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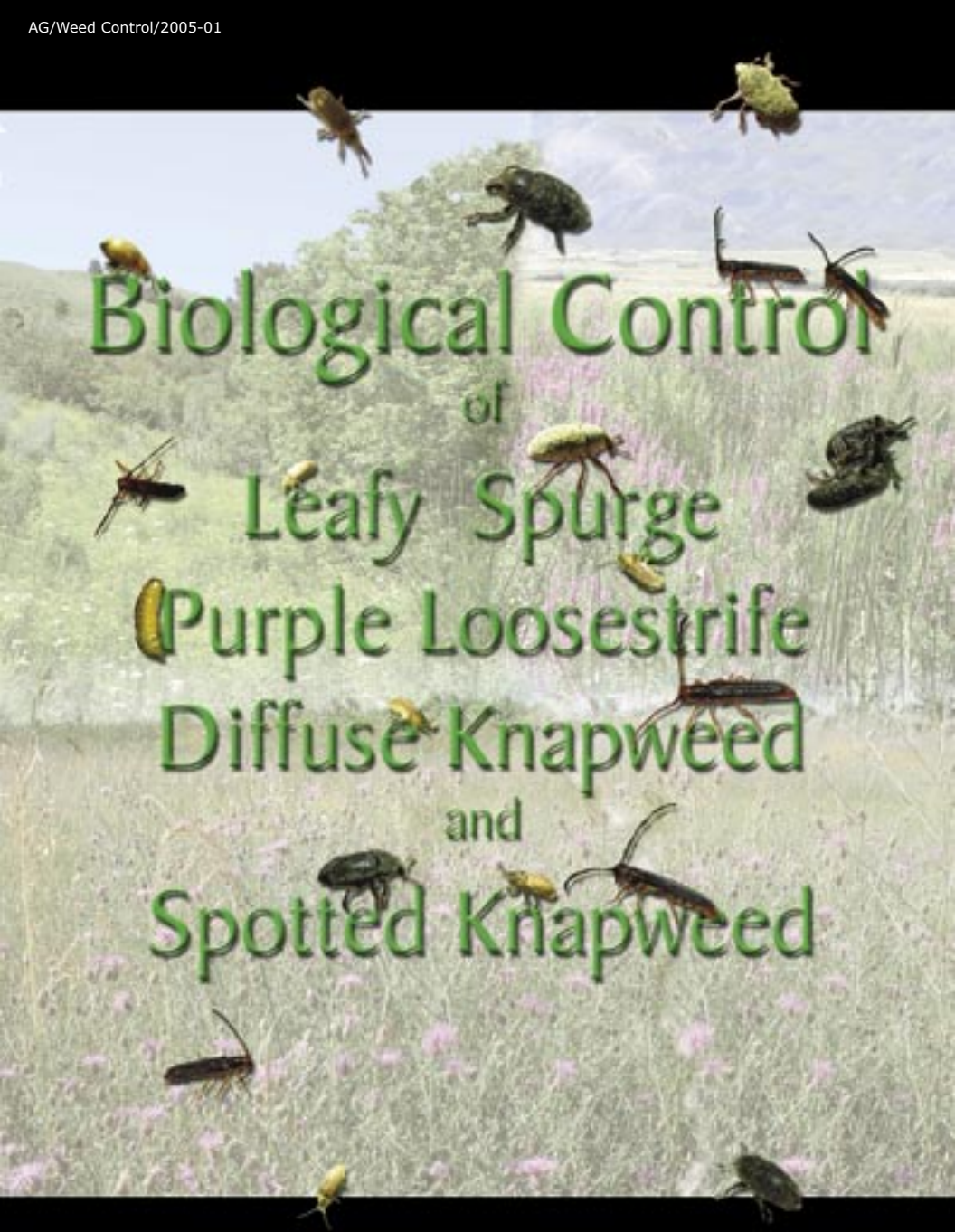

Biological Control of Leafy Spurge Purple Loosestrife Diffuse Knapweed and Spotted Knapweed

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Biological Control of Noxious Weeds

Weeds have been a menace since the time man began cultivating crops. Reduced yields, contaminated feeds, costly weed control efforts and frequent feelings of futility are all associated with persistent, troublesome weeds. Traditional methods of weed control include cultural, mechanical and chemical means. Weed eradication is seldom possible, but weed control is a realistic goal.

Biological weed control is another method that continues to show promise. This self sustaining, environmentally friendly, method consists of introducing and managing selected natural enemies into invasive weed patches. These host-specific, plant-feeding organisms reduce the competitive advantage of the exotic weeds, thus allowing the more desirable plant species to displace the weeds. This is often the most economical and most feasible method of control since many weeds are not accessible to traditional control methods. In these situations, mechanical and/or chemical control methods are not an option, but biological control agents (BCA) can work continually to lower a weed's population to the level where the plant is no longer an economic or environmental threat.

Larinus Minutus weevil

Many of our weeds that are not native may spread easily in part because they lack natural enemies in North America. In their native environments these weeds are controlled by insects, herbivores and disease. For many years, USDA Animal & Plant Health Inspection Service (APHIS) has been searching the globe to identify natural enemies to troublesome weeds. APHIS has been successful in identifying several insects that aid in the control of specific weeds, without being a threat to cultivated or native plants. BCA's released in the United States have been thoroughly tested by APHIS to ensure they are host specific and safe to release. This is a time consuming and expensive task that must be done before agents are allowed to be introduced. The effectiveness of BCA's may be impacted by multiple variables including herbivory, predation, trampling, plant bio-types, temperature, climate variations, elevation, latitude, etc. Biological control agents are living entities and require specific conditions to survive.

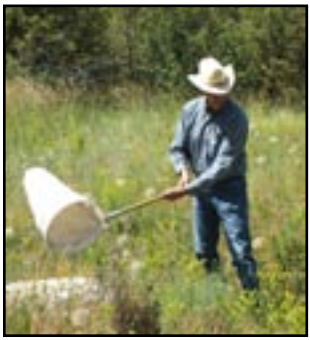
Biological control has many advantages. One of the greatest benefits is that BCA's are on duty 24 hours a day, 7 days a week. There is a

reduced need for herbicide and insects and pathogens don't argue about property boundaries. This long-term, self-perpetuating control method results in a lower cost per acre and allows agents to build up and disperse to the limits of the infestation.

Some of the disadvantages of biological control include the limited availability of agents from their native homelands, though agents are often readily available from BCA vendors. Biological control using insects is slower than other weed control methods. Some suggest that 5 to 15 years is a realistic timetable for weed suppression to occur in the local infestation. Biological control is not a perfect solution for all noxious weed control programs. It can, however, be integrated as an additional tool with other weed management methods.

Northern Utah counties have been successful with several BCA's, primarily on leafy spurge, purple loosestrife, diffuse knapweed and spotted knapweed. These weeds are often in less accessible areas, making biological agents the logical method of weed control. USU Extension, County Weed Departments, US Forest Service, BLM and APHIS have worked cooperatively to establish thriving BCA populations. As colonies have become well established, excess insects have been collected and redistributed to new areas. Cache, Box Elder, Rich and Weber counties have some very successful insectaries established. Some were established almost 10 years ago, while others are relatively new. The BCA's discussed in this brochure are typically easy to catch and distribute. The method consists of using a sweep net to sweep through the specific noxious weed types. Captured insects are put into a tight fitting, but breathable, cardboard container with a little vegetation for food and cover. Insects are kept in a cooler with ice until ready for release. It is best to release captured BCA's as soon as possible, but most will keep for a few days on ice. Insect releases are most successful when all the insects from a container are released together rather than scattered broadly. Landowners who want to use this method should consult their local APHIS, US Forest Service, BLM, Extension or county weed control representative before proceeding.

Before and after a transplant of leafy spurge flea beetles near Richmond, Utah 1999 - 2000



Collecting flea beetles

Leafy Spurge

Leafy spurge is a perennial weed that is difficult to control. Roots from a single plant may be over 20 feet long and penetrate soils more than 15 feet deep. It is primarily a weed of rangeland but has invaded many habitat types, from irrigated valleys to near timber line. Leafy spurge can crowd out native vegetation and is toxic to cattle.

Flea beetles have been one of the most effective and common biological controls used for leafy spurge because they tolerate hot dry summers and sub-freezing winters. Flea beetles are small, about 5-6 mm long, and have powerful jumping legs as their name implies. Four different species are readily available: *Aphthona czwalinae, A. lacertosa, A. flava, A. nigriscutis*. The larvae of these beetles attack the roots and root crown. The adults attack the leaves and flowers.

A. nigrscutis and *A. flava* on leafy spurge plant

A. czwalinae

A. czwalinae and *lacertosa* are both black beetles and are difficult to tell apart. *A. czwalinae* prefers a habitat with warm temperatures with medium to high humidity, partial shade, loamy soils, and a low ant population. *A. lacertosa* prefers sunny and dry areas.

A. lacertosa

A. flava is a slightly larger flea beetle with a bright gold color that prefers hot, dry areas with alkaline soils.

A. flava

A. nigriscutis is a brownish root boring beetle . It prefers sunny, dry areas with well drained soils.

A. nigriscutis

Adult flea beetles will feed gregariously on the leaves and bracts of leafy spurge during the summer. Females will lay their eggs at the base of the spurge plants with the subsequent larva feeding internally and externally on the primary and secondary roots. This causes considerable damage to the plants.

Heavy feeding damage from flea beetles evidenced by the dead stalks in foreground

Examination of some of the plants in our northern Utah sites shows evidence of root damage caused by the larvae. Tall dense stands of leafy spurge have not proven beneficial to beetle colonization. It appears adults have difficulty finding each other for mating. New releases in a less dense marginal area have proven more effective.

Another beetle that has been released in Utah and seems to be doing well is *Oberea erythrocephala*. These beetles are a little over half an inch long, not including their antenna. Larvae attack the stems and root crown and the adults destroy stems and leaves. They prefer partially sunny, riparian type areas and can tolerate sub-freezing temperatures. Grazing can be detrimental to this agent because they utilize 3 to 4 inches of plant tips for egg laying and development during midsummer.

O. erythrocephala

Spurgia esulae, is a tiny fly measuring about 1.90 mm. Adult females lay eggs on the leaves of the growing tip. Larvae develop within galls at the growth tip and destroy the plants ability to flower and produce seed. From 2 to 5 generations are produced per growth season, depending on the warmth of the area. *S. esulae* prefers fairly dense, sun exposed patches.

S. esulae

Goats and sheep are sometimes used where hundreds of acres of leafy spurge can be fenced. Goats and sheep readily gain weight feeding on leafy spurge once they become accustomed to the plant. However, they must constantly be herded to stay on stands of leafy spurge. Goats and sheep can be very compatible with insect biological control, however, contact your local biocontrol authority for the most compatible management plan.

Goats and sheep are often used for biological control on leafy spurge

Purple Loosestrife

Purple loosestrife is a semi aquatic perennial that inhabits wetlands, stream corridors, and irrigation canals. Established stands of purple loosestrife impede water flow and reduce habitat for waterfowl and other wetland animals.

G. pusilla larvae

Currently there are four BCA's available for purple loosestrife control, but only two are utilized in Utah. *Galerucella pusilla*, a golden beetle about 8 mm long, is a defoliating insect that has shown tremendous success in most areas. One area in Cache County was reduced from a thick 5 acre stand to a few random purple loosestrife plants in about 5 years.

G. pusilla adult

Both larvae and adult *G. pusilla* feed on the leaves and buds, destroying the plants ability to photosynthesize and produce seed. These agents prefer stands of purple loosestrife that are not permanently flooded.

H. transversovittatus

Hylobius transversovittatus is a root boring weevil 8 to 12 mm long. Females lay eggs on the soil or on the stem at soil level. Larvae develop in and destroy the roots and the adults feed on foliage. This weevil tolerates wide environmental conditions, but cannot thrive in areas with prolonged flooding.

G. pusilla Feeding damage

Purple loosestrife in bloom

Diffuse & Spotted Knapweed

Diffuse and spotted knapweed are perennial weeds that infest field edges, roadsides, rangeland and waste areas. They are somewhat toxic to livestock and the resin may have carcinogenic properties harmful to humans if handled without gloves. These knapweed's also release a toxin that inhibits the germination of competing vegetation, thereby allowing them to become the dominant species.

Four biological controls have shown good results in Utah for these knapweed species. *Larinus minutus* and *L. obtusus* are weevils about 5 mm long. These weevil species will attack both knapweed's, but *L. minutus* seems to prefer diffuse knapweed and *L. obtusus* prefers spotted knapweed. These weevil lay eggs throughout the summer on the flowers of both diffuse and spotted knapweed's. Larvae feed on seeds and adults feed on the leaves, stems and florets. This reduces the production of new knapweed seeds and lowers the plants ability to spread to new areas. These weevils prefer hot, semiarid areas between 2000 and 5000 feet in elevation.

L. minutus adult

C. *achates*

Cyphocleonus achates is a much larger weevil, about 15 mm long, which prefers spotted knapweed, but will also attack diffuse knapweed. Females lay eggs in the root crown. The larvae do the most damage feeding on vascular tissue in the roots and the adults feed on leaves. *C. achates* does well in semiarid, well drained sites.

S. *jugoslavica*

Sphenoptera jugoslavica is a root boring beetle, about 8 to 10 mm long, which attacks diffuse knapweed and to a lesser extent, spotted knapweed. Larvae feed on the center of the root reducing the reproductive capacity of the plant.

A. zoegana

Agapeta zoegana is a small, bright yellow moth about 11 mm long. It's prefered host is spotted knapweed. Eggs are laid on the leaves of knapweed and other vegitation. After hatching, larvae migrate to the root crown and begin mining the roots which reduces plant density and biomass.

All of these insects do very well in hot, semiarid, well drained environments.

Land owners interested in starting a biological control program must first identify the areas intended for control then introduce the appropriate biological control into those areas. The least costly approach is to introduce one or two releases of insects (200-500 per release) into an infestation and do nothing more. This method will get a colony started, but it may take several years for the insects to distribute themselves throughout the entire infestation. A more effective approach is to release as many insects as possible the first year and then collect and redistribute these insects to surrounding areas in following years as the insect population expands.

The quickest, but most costly approach, is to inundate an infestation of weeds with a combination of insects and herbivores, where applicable, during the first several years. Additional releases can be made in isolated areas as needed. Yearly monitoring is essential to assure establishment and timing for collection and redistribution.

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