

# *Chrysolina quadrigemina* (Suffr.)

**INVASIVE SPECIES ATTACKED:** St. John's wort (*Hypericum perforatum*)

**PREVIOUSLY KNOWN AS:** *Chrysolina gemellata* (Rossi)

**TYPE OF AGENT:** Foliar feeding beetle

**COLLECTABILITY:** Mass

**ORIGIN:** France

## DESCRIPTION AND LIFE CYCLE

### Adult:

The beetles are metallic bronze, green, blue, purple or black coloured and measure 6.1 - 7 mm long. The adults emerge in early June and begin feeding in clusters on young terminal leaves, flower buds or the underside of leaves. They continue to feed until leaf drop in July and early August. Reproduction is related to day length; in longer daylight, less feeding and reproduction occurs. This changes when day length is reduced. At this time they move into plant litter and await the fall rains which break their dormancy and encourage them to return to the upper plant portions to mate. Females oviposit up to 1,500 eggs individually or in small clusters onto winter basal foliage.

### Egg:

The eggs are reddish coloured and measure 1.2 mm x 0.5 mm. They overwinter and hatch the following spring. *Chrysolina quadrigemina* eggs are more resistant to desiccation than those of *C. hyperici* and *C. varians*.

### Larva:

The plump, hump-backed larvae, initially orange coloured, change to dirty pink-grey as they mature. Newly hatched larvae usually appear in the spring, although some will hatch in the fall. They feed on leaf buds and immature leaves causing complete defoliation before moving onto adjacent plants. Feeding on St. John's wort causes the larvae to become light sensitive. Photosensitivity prevents them from feeding during the day, therefore, they must feed during low light periods, and do so before sunrise. After the morning feeding, they seek shade and protection. The smallest hide in leaf buds while the larger ones move under the plants or into the soil. They resume feeding at sunset.

### Pupa:

In mid-May the mature larvae burrow into the soil and create a pupal cell.

### Overwintering stage:

Usually they overwinter as eggs on basal leaves. In mild climates the larvae and adults will survive the winter if temperatures remain above -8°C.

## EFFECTIVENESS ON HOST PLANT

Early spring larval feedings on fleshy new growth cause the most damage; this timing is the controlling key. Although adult feeding can be impressive, it has less impact than larval feeding. Heavy fall feeding may cause some impact on the plants' ability to overwinter.

## HABITAT AND DISTRIBUTION

### Native:

*C. quadrigemina* has the most southern native European distribution of all the *Chrysolina* species released in B.C.. It has a range from northern Africa to Denmark, but is absent from mainland Sweden.



Fig. 1. *Chrysolina* spp. adults



Fig. 2. *Chrysolina* spp. early larvae (credit Powell et al. 1994)



Fig. 3. *Chrysolina* spp. developing larvae

### North America:

*C. quadrigemina* prefer elevations below 1000 m and sites with less summer precipitation than other *Chrysolina* spp. Abundant populations are found in Mediterranean type habitats. It requires open sunny locations as it is intolerant of shade. Dry summers are necessary to avoid breaking their mandatory dormant period. Locations with frequent summer rains will break dormancy, effecting the agent's survival. It tolerates dryer climates than *C. hyperici*. It requires snow cover or plant litter in areas that experience severe frost. *Chrysolina* spp. and St. John's wort populations fluctuate; when the infestation decreases (plants are more widely scattered and their patches tend to become less dense), the beetle population also decreases. Later in the cycle, as the plants once again increase (but notably at lower than historical densities), the beetles also become more abundant.

### British Columbia:

Pure *C. hyperici* and mixed *Chrysolina* spp. populations have been released into the Coastal western hemlock, Interior cedar hemlock, Interior Douglas-fir, Montane spruce, Ponderosa pine and Sub-boreal spruce biogeoclimatic zones. Establishment and dispersal of *Chrysolina* spp. have been found in all these zones and also in the Engelmann spruce-subalpine fir, but has not been found in the Sub-boreal spruce zone. Some southern interior habitats include elevations to 1100 m. It has spread through the Fraser Valley and lower mainland, adapting to the higher precipitation levels. Larvae are readily seen in May with adults abundant in June.

## BRITISH COLUMBIA RECORD

### Origin:

*C. quadrigemina* released in B.C. came from reared populations in Loftus, Calif. Calif. sources came from Australia originating from Mediterranean France stock.

### History:

*C. quadrigemina* was one of two *Chrysolina* species introduced to B.C. near Christina Lake in 1952. Imported populations for field release continued for several years. Over the next few years, *Chrysolina* spp. were released in several locations in the southern interior. These early established releases provided collection sources for future B.C. populations and the first field collection occurred in 1981. Subsequent releases have established and the beetles have dispersed freely with limited assistance.

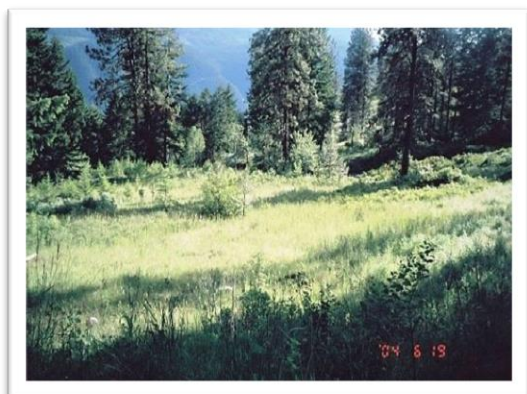


Fig. 6. Established *Chrysolina* spp. site near Grand Forks (Ponderosa pine zone)



Fig. 4. Established *Chrysolina* spp. site at Roberts Bank, lower mainland (Coastal Douglas-fir zone)



Fig. 5. Established *Chrysolina* spp. site near Christina Lake (Interior cedar hemlock zone)

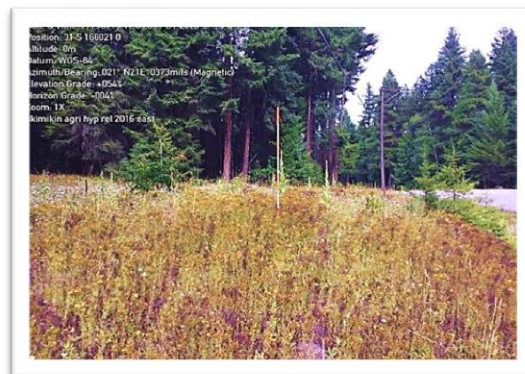


Fig. 7. Established *Chrysolina* spp. site near Tappen (Interior Douglas-fir zone)

### Field results:

In recent years, St. John's wort has been re-establishing and, therefore, renewed efforts have been underway to assist with redistributing the beetles in mixed populations. In the southern interior, larvae are readily seen in May and adults are abundant in June.

### Collection for redistribution:

By early June, adults can be collected by sweeping as they cluster on the plants.

## NOTES

- *C. quadrigemina* are very similar to other *Chrysolina* species, making identification difficult in the absence of the other species for comparison. *C. quadrigemina* adults are larger and often lay more eggs in the fall and less in the spring than *C. hyperici*.
- *C. quadrigemina* larvae emerge slightly earlier in the spring than *C. hyperici*.

## REFERENCES

1. Harris, P. 2003. Classical biological control of weeds established biocontrol agent *Chrysolina hyperici* (Forst.). Defoliating beetle. Agriculture and Agri-Food Canada. Updated April 11, 2003. [http://res2.agr.ca/lethbridge/weedbio/agents/achryhyp\\_e.htm](http://res2.agr.ca/lethbridge/weedbio/agents/achryhyp_e.htm) (Accessed May 20, 2003).
2. Harris, P. 2003. Classical biological control of weeds established biocontrol agent *Chrysolina quadrigemina* (Suffr.). Defoliating beetle. Agriculture and Agri-Food Canada. Updated April 11, 2003. [http://res2.agr.ca/lethbridge/weedbio/agents/achryqua\\_e.htm](http://res2.agr.ca/lethbridge/weedbio/agents/achryqua_e.htm). (Accessed May 20, 2003).
3. Harris, P. and D. P. Peschken. 1971. Part II, Chap. 32, *Hypericum perforatum* L., St. John's wort (Hypericaceae). In Biological Control Programmes against Insects and Weeds in Canada 1959-1968. Commonwealth Agricultural Bureaux.
4. Harris, P. and M. Maw. 1984. Sect. II, Ch. 36, *Hypericum perforatum* L., St. John's-wort (Hypericaceae). In Biological control programmes against insects and weeds in Canada 1969-1980. J.S. Kelleher and M. A. Hulme, (editors). Commonwealth Agricultural Bureaux.
5. Manitoba Agriculture. No date. St. John's wort (*Hypericum perforatum* L.). Brochure. Gov. of Man.
6. Piper, G.L. and N.E. Rees. 1996. *Chrysolina hyperici*. Sect. II, St. John's wort. 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
7. Piper, G.L. and N.E. Rees. 1996. *Chrysolina quadrigemina*. Sect. II, St. John's wort. 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.
8. 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.
9. Winston, R., C. Bell, R. De Clerck-Floate, A. McClay, J. Andreas and M. Schwarzlander. 2014. Biological control of weeds in the northwest. Forest Health Technology Enterprise Team.