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# INSECTS

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## NEW LARGE INSECT GALL ON CANADA THISTLE IN SASKATCHEWAN

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From 1974 to 1980, while an employee at the Regina Research Station, Agriculture and Agri-Food Canada, I released the European Canada thistle stem-gall fly (*Urophora cardui*) on Canada thistle (*Cirsium arvense*) in six provinces.<sup>1</sup> It was hoped that the galls produced by the larvae of this fly would reduce this noxious weed's vigour and aid in its control. The fly became established initially only east of Manitoba but not in western Canada. From studies in Europe and results of our releases, we learned that the fly thrives best in habitats close to water and trees. Also it was found that in New Brunswick the larvae had become more winter hardy in only eight seasons than the original release stock which was collected in the Rhine Valley of Germany and France. Furthermore, larvae from galls collected near Helsinki, Finland, were found to be even more winter hardy than the New Brunswick population.

Armed with this knowledge, a new attempt was made to establish the fly in Saskatchewan. A favourable habitat was found in Echo Valley Provincial Park. In 1984, over 3042 flies were released from galls collected in New Brunswick, and in 1986, 287 flies from galls collected in Finland. The release site, an abandoned lagoon, is located in the portion of the park west of Highway 210. The lagoon is located about 60 m south of the lake shore and can be reached by following a hiking trail

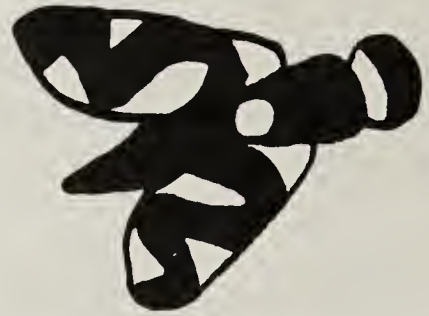


Figure 1. Female Canada thistle stem-gall fly on a Canada thistle leaf. (Traced from a photograph.)

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for about 600 m leading west from the northwestern-most picnic and parking grounds.

### Description of the Fly and Life History.

The Canada thistle stem-gall fly belongs in the family of fruit flies (*Tephritidae*). It is slightly larger than our common house fly (*Musca domestica*). Each wing is adorned with a prominent black "W" pattern (Fig. 1). In Saskatchewan, most adult flies emerge from their galls in June and July. The males emerge first and establish a territory on a Canada thistle shoot. Often, they fight off any other male intruder by waving their wings, showing off the prominent "W" pattern and physically shoving rivals off the leaf with their heads. They also smear a strong smelling pheromone (a communication chemical) onto the leaves, the purpose of which is not entirely understood. Any female landing in the male's territory is welcomed and often courted with much





Figure 2. Large gall caused by the Canada thistle stem-gall fly.

waving of the wings, and soon copulation occurs. The females lay batches of eggs among the tiny, terminal leaves of the main or side shoots. The emerging larvae tunnel into the stem where they induce formation of a gall containing nutritive tissue, the food of the larvae (Fig. 2). The gall is multi-chambered with each larva developing in its own chamber (Fig. 3). The tunnels fill with callus and serve as exit routes for the adult flies in spring. Galls may be small and globular, 1 cm in diameter, containing only one larva, or elongated and large, up to 6 cm, containing up to 28 larvae with an average of 6. We found a maximum of nine galls per thistle shoot. Larvae are pale white, and exhibit a dark, anal plate when mature (Fig. 3). Galls are green during their growth phase in June and July and become lignified, hard and brown in colour in August. The mature larvae overwinter inside their galls. During the winter and spring the galls partially deteriorate. When warm temperatures return, penetrating air allows the larvae to pupate. Soon the flies emerge from their pupae and squeeze their way out



Figure 3. Gall cut open to show five mature larvae in their individual chambers.

through the exit tunnels using a ptilinum (a tough protrusile sac on their forehead) to push the callus aside which has become soft and spongy by spring. With a sharp knife, larvae can be dissected out of the galls in fall. Exposed to air, mature larvae will immediately pupate and flies will emerge in about four weeks. Thus, it is a wise arrangement that the gall is airtight in fall which prevents untimely development and emergence. Canada thistle is the only North American host plant for this gall fly.

### Population Development and Habitat.

The population of the gall fly was followed from 1984 to 1994 in the same three areas, the abandoned lagoon, a sunny location, the narrow, shady trail between the lagoon and the western most parking and picnic grounds of the Park, and along the shore from the picnic ground going west about 500 m, which is a cool, moist habitat. During the hot and dry eighties, most galls were found near the shore, 82% in 1989 and 63% in 1990. The total number of galls



reached a peak of 1661 in 1990. Up to 9 galls per thistle stem (average 5.6 galls) or 6.2 galls per sq m were found in 1989 in the most favorable habitat, i.e. near the lake shore. The summers of 1992, 1993 and 1994 were characterized by below normal temperatures, and above normal rainfall occurred in 1991, 1993 and 1994 and the gall count crashed to 96 in 1993 and 76 in 1994. Furthermore, the surviving population was found mostly on the relatively warm but in those years sufficiently moist release site, the abandoned lagoon, where 90 (87%) of the galls were found in 1993, and 73 (96%) in 1994.

It appears that warm temperatures are important for the adult flies, and moisture for the larvae. The flies are inactive below 20°C and their activity peaks at 30-34°C. From 1992 to 1994, 30°C was reached on an average of only 1.7 days in June, and 1.3 days in July, while from 1984 to 1990, 30° was reached on an average of 5 days in June and 6.3 days in July (Environment Canada Weather Station at Regina, Saskatchewan). On the other hand, habitat of the larvae influences winter survival. We compared the rate of spring emergence of adult flies from larvae collected on the release site, which is relatively dry, with that of larvae collected along the shore, where it is relatively moist. Based on data collected during three years in the dry,

warm eighties, in April only 28% of the larvae from galls collected on the dry site emerged into healthy adult flies, compared with 81% of the larvae from galls collected along the shore. Thus, larvae which developed and overwintered in a favourably moist habitat survived the winter far better than those from a dry habitat.

Galls can also be found near the active, new lagoons close to the south border of the Park. By 1993, galls had spread 4 km east along the lake shore and 2.5 km south from the release site.

The Canada thistle stem-gall fly does not contribute to the control of Canada thistle, but it is an interesting addition to our insect fauna.

### **Acknowledgement**

I want to thank Jo-Anne Derby and Karen Sawchyn for their help in field surveys and laboratory rearings.

1. PESCHKEN, D.P., J.L. DERBY and D.T. SPURR. 1997. Establishment of *Urophora cardui* (Diptera: Tephritidae) on Canada thistle, *Cirsium arvense* (Asteraceae), and colony development in relation to habitat and parasitoids in Canada. In: Dettner et al. (eds.) Vertical Food Web Interactions. Ecological Studies Vol. 130: 53-66.



Ice insects of the order Grylloblattodea are killed by the heat of a human hand.

Snow mosquito young may hatch under the snow.