

Galerucella calmariensis (L.)

INVASIVE SPECIES ATTACKED: Purple loosestrife (*Lythrum salicaria* L.)

TYPE OF AGENT: Foliar feeding beetle

COLLECTABILITY: Mass

ORIGIN: Germany

DESCRIPTION AND LIFE CYCLE

Adult:

Adults are 3 - 5 mm long, tan coloured with a dark band appearing along the margin of their wing-cover and with a triangular mark behind their head. Overwintered adults appear in mid-May into early June, usually when the plants are 20 cm tall, and begin feeding on the plant buds and tender new growth. Females will oviposit within the first week of emergence beginning in June, peaking about mid-month then slowing after the summer solstice and continuing into July. They will lay a few eggs and then disperse. Repeated mating is required for viable eggs. The eggs are laid in small masses of 1 - 36 (average eight) on the lower parts of the plant stems and are covered with a strip of black faecal material. Over their life, females can lay between 300 and 400 eggs. Egg-laying is heaviest (about 10/day) when temperatures are over 25°C. This reduces when the temperature lowers to 20°C. Adults disperse well and their mobility enables them to readily seek new plant sites.

The second generation beetles are more prone to dispersal than those that overwinter and emerge in the spring. Adults emerging in July will mate and oviposit within a week and lay eggs for one month. Those that appear later may breed, but will not oviposit before they hibernate. For two months, parent and F1 generation adults are both present, with their oviposition periods overlapping for one month. Adults that emerge and lay to produce the first generation will die by the end of summer. In the habitats with two generations, some of the adults will lay a few eggs in late summer and early fall, prior to their hibernation. The duration from egg to adult is 30 - 40 days. Following pupation, the new adults will remain on the soil or lower stems for two days until their bodies become hardened and then appear on the upper plant parts.



Fig. 3. *Galerucella* spp. foliar feeding



Fig. 1. *G. calmariensis* adult (credit Powell et al. 1994)



Fig. 2. *G. calmariensis* larva (credit Powell et al. 1994)

Egg:

The creamy-white, 1 mm diameter, spherical eggs incubate for 12 days.

Larva:

Larvae are pale yellow.

There are three instars and all are similar with no obvious distinguishing changes. The youngest larvae feed primarily on young buds and leaves on the upper most part of stems. Soon after, they feed on the undersides of larger leaves. Since this species emerges earlier than *Galerucella pusilla*, it will destroy fewer buds. After 14 days the mature larvae will be 3 - 5 mm long and pupation is then initiated.

Pupa:

Pupation normally occurs in the soil. However, at sites that flood, pupation takes place in the plant stems above the water level.

Overwintering stage:

Adults overwinter in the soil near the surface. Hibernation is controlled by temperature.

EFFECTIVENESS ON HOST PLANT

Larvae and adult feeding on buds will stunt plants and reduce seed production. In heavy *G. californiensis* populations, plants will be destroyed. The spring emerging adults attack early growth, impacting the plants' ability to photosynthesize and restore nutrients. Reduced flowering and seed production is common after several years of attack. Delayed flowering by one month also reduces the number of flowers the plant can produce and later blooming limits pollination. Repeated heavy defoliation and attack will reduce the plants' vigour the following growing season. Sites with high larvae densities will cause defoliation by the end of July.

HABITAT AND DISTRIBUTION

Native:

In its native environment, *G. californiensis* occurs in varying climates within wide ranging ecological habitats. Field surveys indicate their range to be in central and north European countries, for example in south Sweden and Finland and to the south to North Africa, with recorded sightings in Siberia, Kazakhstan and central Asia. When *G. californiensis* and *G. pusilla* habitats overlap, *G. californiensis* occurs when the plants are growing in higher densities.

North America:

G. californiensis tolerates varying habitats where purple loosestrife grows. It is tolerant of flooding, but continual flooding may not be suitable. For this reason, sites with a moisture gradient will offer alternate locations of choice habitat. They appear to prefer areas on the margins of wet lands. *Galerucella* beetles prefer full sun and, therefore, locations with sun exposure will be preferred over shaded or partially shaded sites.

British Columbia:

Galerucella spp. treatments have been made into Bunchgrass, Coastal Douglas-fir, Coastal western hemlock, Interior cedar-hemlock, Interior Douglas-fir, Ponderosa pine and Sub-boreal spruce biogeoclimatic zones. All have shown establishment except those in the Interior Douglas-fir zone.

BRITISH COLUMBIA RECORD

Origin:

G. californiensis populations released in B.C. originate from Germany.

History:

The first *G. californiensis* treatment in B.C. was made in 1993 in the Fraser Valley. Populations used for collection are routinely considered mixed with *G. pusilla* and it is possible both species occur at most sites in B.C., although *G. californiensis* may be the dominant of the two species found.

Field results:

Impressive feeding damage can be found within coastal and interior sites from mid-summer onward. On long linear sites, plants are failing to produce flowers near the immediate release point. In the interior, adults can be observed from July into early August, and the seasons' abundant feeding is evident in early September. In the lower mainland, adults and egg masses were seen from mid-May through June. Adults were collected from the lower mainland in June well within the incoming tide level showing their tolerance for wet sites. In B.C., two generations are normal. *Galerucella spp.* treatment sites in the lower mainland now have low plant densities and reduced flowering, which have negatively impacted seed production. This same success is starting to show in the southern interior.

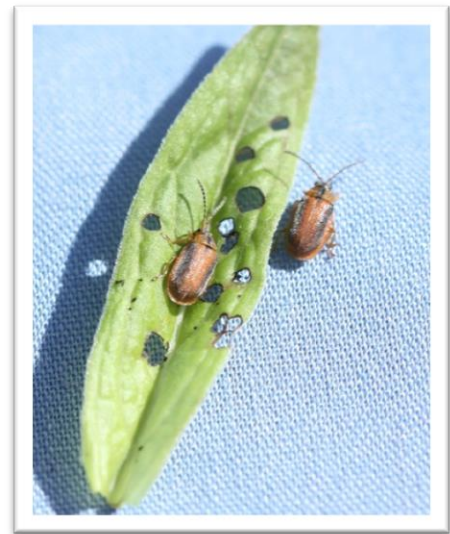


Fig. 4. *Galerucella spp.* adults with foliar feeding on leaf



Fig. 5. Established *G. californiensis* release site on Johnstone Island (Coastal western Hemlock zone)



Fig. 6. Established *Galerucella spp.* sites along canal in Penticton (Ponderosa pine zone)

Collection for redistribution:

Transfers can be successfully done by moving plant material with larvae into new locations or adults can be aspirated from plants during peak periods. When treatments are made with small numbers of beetles released, small populations will usually continue, therefore large releases perform best.



Fig. 7. Established *G. californiensis* mixed *G. pusilla* site at Vaseaux Lake (Bunchgrass zone)



Fig. 8. *G. californiensis* dispersal area in Boundary Bay (Coastal Douglas-Fir zone)

NOTES

- By combining the two *Galerucella* spp., benefits are gained. *G. californiensis* feeds on early plant growth, causing the plants to send out new shoots that then coincide with *G. pusilla*'s feeding requirements. Additionally, the two species prefer different densities of plants, therefore, should feed on a wider range of plants in an infestation.
- DNA of these closely related species have been studied and demonstrate a distinct reproductive separation.

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