

Hyles euphorbiae (L.)

INVASIVE SPECIES ATTACKED: Leafy spurge (*Euphorbia esula* L.)
Cypress spurge (*E. cyparissias* L.)

TYPE OF AGENT: Foliar feeding moth

COLLECTABILITY: Not available for general distribution

ORIGIN: Germany

DESCRIPTION AND LIFE CYCLE

Adult:

Hyles euphorbiae are large brown hawk moths with colourful pink, white and black markings on their wings that measure up to 8 cm across. Their markings are distinct, but can be easily confused with similar native species. A modified mouth part enables them to perceive the sound of bat cries. The moths can be located in the field from late May through June (depending on location) and again in August and September when they feed on the plant nectar of funnel-shaped flowers, hovering like a hummingbird. Adults are strong fliers. The females begin to lay eggs in May and continue to do so through to mid-September, coinciding with the spurge bloom. Each female will oviposit 7-150 eggs singly or in clusters up to 50 onto leaves and floral bracts.

Egg:

The eggs are green and measure 1 mm in diameter. The outer egg cover remains clear during incubation which allows for observation of the development process within.



Fig. 1. *H. euphorbiae* adult on leafy spurge

Larva:

The larvae have five instars that take 2-3 weeks to complete. The larvae stage is prone to ant predation. Each instar has distinctly different colouring and patterns. The first is dark black or black-green, with 6 legs and 10 prolegs. The first instars spin thin thread webs to keep themselves from falling to the ground. The second instars' colour changes to green with white spots. At two weeks, the larvae are in the third instar and will have enlarged to 2-3 grams and changed their colour to green, black and red with yellow spots. The larvae are mature when they have enlarged to

11 cm long and changed their colour to a darker combination of the previous, but with a crimson stripe along its back and an added prominent black-tipped, crimson horn. The larvae appear during June and early August and begin to feed on the spurge foliage. Active feeding larvae accumulate toxins in their skin which deters enemies. They are aggressive feeders that will actively travel when hungry and prior to pupation. Feeding slows when temperatures drop below 15°C. The mature larvae burrow into the soil or plant litter to a maximum depth of 8 cm. Soil and loose materials are cemented together to form a water-proof chamber. Eggs that hatch early can complete larvae development and pupation in 15-20 days and result in a second generation, those that do not complete pupation will overwinter inside the chamber, which can tolerate temperatures to -21°C.



Fig. 2. *H. euphorbiae* 2nd instar larvae



Fig. 3. *H. euphorbiae* early final instar



Fig. 4. *H. euphorbiae* larva, mature final instar

Pupa:

The young pupae are greenish-white coloured with soft bodies, whereas mature pupae are pale brown. Pupae will measure 4-5 cm long. The protective toxins found within the larvae do not persist during the pupae stage and results in high predation by mice and other small rodents.

Overwintering stage:

H. euphorbiae will overwinter as a pupa in a water-tight pupal chamber within the soil. At this stage it will be most vulnerable to predation.

EFFECTIVENESS ON HOST PLANT

The larvae feeding can cause complete defoliation of plants. A foliar feeding use up plant nutrient reserves and reduces the plant vigour. This agent alone is insufficient for spurge control, but can be combined with the effects of other agents.



Fig. 5. *H. euphorbiae* pupa in lab environment

HABITAT AND DISTRIBUTION

Native:

Its native distribution is from south and central Europe and into central Asia.

North America:

It was earlier predicted that the temperatures at most Canadian sites may be too low for this agent. However, since 1992, larvae sightings have become common in southern Alberta and are alleged to be the result of dispersals from Montana. North American established sites are associated with habitat that offers some tree shelter. They require thick growing spurge infestations. Birds, small animals and rodents will feed on the pupae, therefore, sites free from these or with fewer predators are better suited. Avoid sites with large ant populations. *Hyles euphorbiae* is established in Ont. on cypress spurge, which was the source plant for redistribution in North America. Originally it was predicted they would require relatively warm winters, however, establishment in Mont. has shown otherwise. The population sources released in Canada were also redistributed to the US. Subsequently, the U.S. obtained additional populations from Europe. Both sources have successfully established and are dispersing in the Pacific Northwest.



Fig. 6. *H. euphorbiae* dispersal location and habitat near Invermere (Interior Douglas-fir zone)

British Columbia:

The single established release site in B.C. exists in the Interior Douglas-fir biogeoclimatic zone. Dispersal has incidentally been found at several locations in the Interior Douglas-fir and Ponderosa pine zones. *H. euphorbiae* has been found at elevations between 379 m and 991 m. Further habitat study is ongoing.

BRITISH COLUMBIA RECORD

Origin:

H. euphorbiae released in B.C. came from populations reared on cypress spurge in Ont. The original stock came from eastern Germany.

History:

Two *H. euphorbiae* releases were made at one leafy spurge site in the East Kootenays near Wilmer; in 1966 (300 larvae) and in 1967 (1900 larvae). It was determined there was 95% mortality within two weeks of the larvae being released and it was suspected the pupae suffered from heavy predation. The actual release point remains unknown. Subsequent monitoring indicated no establishment until 2009, when larvae were found dispersed in the geographic area of the initial release.

Field results:

Early monitoring was carried out for a few years following the releases made in the 1960's, but, no agents were found. Many years later, in the spring of 2005, there was a possible adult sighting on leafy spurge in Invermere, which is an area considered to be within the vicinity of the original release. At this same site in July 2009, mature larvae were found feeding on plants. Incidental sightings of the larva continue to be observed at sites in the Rocky Mountain Trench and in the Thompson Okanagan near Vernon and Kamloops. There is speculation the dispersed moths in the Vernon and Kamloops areas may have arrived accidentally as a contaminant in the egg stage on plants that may have been moved from established areas. It is believed the moth may be quite widespread and self-dispersing throughout the leafy spurge patches found between Invermere and the U.S.A./Canada border.

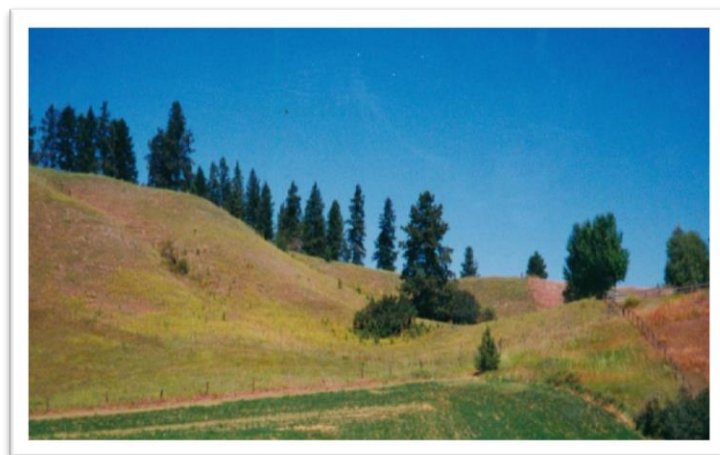


Fig. 7. *H. euphorbiae* dispersal location and habitat near Vernon (Spallumcheen) (Interior Douglas-fir zone)

NOTES

- At 32°C, a generation completes development in six weeks.
- Abundant populations in the USA are prone to a viral disease.

REFERENCES

1. Harris, P. 1984. Sect. II, Ch. 35, *Euphorbia esula-virgata* complex, leafy spurge and *E. cyparissias* L., cypress spurge (Euphorbiaceae). In Biological control programmes against insects and weeds in Canada 1969-1980. J.S. Kelleher and M.A. Hulme (editors). Commonwealth Agricultural Bureaux, Farnham Royal, Slough, England.
2. Harris, P. 2003. Classical biological control of weeds established biocontrol agent *Hyles euphorbiae* (L.) Defoliating moth (spurge hawk moth). Agriculture and Agri-Food Canada. Updated April 11, 2003. http://res2.agr.ca/lethbridge/weedbio/agents/ahyleup_e.htm (Accessed May 20, 2003).
3. McClay, A.S., D.E. Cole, P. Harris, C.J. Richardson. 1995. Biological control of leafy spurge in Alberta: progress and prospects. AB Environmental Centre, Vegreville, AB.
4. North Dakota State University. 1996. Spurge biocontrol-the Canadian experience. Leafy Spurge News, vol. XVIII, issue 2 (June):3-4.
5. Powell, G.W., A. Sturko, B. Wikeem and P. Harris. 1994. Field guide to the biological control of weeds in British Columbia. Min. For. Res. Program.
6. Rees, N.E., N.R. Spencer, L.K. Knutson, L. Fornasari, P.C. Quimby, Jr., R.W. Pemberton and R.M. Nowierski. 1996. *Hyles euphorbiae*. Sect. II, The Spurges, Leafy spurge. In: Biological control of weeds in the west. N.E. Rees, P.C. Quimby Jr., G.L.Piper, E.M. Coombs, C.E. Turner, N.R. Spencer, and L.V. Knutson, (editors). Western Soc. Weed Sci.
7. Winston, R., C. Bell Randall, R. De Clerck-Floate, A. McClay, J. Andreas and M. Schwarzlander. 2014. Biological control of weeds in the northwest. Forest Health Technology Enterprise Team.