

Urophora affinis Frfld.

INVASIVE SPECIES ATTACKED: Diffuse knapweed (*Centaurea diffusa*)
Spotted knapweed (*C. biebersteinii*)

TYPE OF AGENT: Seed feeding fly

COLLECTABILITY: Mass

ORIGIN: France and Russia

DESCRIPTION AND LIFE CYCLE

Adult:

The 1 - 3 mm long flies have dark bodies and clear wings marked with faint dark bars. When at rest their wings are often held close in line with the body. Females can be identified by their long, pointed, black ovipositor. *Urophora affinis* adults emerge in June and July which coincides with the flower budding stage. Adults mate immediately and start to lay eggs between immature flower bracts within three days. Each female lays 120 eggs. There is a narrow egg-laying phase for *U. affinis* where the host plant's floral buds must be a specific size to ensure egg hatching coincides with a particular stage necessary for larvae development.

Egg:

The eggs incubate for 3 - 4 days.

Larva:

Creamy, white larvae penetrate into the flower head and develop into a plump, 'barrel-like' shape. The plant objects to the intruding larvae and over 10 - 15 days produces a woody gall around each of them. The galls are lined with nutritive cells that the larvae feed upon. After 28 days, all the cells inside the gall will be consumed and the larvae development will be complete. Under normal conditions 1 - 2 galls are produced in diffuse knapweed, whereas, 2 - 5 galls are produced in spotted knapweed. The hard galls provide protection for the larvae and pupae during their development from most other seed-feeding insects.

Pupa:

Pupation occurs in the gall and takes two more weeks or over the winter. The earliest to pupate will emerge as new adults that will go on to produce a second generation. However, most larvae need a cold phase to induce pupation so they will generally overwinter inside the gall and emerge the following spring when the flower buds are about 3 mm long.

Overwintering stage:

Most larvae will overwinter in woody galls in the seedheads and pupate the following spring in May.

EFFECTIVENESS ON HOST PLANT

The larvae in the seedheads create hard, woody galls which inhibit seed production and are capable of reducing seed by 75 to 90%. Gall formation depletes root reserves and over time will weaken the plants, resulting in fewer and smaller floral stalks.

HABITAT AND DISTRIBUTION

Native:

Its native distribution occurs in central and eastern Europe and in Turkey.

North America:

Canada received the first *U. affinis* population in 1970. The Canadian populations originated from Russia and France and were released in B.C. Subsequent populations resulting from these early releases were later collected and redistributed in Alta. in 1976. In Canada, *U. affinis* is common in B.C., Alta., Ont., and Que.



Fig. 1. *U. affinis* adult female with prominent ovipositor (credit Powell et al. 1994)

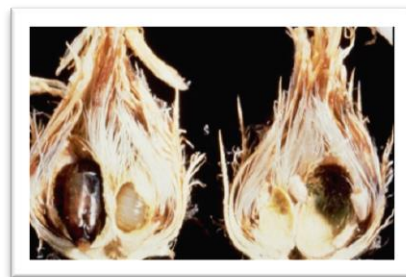


Fig. 2. *U. affinis* larva in woody seedhead gall (credit Powell et al. 1994)

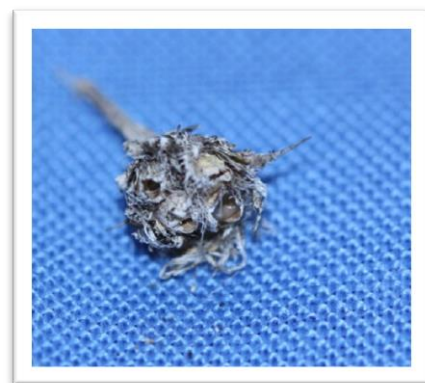


Fig. 3. *U. affinis* woody gall cluster

In 1973, populations that originated from Austria, France and Russia were released in the U.S.A. Some of the Russian populations arrived via Canada. The imported populations were released on diffuse and posted knapweed starting in 1973 in Calif., Colo., Idaho, Mont., Nev., Oreg., Wash., and Wyo. *U. affinis* spread naturally from intentional releases made in Calif., Oreg., and Utah onto squarrose knapweed.

U. affinis is adaptable to a wide variety of knapweed habitats. It does show a preference for mesic sites, appears to do best in wetter years, and prefers spotted over diffuse. It readily disperses to nearby stands, however, it lacks a host-finding ability when it occurs in isolated situations.

British Columbia:

U. affinis releases have been made and found established and/or dispersed in the Bunchgrass, Coastal Douglas-fir, Interior cedar hemlock, Coastal western hemlock, Interior Douglas-fir, Montane spruce, Ponderosa pine and Sub-boreal spruce biogeoclimatic zones.

BRITISH COLUMBIA RECORD

Origin:

U. affinis populations released in B.C. originate on spotted knapweed growing in the French Rhine Valley between Basel and Mulhouse. Populations also originate from Russia, but it is not clear what knapweed species it was harvested from.

History:

The first *U. affinis* release in B.C. was made in 1970 with 297 adults at Walhachin. The following year 860 adults were received and released at new field sites near Chase (87) and Pritchard (493) and a supplement population was added to the Walhachin site (280). These sites established very well and have contributed to agent dispersal. In 1986, several hundred larvae-infested seed heads were collected and redistributed throughout the province. There was a six year lapse before any further field collections and releases were made. The field collections and releases carried out in the 1990's focussed on moving the flies into new habitats, particularly in north western B.C. and onto Vancouver Island. For many years, the last assisted and intentional redistribution effort occurred in 1996. Incidental releases resulted between 2011 and 2016 when *Chaetorellia acrolophi* larvae and pupae were collected in seed heads and then released into new geographic locations. *U. affinis* was also present in the heads and released at the locations.

Field results:

U. affinis is commonly found wherever the host plant grows in the southern interior, existing with other seed and root feeding bioagents. Larvae have been found in spotted and diffuse knapweed seed heads, however, it appears to prefer spotted knapweed. As the two seedhead feeding flies, *U. affinis* and *U. quadrifasciata* populations have merged across B.C. and occupy many of the same infestations, field collections and subsequent releases were often recorded as *Urophora* spp.

Collection for redistribution:

Adults can be swept and aspirated in June and July. Clipping knapweed stems with infested seed heads from August to October is the most efficient method for large collections, however, this method can promote the spread of seeds. Tie clipped stems to a stake for overwintering to prevent them from blowing away. Best success has been found when *U. affinis* is transferred to the same invasive plant species from which it is collected. When seed heads



Fig. 4. *U. affinis* dispersal area near Merritt (Interior Douglas-fir zone)



Fig. 5. *U. affinis* general release habitat at Walhachin (Bunchgrass zone transition to Ponderosa pine zone)



Fig. 6. *U. affinis* dispersal site near Yale (Coastal western hemlock zone)



Fig. 7. *U. affinis* dispersal site at Malakwa (Interior cedar hemlock zone)

are used for releasing, other seed head feeders are often present, therefore, a baseline count of each agent species should be taken to identify their presence.

NOTES

- Each seed head feeder has specific requirements, allowing multiple bioagents to exist in a single seedhead. When occurring on the same sites as *U. quadrifasciata*, *U. affinis* usually dominates. The two species are more productive in conjunction with other agents than alone.
- Spotted knapweed produces few immature buds for *Urophora spp.* to produce its second generation within, whereas diffuse knapweed will continue to produce a succession of flowers until frost.
- *U. affinis* is known to also feed on squarrose knapweed (*C. virgiata spp. squarrosa*), although this knapweed species is not known to be growing in B.C.

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