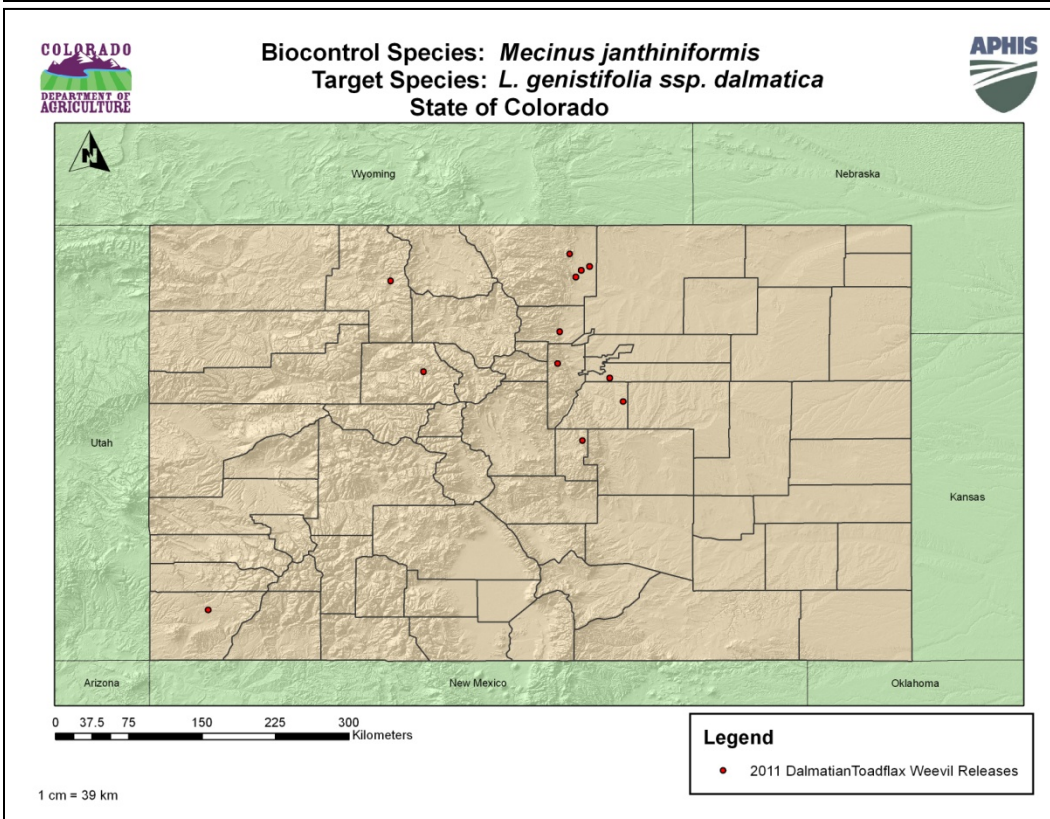
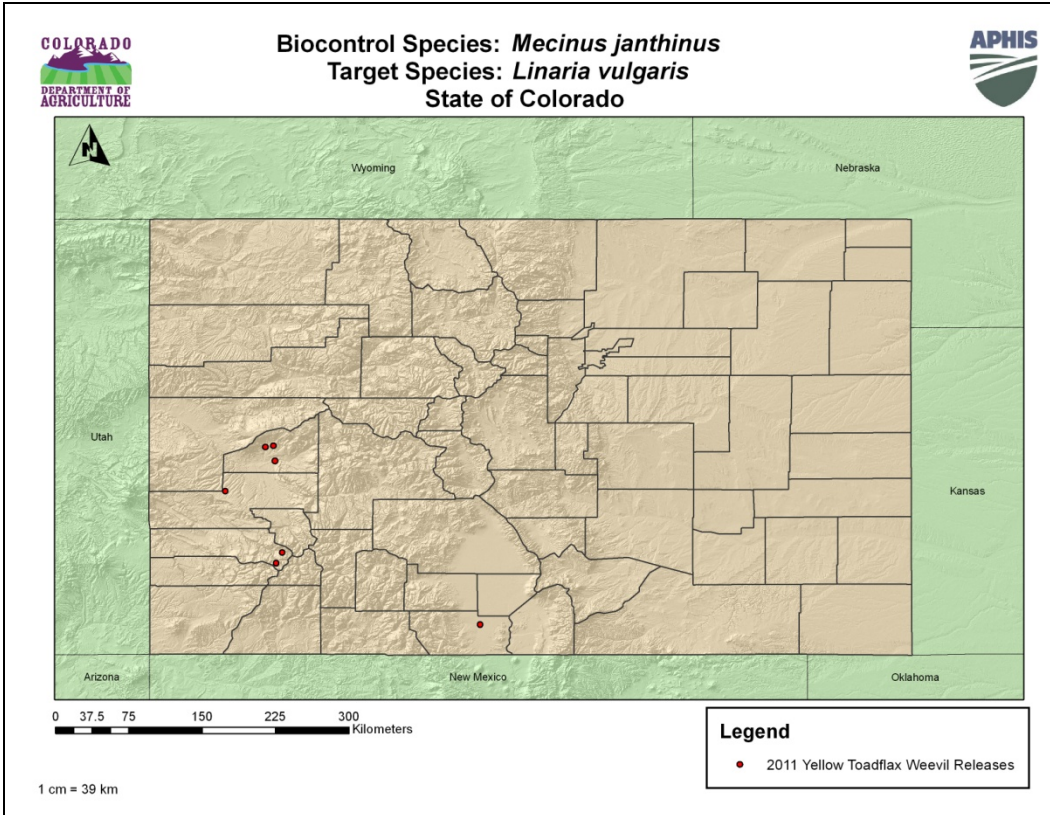
- 2011 Leafy Spurge Long Horn Beetle Releases

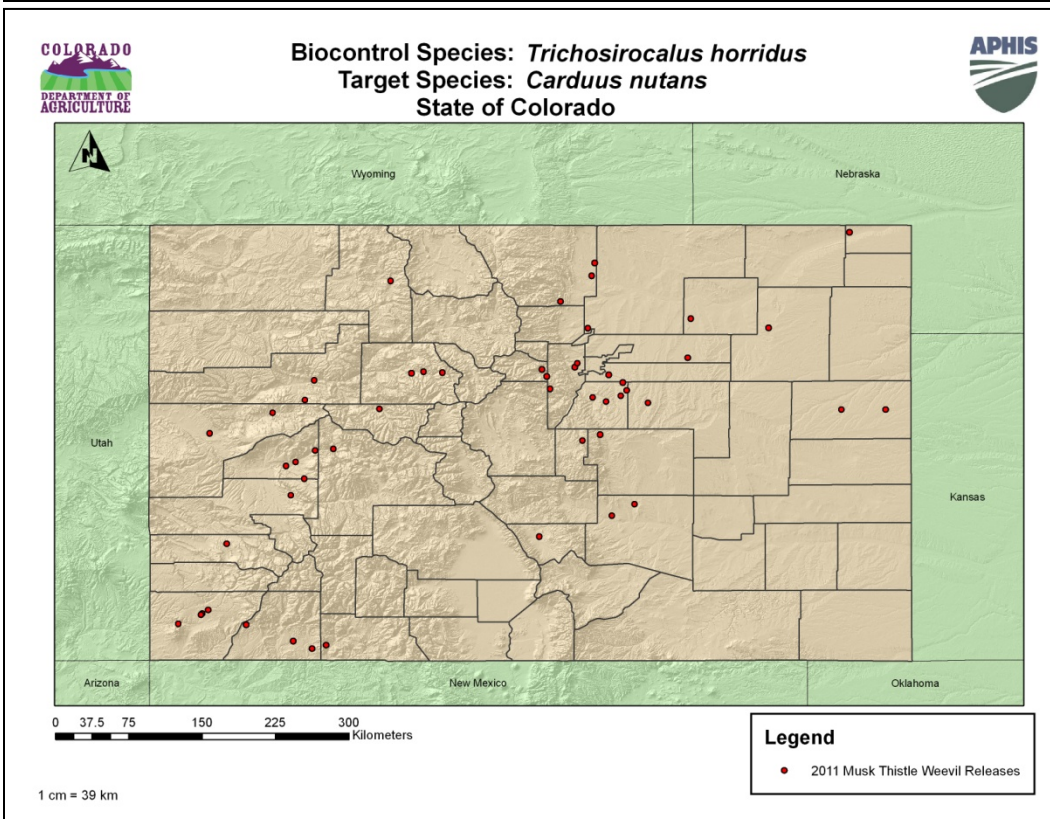
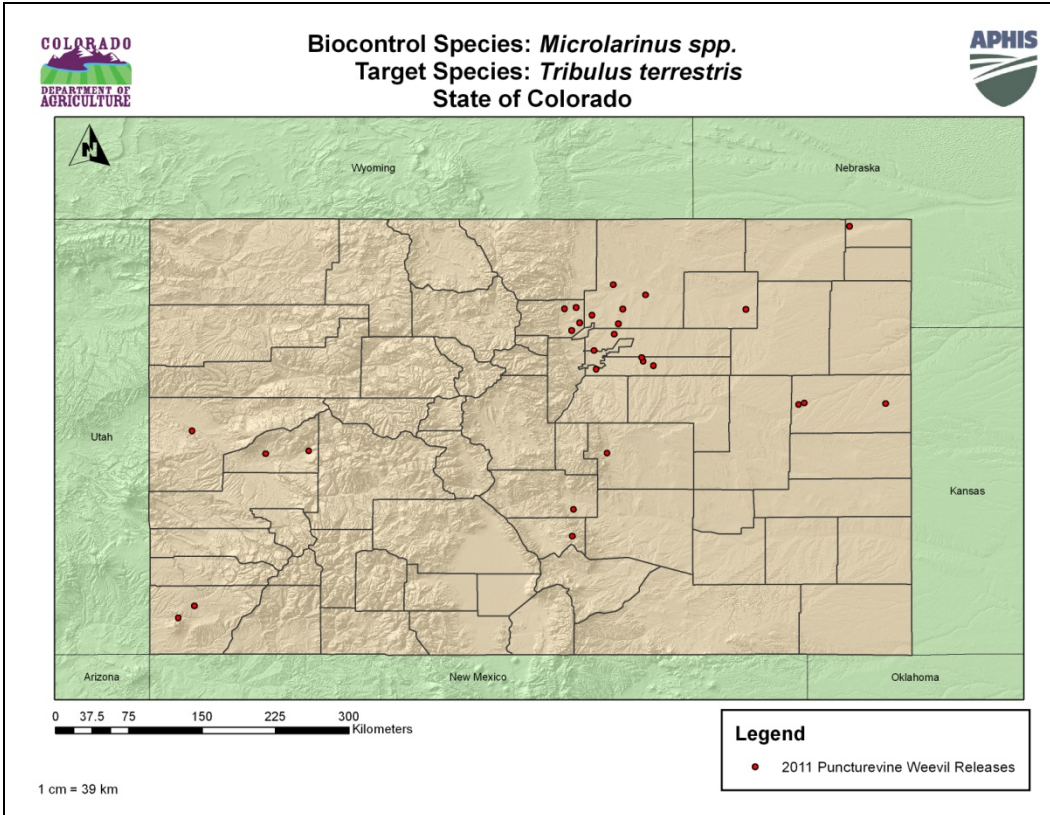








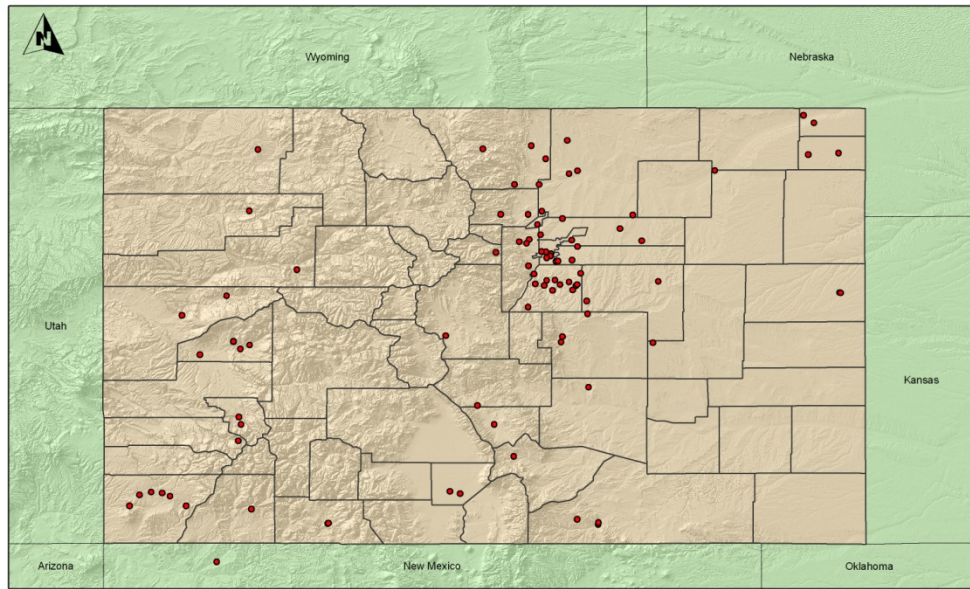








Biocontrol Species: *Urophora cardui*  
Target Species: *Cirsium arvense*  
State of Colorado



0 37.5 75 150 225 300 Kilometers

1 cm = 39 km

**Legend**

- 2011 Canada Thistle Fly Releases

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