

Brachyterolus pulicarius L.

INVASIVE SPECIES ATTACKED: Dalmatian toadflax (*Linaria dalmatica* L.)
Yellow toadflax (*L. vulgaris* Bertn.)
Narrow-leaved Dalmatian toadflax (*L. genistifolia* spp. *dalmatica*)

TYPE OF AGENT: Seed feeding beetle

COLLECTABILITY: Mass

ORIGIN: Europe

DESCRIPTION AND LIFE CYCLE

Adult:

Brachyterolus pulicarius adults are shiny black, elongate to oval, 2.4 x 1.0 mm and covered with few hairs. Short wing covers expose the last abdominal segments of their bodies. Females have slightly longer covers than the males². Rear legs are darker than their other legs³. Near equal male/female ratio adults begin to appear in early May, usually when the plants are 15 - 20 cm tall. Adults congregate and feed on pollen, flowers and on young foliage, sometimes completely consuming terminals. Mating occurs in June when the plants begin to bud. Heavy feeding can cause significant flower loss, which may delay oviposition until the second flowering cycle in July. Eggs are laid individually or in small clusters of up to three into unopened floral buds. Adults live one to three months and populations begin to subside by August².

Egg:

The eggs are white and measure 0.6 mm long. Just prior to hatching, the eggs turn yellow².

Larva:

Pale yellow larvae with brown heads emerge and begin feeding on the reproductive parts of the flowers including pollen, anthers, ovaries and developing seeds^{3, 5}. The larvae are able to move between flowers and developing buds. Smaller flowers are less nutritious than larger ones and, therefore, the quantity of floral damage each larva destroys relates to bloom size. Older larvae will feed on seeds. Mature larvae move into the soil to pupate².

Pupa:

Pupation occurs up to 5 cm deep in the soil near the base of the host plant². The yellow pupae measure 2.8 x 2.0 mm^{2, 3}. The body is covered with few, but long brown coloured hairs, more notably on the head and the last abdominal segment. Each thorax segments has four pairs of spines that angle towards the head, whereas all the other body segments have a paired spines that project toward the rear³. In Europe, the pupae develop over three weeks, however, in Canada, they may overwinter as pupae².

Overwintering stage:

Most overwinter as pupae, however adults can overwinter in climates with long growing seasons such as those in Austria or in some U.S.A. states such as N.Y. where adults can emerge by September².

EFFECTIVENESS ON HOST PLANT

Adults feed first on early succulent terminal growth, causing extensive damage, and later move onto flowers and floral buds as they become available^{5, 6}. Stem and terminal damage initiates branching on toadflax species which can affect the floral stage. Yellow toadflax has the ability to delay flowering due to *B. pulicarius* feeding efforts, however, Dalmatian toadflax is only able to flower



Fig. 1. *B. pulicarius* adult (credit Powell et al.)



Fig. 2. *B. pulicarius* dispersal location in Dalmatian toadflax rearing plots at Kamloops Propagation Facility. Bunch grass zone.



Fig. 3. *B. pulicarius* dispersal location on yellow toadflax near Hope. Coastal western hemlock zone.

once per season and thus the feeding can reduce seed production². Yet, *B. pulicarius* prefers and also does better on yellow toadflax than on Dalmatian toadflax⁷.

Larvae feed on the reproductive parts of the plants and developing seeds. On yellow toadflax, *B. pulicarius* larvae feeding reduces the first bloom by 95%. This heavy attack causes delayed bloom until July or August. Adult and larva feeding continue to reduce bloom and bud development by 89% for the second bloom and 52% for the third bloom. Overall seed production is reduced by 74% and each beetle is responsible for destroying 76.5 seeds. A study based in Saskatchewan, noted the adult and larva feeding efforts had no effect on dried plant biomass or overall plant density².

B. pulicarius directly competes with *Rhinusa antirrhini* and *R. neta* (seed-feeding weevils). However, the combined efforts of *B. pulicarius* and *R. antirrhini* at fields sites are reported to provide increased control of yellow toadflax versus at sites where agent competition was low. Additionally, *R. antirrhini* can displace *B. pulicarius*, yet, *B. pulicarius* is more common earlier in the season, thus providing some effectiveness before the later emergence of *R. antirrhini*².

Heavy foliar feeding on Dalmatian toadflax can help reduce plant vigour and plant height, while also increasing primary branching and, subsequently increase flower production. However, the continued feeding by *B. pulicarius* on the new primary buds causes secondary branching while also decreasing the plants ability to flower. In a caged study, the results of the combined adult and larva feeding habits, seed production was decreased by 93%².

HABITAT AND DISTRIBUTION

Native: *B. pulicarius* is widely distributed throughout Europe².

North America:

B. pulicarius is believed to have entered into Canada by accidental introduction previous to when it was first noticed in 1919 in New York, U.S.A.⁷. *B. pulicarius* has successfully established in a wide variety of habitat types throughout North America. In 1953, *B. pulicarius* was found in all Canadian provinces¹. In the U.S.A., it is considered widespread and abundant on yellow toadflax and less common and in lower quantities on Dalmatian toadflax. However, Dalmatian toadflax sites in Idaho, Oreg. and Wash. appear to maintain higher populations of the agent⁷.

B. pulicarius was intentionally redistributed in 1989 in Canada onto yellow and Dalmatian toadflaxes. In 1992, 2000 adults were collected from Dalmatian toadflax in Canada and shipped to the U.S.A for release onto Dalmatian toadflax in Idaho, Mont., Nev. and Wyo. Additional adults were shipped in 1997 and released onto yellow toadflax in Mont.⁷. Redistributions are no longer recommended or carried out due to the competition and with no added benefits from *R. antirrhini*^{7, 8}.

British Columbia:

Only two *B. pulicarius* releases have been made in B.C., both occurring on Dalmatian toadflax. The first release was made near Grand Forks in 1989 and the second release was made near Fort St. John in 2004. No further assisted redistribution efforts have been taken. *B. pulicarius* is well established and dispersed in B.C.

The two releases made in B.C. are in the Boreal white and black spruce and Ponderosa pine biogeoclimatic zones. *B. pulicarius* has subsequently been found dispersed in many biogeoclimatic zones in B.C. including in the Bunchgrass,



Fig. 4. *B. pulicarius* dispersal location on yellow toadflax near Malakwa. Interior cedar hemlock zone.

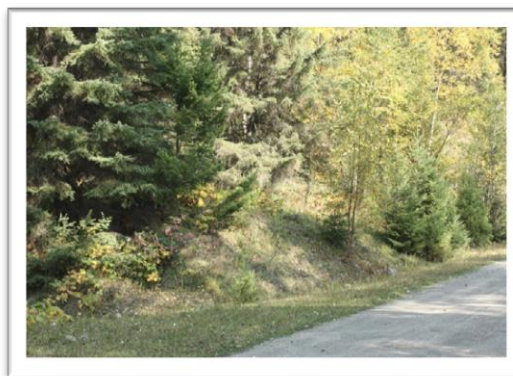


Fig. 5. *B. pulicarius* dispersal location on yellow toadflax near Whitecroft. Interior Douglas-fir zone.

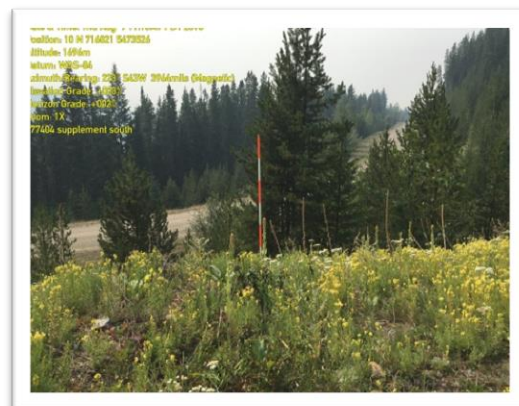


Fig. 6. *B. pulicarius* dispersal location on yellow toadflax near Hedley. Montane spruce zone.

Coastal western hemlock, Interior cedar hemlock, Interior Douglas-fir, Montane spruce, Ponderosa pine and Sub-boreal spruce biogeoclimatic zones. The status of the site in the Boreal white and black spruce zone is not known at this time.

BRITISH COLUMBIA RECORD

Origin: It is unknown where the adventive source of the *B. pulicarius* populations found in B.C. originated.

History: *B. pulicarius* was first discovered in B.C. on Dalmatian toadflax in 1953^{7, 8}.

Field results:

B. pulicarius has self-dispersed and is commonly found throughout the toadflax infestations and in B.C. it appears to have no preference for one species of plant over the other. Early reports show that toadflax inventory and *B. pulicarius* dispersal occurred in many areas of the province. *B. pulicarius* is often found sharing sites with other toadflax agents including *Rhinusa spp.*, *Calophasia lunula*, and *Mecinus spp.*

Collection for redistribution:

B. pulicarius is widely dispersed in B.C. Although it is not actively collected and released, adults can be swept from plants in early summer, although aspirating adults directly from the host plants is efficient and less destructive.

NOTES

- At one time it was believed that there may be two *B. pulicarius* biotypes, however, studies later proved there was only one species type^{7, 8}.
- Early emerging adults have been observed feeding on the pollen of early spring flowers of dandelion and strawberry, doing so without causing any damage².
- A scientific detailed description of the life cycle stages of *B. pulicarius* can be found in the document: A European Nitidulid, *Brachyterolus pulicarius* L. (Coleoptera, Family Nitidulidae) by G.E.R. Hervey.

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Fig. 7. *B. pulicarius* dispersal location on yellow toadflax near Chase. Ponderosa pine zone.



Fig. 8. *B. pulicarius* dispersal location on yellow toadflax near Mc Bride. Sub-boreal spruce zone.