Longitarsus jacobaeae (Waterhouse) Swiss biotype

INVASIVE SPECIES ATTACKED: Tansy ragwort (*Senecio jacobaea* L., *Jacobaea vulgaris* Gaertn.)

TYPE OF AGENT: Root feeding flea beetle

COLLECTABILITY: Not available for general distribution

ORIGIN: Switzerland

Unless noted otherwise, the information provided on this page relates to the Swiss biotype of *L. jacobaeae*.

DESCRIPTION AND LIFE CYCLE

Adult:

The adult males are 2-4 mm long while the females are 1 mm larger than the males. Initially golden-tan, they change to golden-brown when mature and finally to dark brown when old. They have enlarged rear legs that enable them to leap great distances[6].

Unlike the Italian strain, the Swiss variety adults do not require a diapause period. Adults emerge in late spring and feed intensively for about two weeks on plant foliage and then begin ovipositing. At 600 m elevation sites in Switzerland, the first adults begin to emerge the third week of June. Emergence at higher elevation sites are delayed by about one week for every 200 m increments. Adult emergence at the lower elevations (600 m) continues for two to three weeks, whereas at higher elevation sites the emergence period appears to continue over a longer span of time[11]. Females deposit their eggs on or near root crowns during late summer and can continue into early fall[4, 13]. The females lay 15 to 755 eggs, on average 346, during their ovipositing period[3].

Fig 1. *L. jacobaeae* adult (credit Powell et. al. 1994)

Egg:

Similar to the Italian biotype, *L. jacobaeae* eggs are oval and measure 0.66 x 0.3 mm[4]. Initially yellow, the eggs darken during the incubation period[5]. The eggs of the Swiss biotype delay hatching until the first warm days of the following spring[3].

Fig. 2. *L. jacobaeae* adult

Fig. 3. *L. jacobaeae* larva (credit Powell et al. 1994)

Larva:

L. jacobaeae develop through three larva instars. The first instar larvae begin to feed on the leaf epidermis, moving towards the leaf veins, down the petiole and towards the root crown[3, 11]. By the time the larvae reach the root, they are usually in their second instar. They will remain there and continue to feed through their third instar. Mature larvae have been known to exit their host plant root and travel more than 10 cm through or over the soil surface in search of new plants[3]. Elevation may affect larvae emergence dates which in turn may have some significance regarding their development within the plant[11].

Pupa:
Mature *L. jacobaeae* larvae exit the root and pupate in the soil[3].

Overwintering stage:
The *L. jacobaeae* Swiss biotype released in B.C. overwinters in the egg form[3].

EFFECTIVENESS ON HOST PLANT

The adult flea beetles feed on leaves causing impressive looking damage, but generally contribute little towards controlling the plant. The larvae feeding on the plant root from late spring into early summer causes the most impact.

Long-grooved formations within the roots are the result of larvae feeding on the outer layers[12]. In crowded or waterlogged conditions, larvae will feed on root crowns and within the petioles of lower leaves[5]. In Switzerland, larvae feeding damage was found on 72% of all plants[11]. Root feeding impacts the plant's stored energy reserves necessary to survive the winter. In general, it has been noted that the effectiveness of biocontrol may take up to six years before a significant change in plant density can be observed, for example, tansy ragwort plants may continue to survive but remain as a rosette for several years if they are damaged, nutritionally impoverished, or subjected to strong competition[7, 11]. However, McEvoy and Rudd demonstrated that *L. jacobaeae* rapidly reduced tansy ragwort's ability to survive which led to a sharp decline in plant abundance in a five year field study. *L. jacobaeae* feeding can indirectly affect seed production; however, this is more efficient when coupled with *Botanophila seneciella* or *Tyria jacobaeae* (in particular) feeding[1, 6].

Buried seed is not affected by *L. jacobaeae* feeding and the plant population may resurge if the number of flea-beetles decreases as a result of lack of food. A *L. jacobaeae* population can survive on few plants and their numbers will rise again when the flea beetles adeptly find new plants as the plant population increases[1, 6]. However, if the flea-beetle population is no longer present due to lack of food, the agent may need to be re-introduced into the area.

Fig. 4. *L. jacobaeae* adult feeding damage

Fig. 5. *L. jacobaeae* larva feeding damage

Fig.9. Typical *L. jacobaeae* adult foliar feeding

HABITAT AND DISTRIBUTION

Native:
The distribution of the *L. jacobaeae* Swiss biotype is relatively unknown. There is speculation that it occurs north of the Alps from eastern France to Austria and may also be present in central, northern and eastern Europe. At this time, scientists are confident in saying it is not present in western France, Spain and some areas of the United Kingdom where *L. flavicornis* occur[3]. In Europe, the Swiss biotype is found in areas with cool moist summers and early cold winters[5].

North America:
The Swiss biotype *L. jacobaeae* is predicted to establish at elevations between 300 and 1400 meters[3]. The flea-beetle does not tolerate heavy shade, however, it has been noted to populate plants growing in shade[2, 8].

In the U.S.A., a cold adapted strain of the Italian biotype was released in 1969 in Calif. but failed to establish. Later, beginning in 2002, attempts were made to establish populations with an additional Swiss biotype. These latter releases were successful in Idaho, Mont., and Oreg. and populations are now rapidly increasing at sites not suited for the Italian biotype[13].

British Columbia:

It is still too early to understand the preferences and limitations of the Swiss biotype of *L. jacobaeae* released in B.C. It is expected to tolerate higher elevations, earlier fall temperature changes, and prolonged snow cover. It is also expected to survive in areas that receive a minimum of -25° C during the winter[3]. Additionally, research has found that dense soil with low porosity can affect survival of soil-inhabiting larvae by restricting their movement[9].

Fig. 6. 2011 Naramata release site (Interior Douglas-fir zone)

At this time in B.C., the flea beetle is established at both release sites located at 1100 m elevation in the Okanagan, in the Interior Douglas-fir zone. The two sites are between 1.8 and 0.3 ha and originally occurred with densities ranging between two and 10 plants per square meter. Adults and evidence have been found at the sites with significant competing vegetation including shrubs, forbs and grasses as well as in stands with little to no competing vegetation. The aspects at the two sites are variable throughout each infestation and range between zero to 10 percent slopes. The most variable sloping site has aspects ranging from south through to north-northwest. Generally, *L. jacobaeae* require well-drained soils. However, the two B.C. established release sites occur in habitats with contrasting soil moisture qualities. The first release made exists at a site with a relatively overall deep organic layer and fertile clay loam soils. The second release site is located where the organic matter layer typically has been removed and in some areas mineral soil is exposed. These sites occur in a cattle range area that is grazed annually, however, the cattle are not expected to cause excessive damage to the infestation as they avoid feeding on the plants. The snow cover at both sites may be beneficial for insulating overwintering eggs. In 2017, the first field collection occurred and the resulting adults were released into a new habitat type in the Sub-boreal spruce zone on the island Haida Gwaii. It is still too early to determine the status of this most recent release.

Fig. 7. 2013 Naramata release site (Interior Douglas-fir

BRITISH COLUMBIA RECORD

Origin:

The *L. jacobaeae* Swiss biotype population source released in B.C. arrived from Montana from stock that originated near St. Imier, Canton Bern and Mettembert, Canton Jura, Switzerland.

Fig.8 *L. jacobaeae* adults

History:

The Swiss strain had been approved for release in Canada in the 1970s and released in B.C. in 1972 near Abbotsford, but, it did not establish (Winston). It had been permitted in 1993 for further imports to Canada, but, none were shipped. Following several failed attempts to establish the Italian biotype in the central Okanagan, additional research was conducted on the cold hardy Swiss biotype between 2005 and 2010 prior to the 2011 imports to ensure the data was to current standards. The shipment of *L. jacobaeae* Montana stock was received by Agri – Food Canada Centre (AAFC) in Lethbridge in June 2011. Part of this original shipment remained at the Lethbridge facilities specifically for rearing purposes and the remaining 72 adults were forwarded to B.C. and released at a field site east of Naramata (Okanagan) near Chute Lake. Same season monitoring occurred in June, August and September, but, no adults were observed. This site was supplemented with 702 adults in September of the same year and another 1114 adults the following spring. Monitoring continued through the 2013 spring and summer, but, again no adults or feeding evidence was found. Suspecting that the excessive spring soil moisture caused by snow melt and seasonal rains may have caused the population to fail, it was decided to release additional flea-beetles into a drier microhabitat at a nearby patch of tansy ragwort. In June 2013, the last available population of 898 adults were received from Lethbridge and released at the dry location. The site was revisited one month later and foliar feeding was

present near the release point. Fortunately, the 2011 seasonally moist release site finally yielded adult flea-beetles in 2014.

An operational trial involving both release sites and a control was set up in September 2013. The transects were sampled for vegetation cover and agent presence. Sampling results immediately began to show considerable foliar feeding evidence but few adults were observed at both sites. The transects were sampled yearly to gauge the agent's effectiveness. Data collection was complete by 2017.

Field results:

Annual monitoring of the two Okanagan sites has revealed stable flea beetle populations and in 2015 the host plants had visually declined. As well in 2015, the 2011 release site was monitored and adults were found dispersed 100 m away from the release point on plants occurring in open habitat, whereas in areas where the plants grew beneath mixed stands of deciduous and conifer trees, the agent was found to have only dispersed to 51 m. In August 2017, 1097 adults were collected from the Naramata site and then released on Moresby Island (Haida Gwaii).

NOTES

- The winter (Italian) and summer (Swiss) breeding biotypes of *L. jacobaeae* are widespread in Western Europe, interbreed and produce offspring with intermediate life cycles[5].

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