

# *Sphenoptera jugoslavica* Obenb.

**INVASIVE SPECIES ATTACKED:** Diffuse knapweed (*Centaurea diffusa* Lam.)  
Spotted knapweed (*C. beibersteineii* Lam.)

**TYPE OF AGENT:** Root feeding beetle

**COLLECTABILITY:** Mass

**ORIGIN:** Macedonia

## DESCRIPTION AND LIFE CYCLE

### Adult:

*Sphenoptera jugoslavica* are stout beetles and have a hard outer shell and are 7 - 10 mm long. The front of their head is flat and their posterior end is tapered into an oval shape. They are dark metallic copper, bronze or black. When startled or fearful they will play dead. Males emerge one week before females in July, just as the plants are forming flowers. Within a few days mating begins. Females must feed to ensure egg maturation, consuming 0.25 cm<sup>2</sup> of foliage. Five to 12 days after mating, oviposition begins and continues over their four week life span. Females lay an average of 50 eggs into rosette leaf axils. Their U-shaped rear abdomen requires plants to have a petiole base 3 - 6 mm wide. Small petioles result in eggs laid in incorrect locations. When temperatures are 30°C or more they will lay eggs a much greater rate.

### Egg:

The flat, white eggs turn blue-grey during the first 4 - 5 days. Eggs incubate 2 - 4 weeks.

### Larva:

Larvae are white, legless, have a large flat head and a segmented body. First instar larvae feeds between petioles. At the time when knapweed is setting seed, the second instar larvae mine into the upper root. The plant reacts by healing the feeding scars, but the larvae continue to feed. The feeding creates a cavity with dense callus formations that cause the root to swell. They feed on protruding growths of the callus and on plant fluids, filling the chamber with frass. At this time they overwinter, bending their abdomen (head to tail) to form a 'hook'. The larvae pupate the following spring within the feeding chamber. Pupation usually occurs from late May to early June. Some slower developing larvae will resume feeding in the spring until mid-July and pupate later than most. Plants rarely support more than one larva, if two develop on a single root, the one feeding lowest in the root will be smaller. They cannot develop on small rosettes with poor producing vegetation. Larvae can be smothered in vigorous rosettes which over-produce callus growth.

### Pupa:

Pupae are white, moulting into adults in nine days when temperatures are 20°C. They remain in the roots until warm temperatures and dry weather arrives in July.

### Overwintering stage:

Larvae overwinter in roots and pupate the following spring. Slow developing larvae may overwinter, resume feeding in spring and, therefore, pupate later than the general population.

## EFFECTIVENESS ON HOST PLANT

Larvae feeding on roots severely impact the plants vigour. When larvae mine into a bolting plant, they mine the stem and then the root, 2% of these plants survive the winter. Larvae attack can stop rosette growth and delay bolting for one or two years. Large plants can survive the first year of attack and set bloom and seed, but will do so in reduced quantities (41 - 57% less). Plants are usually attacked over more than one year, adding significant negative impact



Fig. 1. *S. jugoslavica* adult (credit Powell et al. 1994)



Fig. 2. *S. jugoslavica* larva

## HABITAT AND DISTRIBUTION

### Native:

*S. jugoslavica* is native to only a few European countries including, Romania, Bulgaria, Greece, European Turkey, and the former Yugoslavia.

### North America:

*Sphenoptera jugoslavica* thrives in arid environments that have a period of drought in summer. It prefers well-drained coarse soils on south aspects. Exposed soil between plants will increase the soil temperature which further enhances a preferred environment. It exists in Bunchgrass and Ponderosa pine habitat. Locations with aspen, Douglas-fir or lodgepole pine are probably too moist. It has a preference for diffuse knapweed over spotted knapweed.

### British Columbia:

It has been found released and found established in the Bunchgrass, Coastal Douglas-fir, Engelmann spruce-subalpine fir, Interior cedar-hemlock, Interior Douglas-fir, Montane spruce and Ponderosa pines biogeoclimatic zones. Dispersal is most frequently found in the Bunchgrass, Interior Douglas-fir, and Ponderosa pine zones.

## BRITISH COLUMBIA RECORD

### Origin:

The *S. jugoslavica* populations released in B.C. originate from Macedonia.

### History:

The first field two releases of *S. jugoslavica* occurred in 1976 in the southern interior. The site near the White Lake Observatory established from 188 adults and went on to become the collection source for further populations throughout the province and the United States. The other site near Grand Forks did not establish. At this time it is determined that the beetle is well established in the field and no longer requires redistribution efforts.

### Field results:

By 1999, 148,248 *S. jugoslavica* beetles had been released in B.C., most of which were collected from the original 1976 White Lake location. Assisted redistribution slowed over time and in 1997 the last field collection and release was made.

Although *S. jugoslavica* prefers diffuse knapweed it is frequently found on spotted knapweed growing in the warm to hot knapweed range of the southern interior. It is found in the same knapweed infestations as many other biocontrol agents. It is commonly found sharing sites with other root feeders including: *Pterolonche inspersa*, *Cyphocleonus achates*, and *Agapeta zoegana*. It also shares sites with the seedfeeders: *Urophora affinis*, *U. quadrifasciata*, *Larinus minutus*, and *L. obtusus*.

### Collection for redistribution:

Adults can be collected by sweeping from mid-July to mid-August. New sites need to be where the plants encounter a drought stress period in summer to ensure survival. Self-dispersal of this agent has filled most its desired habitat in the southern interior, leaving little need to assist with distribution.

## NOTES

- *S. jugoslavica* shares habitat and sites with a large host of other knapweed agents.
- *P. inspersa* will feed on *S. jugoslavica* larvae if they both exist in the same root.



Fig. 3. *S. jugoslavica* dispersal area on spotted and diffuse knapweed in Lac du Bois near Kamloops (Bunchgrass zone)



Fig. 4. *S. jugoslavica* dispersal area on diffuse



Fig. 5. *S. jugoslavica* dispersal area on diffuse knapweed near Grand Forks

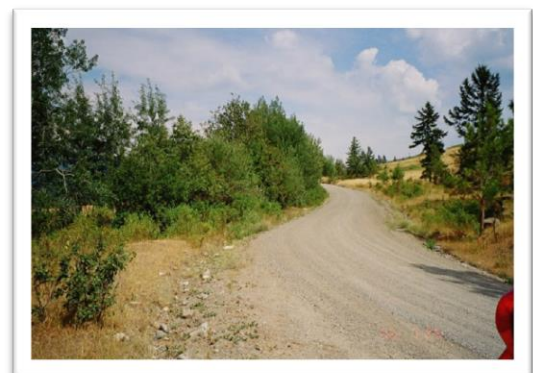


Fig. 6. *S. jugoslavica* dispersal area north of Kamloops (Interior Douglas-fir zone)

- In picloram spray trials, *S. jugoslavica* failed to establish on plants that re-grew 2 - 3 years after treatment.

## REFERENCES

1. Bouchier, R.S., K. Mortensen and M. Crowe. 2002. Chap. 63, *Centaurea diffusa* Lamarck, diffuse knapweed, and *Centaurea maculosa* Lamarck, spotted knapweed (Asteraceae). In Biological control programmes in Canada, 1981-2000. P.G. Mason and J. T. Huber, (editors). CAB International.
2. Harris, P. 2005. Classical biological control of weeds established biocontrol agent *Sphenoptera jugoslavica* Obenb. Root-gall former. Agriculture and Agri-Food Canada. Updated August 3, 2005.  
[http://res2.agr.ca/lethbridge/weedbio/agents/asphejugo\\_e.htm](http://res2.agr.ca/lethbridge/weedbio/agents/asphejugo_e.htm) (Accessed February 15, 2007).
3. Powell, G. W., A. Sturko, B. Wikeem and P. Harris. 1994. Field guide to the biological control of weeds in British Columbia. B.C. Min. For. Res. Prog.
4. Powell, R. and P. Harris. 1986. Biological control of diffuse knapweed by *Sphenoptera jugoslavica* (Obenb.). Canadex. Agric. Can.
5. Turner, C.E., J.M. Story, S.S. Rosenthal and N.E. Rees. 1996. *Sphenoptera jugoslavica*. Sect. II, The knapweeds, In: Biological control of weeds in the west. N.E. Rees, P.C. Quimbly Jr., G.L.Piper, E.M. Coombs, C.E. Turner, N.R. Spencer, and L.V. Knutson, (editors). Western Soc. Weed Sci.