

Tyria jacobaeae (Linnaeus)

INVASIVE SPECIES ATTACKED: Tansy ragwort (*Senecio jacobaeae* L)

TYPE OF AGENT: Foliar feeding moth

COLLECTABILITY: Mass

ORIGIN: Switzerland, Sweden and France

DESCRIPTION AND LIFE CYCLE

Adult:

Tyria jacobaeae adults are attractive bright red and brown/black moths 15 to 22 mm long with a wingspan of 27 to 35 mm¹. Their forewings are black-grey with brilliant crimson red stripes on the upper and lower margins and two red dots near the tips while the hind wings are crimson. The brilliant colouring indicates the possibility of toxicity, therefore, discourages predators. *T. jacobaeae* has one generation per year. The adult moths emerge from pupation in late spring (May through June) and begin mating and egg-laying within two weeks¹. The females lay 73-285 eggs (few compared to other insect species) in batches of 10-150 onto the underside of rosette basal leaves^{3,11}.

Adults can be highly active, take flight when approached and have long irregular-patterned flights before resting. However, they do not travel far to find a mate⁹. They are attracted to light and their peak flights occur at dawn and dusk. When populations are high, the adults migrate in mass flight³.

Egg:

The eggs are 1 mm and are round with ribs³. Initially the eggs are yellow but they gradually turn transparent grey and hatch after several weeks³.

Larva:

The larvae changes colour through their five instars, from grey-green in the first instar to black with ringed orange-gold bands in the second through fifth instars^{3,8}. Larvae develop to their fifth instar in four to seven weeks and when mature, they measure 2.5 cm in length^{3,10}. The first instar feed aggressively on the undersides of the leaves before they make their way to adjacent leaves and bolting stems as they grow. They prefer to feed on flowers and leaves while tender stems are less preferred, but will also be heavily consumed when population numbers are high. Once the larvae have stripped the plant, they will crawl to additional plants to find more food^{1,3}. Larvae must consume sufficient plant material to pupate and need to be at least 140 mg to fully develop, some growing to 260 mg³. Mature larvae leave the plant and prepare to pupate¹.

The larvae tend to congregate at the tops of plants and drop from the plants when they are disturbed where they remain suspended by silken threads. When it is safe to do so, they climb up the thread and return to feeding. Larvae have been known to travel up to 800 m to find food when plant densities decrease⁴. Feeding on tansy ragwort causes larvae to store toxins which discourage vertebrate predation, however they are consumed by other insects and even initial establishment in B.C. was thought to be prevented by the predation of carabid beetles. They are also prone to attack by parasitic nosema³.

Pupa:

The pupae are dark reddish-brown and 20 to 25 mm long¹.

Overwintering stage:

T. jacobaeae overwinter as pupae under rocks, debris and in soil near the plant community^{1,5}.

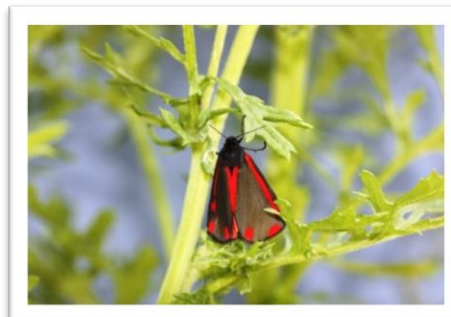


Fig. 1. *T. jacobaeae* adult



Fig. 2. *T. jacobaeae* larva



Fig 3. *T. jacobaeae* pupae

EFFECTIVENESS ON HOST PLANT

Adults do not feed on the plants. The larvae feed, in preferential order, on the flower buds, on leaves (often leaving the mid vein) starting with upper stem leaves, then lower stem leaves, and finally on rosette leaves and may even feed on the outer layer of the stem if food sources are insufficient. Peterson noted that 30-40 larvae can defoliate an entire plant⁹. In B.C., sites on the coast and in the Okanagan have had populations of the agent build to this extent and higher, completely defoliating infestations. This feeding has varying effects on the plant population. Cox and McEvoy noted tansy ragwort plants that have been defoliated early in the growing season have a greater compensation capacity to rapidly regenerate than those defoliated later which is positively correlated with the amount of moisture available to the plants with late summer rains that fall after the larvae have begun to pupate². However, they later determined that precipitation in Oregon does not decrease the combined ability of *T. jacobaeae* and *L. jacobaeae* to control tansy ragwort infestations⁶. It is speculated that plants in the dry interior Okanagan Valley should have a lower compensation capacity and may not regenerate as easily as those at the coast. The larvae also affect the plant's ability to photosynthesize and replenish energy reserves in the roots, potentially leading to plant death in winter conditions. Those plants that do regenerate from defoliation and are able to produce flowers, have lower seed viability than those with seeds produced in early-flowering plants¹⁰. *T. jacobaeae*'s effect on tansy ragwort may simply decrease when the moth's populations decline as a result of decreased food.



Fig. 4. Evidence of *T. jacobaeae* larva feeding on floral buds

HABITAT AND DISTRIBUTION

Native:

T. jacobaeae is native from Europe to west central Asia. In the Netherlands it occurs in sandy dune areas⁴.

North America:

The earliest releases of *T. jacobaeae* occurred in 1959 in the U.S.A. from populations that originated in France^{12, 13}. In the U.S.A., releases have occurred in Calif., Mont., Oreg. and Wash.¹².

Releases made in Canada between 1961 and 1962 originated from Switzerland. In 1961, 500 *T. jacobaeae* were obtained from Sweden and used for a laboratory culture⁶. Subsequent releases were made in Canada in 1966 and 1967 with populations from the U.S.A. sources that originated in France, but it is believed that these did not establish^{12, 13}. Releases occurred yearly in P.E.I. from 1964 to 1967, in N.S. from 1961 and 1963, and in B.C. from 1962 through 1965 and again in 1967 with imported stock. Field collections began in N.S. in 1970 and in B.C. in 1974. *T. jacobaeae* is considered established in B.C., N.B., N.S., and P.E.I.^{4, 5}.

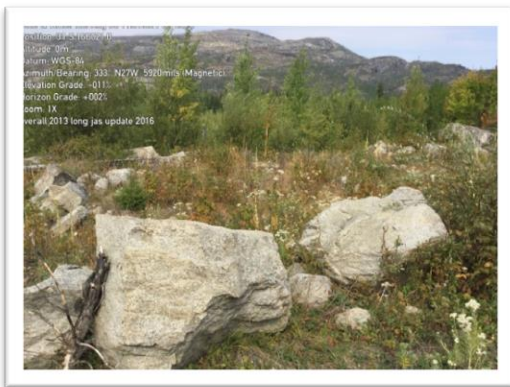


Fig. 6. *T. jacobaeae* dispersal area near Naramata. Interior Douglas-fir zone



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

T. jacobaeae does well in open, sunny, warm sites that have a plant density of at least 4 plants/m². It does poorly at sites in: shaded areas when plants are occurring under canopy; low plant density; steep canyons; areas adjacent to coastal elements; or areas that flood¹. Prolonged dry periods, especially during the moth's pupation period, are undesirable.

T. jacobaeae appears to be affected by seasonal temperatures. In cooler and wetter than normal spring months, pupation can be delayed, causing the adults to emerge later and delaying the ovipositing and larvae stages beyond normal emergence dates and peak periods. In turn, moths have been seen in late fall in colder areas in the U.S.A. such as the Cascade Mountains or some areas along the coast¹.

British Columbia:

In B.C., *T. jacobaeae* has been released, and established, into the Coastal Douglas-fir, Coastal western hemlock and the Interior Douglas-fir biogeoclimatic zones.

Larvae collections taken from Vancouver Island in 2008 and 2010 were able to survive in the new geographic and habitat locations where they were released in the central and lower Okanagan, whereas earlier releases into these same sites attempted in 1992 and 1994 did not.

BRITISH COLUMBIA RECORD

Origin:

The *T. jacobaeae* populations released in B.C. originate from Switzerland⁴, Sweden, and from the U.S.A. via France populations¹³.

History:

In 1962, *T. jacobaeae* was first released near Abbotsford. Collections from early established field sites in the lower mainland, Fraser Valley and Vancouver Island began in the 1970's and continued at regular intervals until 1996 while further collections took place in 2006. These *T. jacobaeae* were released mainly at additional sites on the lower mainland and Vancouver Island. However, in 1992 and 1994, collections were made from Abbotsford and released near Naramata / Chute Lake. Neither of these established. The collections made in 2006 included moving the moths into slightly new habitat such as on Texada Island. In 2008, a third attempt to establish the moth in the Okanagan took place and establishment was confirmed two years later. A subsequent release was made in the central Okanagan in 2010. At this time *T. jacobaeae* is considered to be quite widespread in most of the target plant locations within B.C.

Field results:

T. jacobaeae can be found dispersed throughout the Fraser Valley, Vancouver Island and several coastal islands. Sightings in the coastal community are limited to where the invasive plants grow in dense patches which can support the aggressive-feeding larvae. In the Fraser Valley, adults have been seen in mid-May and evidence of larvae feeding has been found through August. Larvae are found on Vancouver Island during July. The latest releases made in the Okanagan near Kelowna and Naramata have continued to maintain a population. There has been an observed significant decline in tansy ragwort plants at one of the *T. jacobaeae* release sites in the Okanagan Valley after only four years. Subsequent informal monitoring has shown that both Okanagan release sites have notably few plants. *T. jacobaeae* has been found to be quite dispersed within the patches and along the corridors of plants in these two tansy ragwort infestations. However, the moth population near Kelowna may be confined to the isolated infestation it was released into. In 2009, monitoring results at the Naramata site yielded 497 larvae in 15 minutes. The plants were heavily defoliated with multiple larvae still attempting to feed. In order to



Fig. 7. Established *T. jacobaeae* release site in Okanagan near Naramata, Interior Douglas-fir zone.



Fig. 8. *T. jacobaeae* dispersal area near Naramata, Interior Douglas-fir zone.



Fig. 9. Established *T. jacobaeae* release area near Nanaimo, Coastal western hemlock zone.



Fig. 10. Established *T. jacobaeae* release near Kelowna, Interior Douglas-fir zone.

preserve as many agents as possible, approximately 250 of the larvae were moved from the heavily defoliated plants onto plants with more available foliage within the same infestation.

NOTES

- When toxic alkaloids are consumed from host plants they accumulate within the larvae. The larvae and adults are usually avoided by birds and rodents, (red, orange, yellow and black colours warn potential predators)^{1,4}.
- *T. jacobaeae*'s effect on the plant can decrease if the pupae are attacked by disease as was found in Montana where two diseases were discovered affecting the pupae. It is speculated that in cooler temperatures where the pupae remain in the soil longer, their potential to disease exposure is greater (G. Markin, unpublished data, 1998, Montana).



Fig. 11. *T. jacobaeae* dispersal site in Fraser Valley, Matsqui area. Coastal Douglas-fir zone.

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