Aphthona czwalinae (Weise)

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

TYPE OF AGENT: Root feeding flea beetle

COLLECTABILITY: Not available for general distribution

ORIGIN: Hungary

DESCRIPTION AND LIFE CYCLE

Adult:

The black flea beetles measure 2.8 to 3.5 mm long. Their bodies are tapered at the front. Typically the upper portion of their rear legs are black (but can vary to brown), appearing similar to *Aphthona lacertosa* making them difficult to differentiate. As with all flea beetles, they are capable of jumping great distances and do so readily. Adults usually appear in June and July, but can vary yearly depending on climate. It has been recorded for several years to appear 10 days later than *A. lacertosa*. The adults tend to congregate for feeding, mating and egg-laying. Females begin to lay eggs one week after emergence. The eggs are laid in clusters of 20 - 30 underground next to a spurge stem. The females seek holes and crevices near plants to deposit their eggs, preferring to keep their ovipositor from contacting the soil. They continue to oviposit every three to five days and produce an average of 250 eggs over the season. The earliest emerging adults may have a high mortality rate. Of all the *Aphthona* species, *Aphthona czwalinae* has the shortest adult life span, usually about 2-3 weeks long. Females die shortly after the egg-laying period.

Fig. 1. *A. czwalinae* adult (credit Powell et al. 1994)

Egg:

The pale yellow eggs measure 0.7 x 0.4 mm and darken to brown-yellow as they mature. The eggs hatch after 16-17 days when temperatures are 21^{0}C. If the temperature drops to 10^{0}C, the eggs do not develop until optimal temperatures resume.

Larva:

Larvae are white and slender with brown heads and often occur in a comma-like position. After about 17 days of incubation, the larvae emerge and move onto small roots and begin feeding. The first instar of the larvae feed on latex-free fibrous roots. By the third instar they feed freely on main roots, consuming all but the toughest parts. Larvae development requires 127 degree days above 13.7^{0}C or a minimum of 88 days at 20.5^{0}C. The larvae create a soil particle chamber where they will hibernate over winter for a minimum of 4-months at 10^{0}C or less. Larvae that do not feed sufficiently before the onset of winter and those not exposed to the cold temperatures will not develop.

Pupa:

Pupation begins the following spring within the soil particle chamber.

Overwintering stage:

Usually they overwinter in the soil as mature larvae within soil cells. Eggs may also over winter if the temperatures are too low to hatch.

EFFECTIVENESS ON HOST PLANT

Larvae feed on root hairs, young roots and parts of the main root, reducing the plants ability to absorb moisture and accumulate nutrients. Overall plant height is reduced to 10-20 cm tall. Plants will produce fewer stems and most will fail to flower and produce seed.

Adults feed on leaves, terminals, margins and shoots. Each *Aphthona* species group feeds in a specific manner; flea beetles, including *A. czwalinae,* scrape the leaf surfaces and occasionally perforate the leaves. Though the feeding is quite impressive, it alone provides little impact. Dense populations can defoliate the plant significantly and reduce the plant's ability to photosynthesize, therefore, reducing the plant's nutrients required for healthy growth and reproduction.

HABITAT AND DISTRIBUTION

Native:

In Eurasia, *A. czwalinae* is found from central and eastern Europe to central Asia and eastern Siberia. It's most southern range occurs in eastern Austria and northwestern Hungary. Preferred habitat includes areas with mixed vegetation. It is found on mesic sites with loamy soils. Open dry sites appear to be less favoured.

North America:

A. czwalinae have established in several U.S.A. states, including: Colo., Iowa, Minn., Mont., Nebr., N. Dak., Oreg., S. Dak., Wash., Wisc., and Wyom. In Canada it has established in B.C., Alta., and Man. *A. czwalinae* will establish on prairie loam and clay soils with nearby water sources. They do well in warm summer climates on mesic loamy sites or on well-drained, sandy or rocky soils. They are more tolerant of shady conditions and heavier soils than *A. nigriscutis* and *A. cyparissiae*. They are capable of establishing at northern locations with shorter growing seasons. In Canada, they have withstood up to three months of spring flooding, but will avoid continued marshy sites. They show a strong relationship to sites where *Agropyron repens* and other vegetation grows taller than their host plant. Like all *Aphthona* species, they too compete poorly where ant populations are present. A climate with a 4-month period of temperatures of 10^0C or less is required for complete development.

British Columbia:

Limited releases have been made into the Bunchgrass, Interior Douglas-fir and Ponderosa pine biogeoclimatic zones. They have established in the Interior Douglas-fir and Ponderosa pine zones. It is speculated that the plants at the site in the Bunchgrass zone occur at a density that is less desirable to the flea-beetles.

Fig. 2. *A. czwalinae* release site in North Okanagan at Spallumcheen (Interior Douglas-fir zone)

BRITISH COLUMBIA RECORD

Origin:

The origin of *A. czwalinae* populations released in B.C. came from N. Dak., U.S.A., reared from Hungarian stock. They arrived in a mixed population with up to 20% *A. lacertosa*.

History:

A. czwalinae was first introduced to B.C. in 1995 in a mixed population with *A. lacertosa*. They were released at two locations, one in the north Okanagan near Spallumcheen and the other in the south Cariboo northwest of Clinton. In 1997, another imported shipment was released in the east Kootenays near Radium. In 2000, the first small field collection was made from what has resulted in the only collection site in B.C. Additional collections and field releases continued until 2005.

Fig 3. Short term established *A. czwalinae* release site near Kamloops (Ponderosa pine zone)

Field results:

The narrow adult emergence window requires frequent site visits to avoid missing the agents' peak period. In the southern interior this stage appears to last only one month. In 2000, the first field collection was made from the Spallumcheen site in the north Okanagan. Since this time, small collections have continued from here and have been used to establish and supplement two sites near Kamloops. The earliest adult sightings have been in late May at the Okanagan site. Despite the possibility that early emerging adults have high mortality rates, a collection and release made in May 2005 resulted in survival through to the following year. In 2012, dispersal sampling carried out in Spallumcheen showed very little self-dispersal taking place. *A. czwalinae* was found no further than approximately 270 m from the original releasing point. It is not known if the agent prefers to not disperse or if the distance between the plant patches was a deterrent. Dispersal sampling for *A. czwalinae* will continue in suitable habitats near the vicinity of established release sites. No efforts have been made yet to determine which *Aphthona* species occur in higher numbers at any of the established locations following release of mixed populations.

NOTES

- *A. czwalinae* appear to maintain very low densities.

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