

## Biological Control of Knapweeds

### Knapweeds:

Several invasive species of knapweeds (*Centaurea* spp.) invade the United States. With the exception of two species, knapweeds are native to Eurasia and usually are found undesirable. Most knapweeds entered the United States in the early 1900's in agricultural imports such as alfalfa seed. Knapweeds emit alkaloid chemicals into the soil to eliminate competition from native plants. These secondary plant compounds can also be carcinogenic to humans. We will focus on the knapweeds that have the greatest impact on the State of Utah. These species include: spotted knapweed (*C. stoebe* ssp. *micranthos*), diffuse knapweed (*C. diffusa*), squarrose knapweed (*C. virgata* ssp. *squarrosa*), and Russian knapweed (*Acroptilon repens*). Yellow starthistle, which is also in the knapweed genus is discussed in another fact sheet.



Diffuse knapweed

**Spotted knapweed** is very similar to diffuse knapweed. It is also a biennial with a vigorous taproot. Flowers are similar in shape to diffuse knapweed and also flower from July to September. The flowers of spotted knapweed are usually lavender to purple in color. Floral bracts of spotted knapweed are shorter and stiffer than those of diffuse knapweed. Spines are shorter than diffuse knapweed spines. The bracts have a black spot at the tip. Spotted knapweed prefers a moister environment than diffuse knapweed. Spotted knapweed

**Diffuse knapweed** is a biennial with a vigorous taproot. Plants are mint-green to grey-green in color. Flowers are white to lavender with spiny floral bracts. Flowering occurs from July to September. Diffuse knapweed reproduces exclusively by seed. This invasive weed occurs in hot dry disturbed areas such as roadsides. It is intolerant of shade and prefers well drained, light textured soils. Diffuse knapweed infests over 600,000 ha in the western United States and can occupy up to 65% of grazing land in some areas.

increases soil erosion and decreases biodiversity as well as depleting grazing land.



Spotted knapweed



Squarrose knapweed

**Squarrose knapweed** is a perennial with a woody crown and a deep taproot. It appears more bush-like than diffuse and spotted knapweed. Flower shape is similar to spotted and diffuse knapweed. Flowers of squarrose knapweed are more slender than spotted or diffuse knapweed. They are pink to purple in color. As with diffuse and spotted knapweed, squarrose knapweed reproduces only by seed. The worst infestations of squarrose knapweed occur in Utah infesting over 150,000 acres.

**Russian knapweed** has been moved from the knapweed genus (*Centaurea*) and into the genus *Acroptilon*. Unlike true knapweeds, Russian knapweed is a perennial that spreads primarily by its extensive lateral root system. Bright green stems are usually erect and openly branching. Flowers are rose to purple in color and occur from June to September. Russian knapweed infests grazing land, grain and other crops. It is a difficult plant to control and is toxic to horses. Traditional knapweed biological control agents are ineffective for Russian knapweeds. There is currently only one biological control agent available for Russian

knapweed. *Subanguina picridis* a gall forming nematode has a marginal effect. Research is currently being conducted to find new agents to treat Russian knapweed.



Russian knapweed

### **Biological Control of Knapweeds:**

Effectiveness of biological control of knapweeds varies greatly. Three main factors affect the level of control: 1) Type of knapweed; 2) Type of biocontrol agent; 3) Climate and habitat biocontrol agents are released in. We will discuss five primary biological control agents that have been widely used for knapweeds. There are two seed head flies, (*Urophora affinis* and *U. quadrifasciata*); a seed head weevil, (*Larinus minutus*); and two root borers, (*Sphenoptera jugoslavica* and *Cyphocleonus achates*).

***Larinus minutus***, the seed head weevil is the most effective biological control agent in controlling diffuse and spotted knapweed. *L. minutus* also attacks squarrose knapweed to a lesser degree. Adult *L. minutus* overwinter in the soil at the base of plants. Adults are 4-5 mm long and mottled brown in color. When adults emerge in May, they begin mating and laying eggs in the flower head. The damaging stage is the larval stage which feeds on the flower for 4 weeks then pupate inside the seed head. Adult *L. minutus* can be collected from May through July and are easy to collect by simply picking adults from knapweed plants.



*Larinus minutus* adult



*Sphenoptera jugoslavica* adult

***Sphenoptera jugoslavica*** is one of the two root boring insects. Adult *S. jugoslavica* are 8-10 mm long, flattened and elongate. They are dark and metallic in color. Adults lay eggs near the root and second instar larvae bore into the root to overwinter. While overwintering, larvae form galls that cause damage or death to knapweed plants. Adults emerge from July to September and can be easily collected during this time. Collection should be done in the early evening when *S. jugoslavica* can be picked directly off of plants. The root boring beetle is very effective on squarrose knapweed as well as diffuse and spotted knapweeds.



*Sphenoptera jugoslavica* larva



*Cyphocleonus achates* adult

The second root borer is ***Cyphocleonus achates***. This large weevil is 14-15mm long and light to dark brown. This life cycle is similar to *S. jugoslavica*. Adults lay eggs on the root crown and larvae bore into the root and form galls. *C. achates* overwinters in the larval stage. Adults emerge from June to September. Collection of these weevils is very difficult. They are not easy to locate in an infestation of knapweed. *C. achates* is commercially available but should be considered as a second option if easier, free insects are not available. *C. achates* is effective on diffuse and spotted knapweed only. The effect can be up to 60% alone or 100% when used with other biocontrol agents.

The two seed head flies, *Urophora spp.*, are very widespread throughout the State of Utah. They are currently being studied for their profound effect on squarrose knapweed. They also have excellent results on spotted and diffuse knapweeds. Eggs are deposited in June in immature knapweed flower heads. The larvae form hard galls in the seeds and overwinter inside those galls. Adults emerge in June and July with a second generation in August or September. Adults are 4mm long with varying wing patterns depending on which species of fly you are considering. Flies are easy to collect with a mesh net. Be careful when collecting not to injure flies with other debris.



*Urophora quadrifasciata*



*Urophora affinis*

### **Integrated Pest Management of Knapweeds:**

An integrated pest management method is the best way to fight knapweeds. Several options are available including mechanical control (i.e. pulling or digging), chemical control, grazing and biological control. Flies are more susceptible to pesticides than other biological agents so care should be taken when flies are released. Several species of biological control agents should be released in one area. Chemical or mechanical control are suggested for smaller, easily accessible infestations. Biological control is best used on large, difficult to manage infestations of knapweeds. Grazing can be implemented using sheep or goats at the same time as biological control and usually with chemical control according to chemical labeling.

Amber Richman  
USDA-APHIS-PPQ  
1860 West Alexander St. #B  
West Valley City, UT  
84119  
(435)830-4146  
usucowgirl@hotmail.com