Colorado Biocontrol

Spring 2009

The Insectary

Biocontrol is the use of natural enemies (predators, pathogens, parasites and herbivores) to control insects, weeds, or other pest organisms. The advantages of using natural controls are that they are inexpensive, safe for the environment and for human health, and they are self propagating which means that small numbers released may expand into large and persistent populations for long term pest control.

The Colorado Department of Agriculture has promoted the use of biological control in pest management since the 1940s. At that time the Palisade Insectary first released biocontrols (parasitic wasps) for use against the Oriental fruit moth, a serious pest of peaches in the fruit growing regions of the Grand Valley. The program was a success and continues to this day. Following this first success other biocontrol agents were released for a number of insect pests, and then for some of the most difficult-to-control noxious weeds. The Palisade Insectary is now home to the Biological Pest Control Program, within the Conservation Services Division of the CDA. The Insectary releases and monitors about 20 different species of biological control agents for use against both weeds and insect pests.

Biocontrol works by establishing a balance between the target pest and the control agent. The pest and the agent will always be around, but after the balance is achieved the pest population will be lower which may satisfy the needs of a pest control program. For example a noxious weed may be present after biocontrol but in lower densities and with some biocontrol agents feeding on them. This is often an acceptable goal for weed managers. On the other hand if the goal is complete eradication, as with List A weeds in Colorado, biological control is not adequate and other methods must be employed.

Biocontrol can be used in conjunction with other pest control methods as part of an integrated pest management (IPM) strategy. Sometimes biocontrol is the only method needed to bring a pest under control but in other instances biocontrol may not be sufficient and other methods must be brought into the mix. For instance a weed IPM program may include biocontrol, herbicides, mechanical removal or livestock grazing. One of the challenges in IPM is to blend the methods to optimize control while preserving populations of biocontrol agents and their food sources. Applied researchers are developing methods for using biocontrol in conjunction with herbicides and grazing to enhance the impact of biocontrol on weeds. The secret is in the timing of control methods and the results are often far better than with any single method alone.

Is it safe? That is the most frequently asked question about biocontrol. Releasing a new species of insect or mite comes with risks, but the risks are small due to the years of research and testing that are now required before a new biocontrol agent is approved for release in the US. Newly introduced weed

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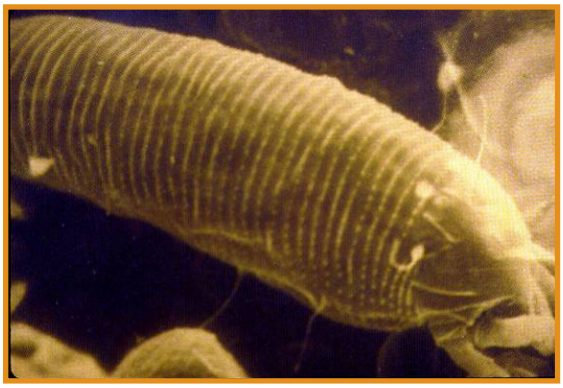
2009 Biocontrols

biocontrol agents will have been through at least 10 years of extensive testing by the USDA and overseas cooperators to make certain that they won't have an impact on non target species. Overseas cooperators, who are trained and experienced entomologists and botanists, select only host specific agents, found exclusively on the target weed in their native lands. Each prospective agent goes through a whole battery of host range tests in which they are presented with an array of non-target plants and allowed to starve unless they choose feed on a non-host. If they feed on a non-target then more extensive tests are done to see if they are capable of development on the non-target. Insects that feed and develop normally on non-targets are rejected, meaning that they are no longer considered for approval. Because of these precautions the safety record for weed biocontrol in the US has been excellent; there have been no unforeseen non-target impacts.

This newsletter is intended to get biocontrol information out to pest managers with a focus on Colorado. This first newsletter will look at the bindweed, leafy spurge and tamarisk programs while future newsletters will focus on our other programs. The newsletter will update programs as well as report progress on new programs. In the coming field season we will be evaluating a new agent for yellow toadflax and we may even have small numbers of a new agent for Russian knapweed. The fall newsletter will appear in October with updates on summer activities and articles on biocontrol of Dalmatian toadflax and on monitoring the results of biocontrol.

We hope you have a successful field season!

Field Bindweed Control



For the past ten years the CDA has been instrumental in the establishment of *Aceria malherbae*, the field bindweed gall mite, across Colorado and neighboring states. Field bindweed, *Convolvulus arvensis*, is known by many common names such as creeping jenny, wild morning-glory, and vineweed. It is a perennial, noxious weed that can cause a loss in crop yield by as much as 60% and generally, is a nuisance to home owners and gardeners alike. It is believed that field bindweed first arrived in the United States accidentally in contaminated crop seed and was identified as early as 1739 in Virginia. These past 250 years or so have put field bindweed on the map as a pest in all 48 contiguous states. In 1998, serious economic losses were reported in 22 states, primarily in the Great Plains and western United States.

Each trumpet-shaped flower commonly produces four seeds and a single plant can easily produce over 400 seeds that may remain viable in the soil up to 50 years. Rhizomatic reproduction also makes this plat a difficult one to control. The root system is comprised of a tap root as long as three meters and extensive lateral roots. The creeping and twining action of the plant creates dense mats that crowd out desired vegetation and rob them of moisture and nutrients. Due to these natural attributes, chemical and mechanical controls are not well suited to the management of this weed.

Field bindweed is also naturally resistant to drought conditions. These factors make the use of biological control very appealing for the reduction of field bindweed. Because of this the USDA developed a bindweed biological control program and found *A. malherbae* feeding on field bindweed, *Convolvulus arvensis*, in its native land of Central and Southern Europe. After safety testing was complete mite releases began in Texas in 1989. The first mites release were made in Colorado in 1997 and success was first seen in 1999. Since then bindweed has been controlled at a number of field sites, mostly in western Colorado.

Mite collection usually begins in mid May and continues through the summer. Requests for this agent are taken throughout the year and tabulated into a list. This list is then evaluated and mass distributions are scheduled with CSU Extension, county weed managers, Conservation Districts, and others to best fill the orders and decentralize the redistribution. We encourage all counties to develop their own insectary collections sites for future distributions within their county. In 2008, we had 20 county distribution sites in Colorado and will continue this process again for 2009. By 2012, the Department of Agriculture will no longer be heading this program and all requests will go to the county. They in turn will be able to charge a fee that is appropriate to their needs. If you are interested in holding a redistribution effort in your county please contact the CDA Insectary at 970-464-7916 or email Terri Locke at **terri.locke@ag.state.co.us.**

Leafy Spurge Control

Leafy spurge is an invasive, deep rooted perennial weed that may reach three feet in height with a 20 foot root system, making it difficult to control using herbicides. Plants produce large numbers of seeds which remain viable in the soil for up to eight years. Leafy spurge was introduced from Eurasia into the US over 180 years ago and now covers millions of acres in the western US, outcompeting native plants and destroying the value of rangeland since it is poisonous to cattle and of marginal value for sheep.

Twelve different insect species have been introduced as biocontrol agents for leafy spurge. The most commonly used in Colorado are five species of flea beetles in the genus *Aphthona*. These beetles all have similar life cycles with the adults appearing in the late spring and early summer to feed on foliage and lay eggs that drop to the soil surface. Larvae enter the soil, feed on root hairs and eventually enter the root systems of the leafy spurge plants.


Leafy Spurge
Long Horned Beetle

They overwinter in the root system, pupate and emerge as adults the following season. Damage to the root system is the primary cause of leafy spurge mortality and some of that damage is caused by the infection of roots with opportunistic soil borne pathogens that enter through wounds caused by larval feeding.

Aphthona beetles are effective biocontrol agents in many areas of Colorado, capable of killing spurge infestations within 2 years of release. The CDA has been releasing them for 20 years and they have been established for years in many locations throughout the state. Unfortunately in some areas they don't bring down spurge infestations to acceptably low levels. The flea beetles don't work as well in wet or sandy soils or in dense infestations of spurge where the soil surface is buried under thick layers of leaf litter. In such cases other control options are needed.

One good biocontrol option is the red-headed leafy spurge stem borer, *Oberea erythrocephala*, in the long horned beetle family (*Cerambycidae*). Unlike the *Aphthona* beetles the long horned beetles lay eggs in the stems of spurge plants and the larvae bore down into the root crown. This means that they are not susceptible to problems encountered in the soil or at the soil surface. At some sites, including one experimental site in Colorado, these beetles have been able to control leafy spurge.

The CDA is now in the fourth year of a program to monitor *Aphthona* beetle efficacy, to make new releases and better establish the long horned beetle in Colorado and to investigate the role of root pathogens in killing spurge plants. We are looking for more field sites for our work. If you are interested in helping us find field sites (sites with more than 2 acres of leafy spurge) or are generally interested in our leafy spurge monitoring project please contact Dan Bean at **dan.bean@ag.state.co.us**.


Leafy spurge infestation
- **BEFORE** biocontrol
2007


Leafy Spurge Flea Beetle


Leafy spurge infestation
- **AFTER** biocontrol
2008

Tamarisk Control

Tamarisk (saltcedar) is an exotic noxious weed that has invaded most riparian systems the western US. In Colorado we have about 70,000 acres of tamarisk along river and stream corridors as well as in isolated patches on farm ponds, springs and seeps. Tamarisk crowds out native vegetation, provides poor wildlife habitat, uses precious water, is a major riparian fire hazard and is a nuisance for recreational users of lakes and streams. Tamarisk was introduced into the US over 150 years ago and still continues to spread through some of the most valuable lands in the west. Tamarisk control is not just a matter of removing it from infested lands but also stopping it from further spread.

Tamarisk control is challenging because the trees are often located in difficult terrain or near sensitive waterways, and they are able to resprout following most forms of physical removal. Fire, in particular, only seems to annoy and invigorate the plants. Labor intensive control measures, such as cutting followed by stump treatment, are the most effective but tend to be very expensive. Biological control has now become an option in Colorado and is rapidly changing the equation for tamarisk management.

The tamarisk leaf beetle, *Diorhabda elongata*, is found throughout the range of tamarisk in Eurasia and North Africa. The beetles that we have in Colorado were originally from the northwestern part of China, near the town of Fukang, or from Kazakhstan, near the town of Chilik. For all practical purposes beetles from these two origins are identical; they cannot be distinguished by taxonomists and they behave in exactly the same manner regarding host plant preference. We call them the Central Asian strain of *D. elongata*. There are other strains currently in use in the US including the Mediterranean strain from Crete and mainland Greece, the North African strain from Tunisia and the Uzbek strain from Uzbekistan. We have these strains in culture at the Palisade Insectary but they are currently not permitted in Colorado so all work in our state is with the Central Asian strain.

Tamarisk Control

The tamarisk leaf beetle feeds on the scale-like leaves of the tamarisk plant. Beetles feed as adults but about 90% of the damage comes from feeding as larvae. Adult beetles can fly and are attracted to plants by the smell of the leaves (host pant volatiles) and by a pheromone emitted by the males after they begin feeding. This combination of odors brings in large numbers of males and females and in a few days the tamarisk plant is covered with eggs. These hatch into small black caterpillar-like larvae that feed voraciously on the foliage. When the larvae complete feeding (in about two weeks) they drop to the ground and pupate in the leaf litter or soil beneath the plant. After two weeks they emerge as adults. Adults that emerges later in the season feed then enter a dormant state known as diapause and they spend the fall and winter beneath the tamarisk plants as adults waiting for the spring flush of foliage.


Tamarisk beetles


Tamarisk leaf beetle eggs


Salt Cedar/Tamarisk (*Tamarix ramosissima*)

Beetle larvae can defoliate a plant in a matter of days. The plants turn from bright green to straw brown following defoliation and a healthy plant will then send out new foliage within weeks. After several cycles of defoliation plants begin to die back and they can be killed by several years of defoliation. Even before they are dead the tamarisk plants lose vigor and the canopy opens, allowing other plants, such as willows, cottonwoods and grasses, to return.

In western Colorado the beetles have been established along the Dolores, Colorado, Yampa and Green Rivers. In some areas beetles have defoliated large swaths of tamarisk and the Dolores River drainage was completely colonized by beetles at the end of 2008. In eastern Colorado we've seen much less success, although one the first successful beetle release sites in the US was near Pueblo in 2001.

The tamarisk biocontrol program is now in the implementation phase, meaning that beetles are available from the Palisade Insectary for release at strategic locations across Colorado. The Insectary also supports a western states implementation program under the direction of Dr. Rich Hansen, USDA APHIS (Ft. Collins) and a research and monitoring program in Colorado in collaboration with Dr. Andrew Norton, CSU. The Insectary has collected, stored and shipped over 300,000 beetles in support of these programs.

This season we are particularly interested in establishing beetles in the Arkansas drainage at multiple locations. We currently have plans for 10-15 releases in the drainage but we are interested in getting 3-5 more sites on the Arkansas and Purgatoire Rivers. To have a release you must be willing to provide information on beetle establishment and tamarisk health over at least a 3 year period.

A beetle release begins with the collection of 5,000 to 20,000 adult beetles, followed by counting and packaging them in cardboard containers and finally releasing them in an area with at least 5 acres of tamarisk. Beetles are released on a single tree (they do their best work as an aggregation) either in the early morning or just before sunset (they don't like to fly at these times). Release is accomplished by opening the container(s) and placing them in a single tamarisk tree. The beetles are allowed to walk out of the containers under their own power. This minimizes disturbance to the insects so that they remain near the release location.

The southwestern willow flycatcher, *Empidonax traillii extimus* has historically nested in willows but now nests in tamarisk over part of its range, particularly in Arizona and New Mexico. The subspecies is endangered so tamarisk beetle releases are not permitted within 200 miles of pairs nesting in tamarisk since feeding by the beetles could disrupt nesting. The best and most obvious long term solution for flycatcher population recovery is restoration of native vegetation, including willows, to provide optimal bird habitat. Restoration takes time and dollars so playing it safe means restricting the use of the beetles. In Colorado these restrictions exclude the upper Rio Grande, the upper Dolores and the San Juan watersheds from the tamarisk biocontrol program.