



Common name

nasal bots, skin warbles, maggots, myiasis

Scientific name

caribou bot fly, *Cephenemyia trompe*; bot flies of deer, moose & elk, *Cephenemyia apicata*, *Cephenemyia jellisoni*, *Oestrus ovis* (this species may live in bighorn sheep); caribou warble fly, *Hypoderma tarandi*; rodent warble flies, *Cuterebra* spp.

(only those species that live in western Canada)

What's Bugging Wild Critters?

Fact sheet # 44:
Fly Larvae



Significance

Larvae of these flies live in the tissues of various wildlife species. They rarely cause significant damage but they look quite gross to most folks. They are NOT infective to humans or livestock.

What? Where? How?

Bot flies and warble flies often have strict habitat requirements and generally can be grouped by where they live or who they live in. Three major groups of flies in western Canada have larvae that live in tissues of other species: nasal/pharyngeal bot flies (in the nasal passages and back of the throat of various ungulates), cervid warble flies (under the skin of ungulates) and rodent bot flies (under the skin of small rodents).

Like other fly larvae, bot and warble larvae are all relatively short and fat sausage-like maggots that feed exclusively on a soup of digested cells and fluids. Unlike most other flies, bots and warbles require that the cells and fluids come from living animals. Bot and warble larvae live in tissues of the upper respiratory system where they have direct access to air. Or they live in individual capsules under the skin, each with a tiny breathing hole to the surface. The adult flies live free and look much like big hairy houseflies.

Transmission Cycle

Nasal bot flies: Adult bot flies live for only 2-3 weeks after they emerge. In order to make up for their short life, they have evolved marvellous ways of improving their chances of maintaining their species.

Female flies continually search for males. Meanwhile, male flies gather on high points

FLY LARVAE: BOTS AND WARBLER in Alberta

and check constantly for passing females. When a female flies by, a male grabs her, wrestles her to the ground, and mates with her (seems females have no choice!).

Fertilized eggs mature rapidly in the female flies and even develop to the first larval stage. Mated females are attracted to carbon dioxide, which occurs in high concentration in ungulate breath. So the female changes her search behaviour and starts looking for an ungulate. When she finds a suitable individual, the female fly shoots her larvae onto its muzzle (nose) or into its eyes or she may inject eggs under the skin of its face. And she does this in the blink of an eye! To improve success, she includes a little glue with each larva to make sure it does not dry out or fall off.

The larvae are programmed to move towards heat, away from light, and away from the ground. As a result, they quickly move into the eyes, mouth, or nose. They stop and develop for a little while in the nasal passages and later move on to the tissues at the back of the throat.



Fly Larvae in Alberta

(various species)

You might wonder why the larvae are not just blown out of the nose or swallowed down the throat. It so happens that the larvae have a series of stiff bristles on their outer surface. Also, there are two massive hooks near the mouth. The hooks and bristles act as anchors that keep the larvae in place regardless of what the ungulate does to try to get rid of them.

When fully mature, the larvae retract their bristles, slide out of the tissues, and are coughed up and spit out of the mouth or sneezed out of the nose. Once on the ground, they burrow into the dirt, pupate, and eventually pop out as an adult fly.

Caribou warble flies: These flies also have a short life as an adult. Males gather along dry streambeds or roadways where they sit on tall grass or shrubs and wait for passing females. In the Arctic, they use rock piles instead of tall grass!

Mated females actively search for caribou, using increased CO₂ as a guide. Once they find a caribou, the females land and glue their eggs

close to the base of a hair. The hair provides protection for the female and her eggs and keeps the eggs from being groomed away.

The eggs are adapted for optimum development and survival in the exact temperatures and moisture conditions found at the base of caribou hair! Hatched larvae move towards heat and this takes them down to the skin surface, where they immediately start to tunnel. Once under the skin, they migrate to the caribou's back, stop moving, and create a tiny breathing hole through the skin.

The caribou responds by building a thin wall around each larva to prevent any further migration. This little capsule is the actual "warble".

The larvae develop within the capsule, and in late winter or spring are ready to pop out through the hole in the skin, fall to the ground, and burrow into the grass or litter. They eventually develop into adults which emerge from the pupa and fly away, immediately looking for other flies to mate with. If the emerging fly is a female, she already has fully developed eggs ready to be fertilized by a male.



Rodent bot flies: Adult males gather to wait for passing females. Unlike nasal bot flies, the males have to wait until the eggs develop in newly emerged females—mating can only occur after the eggs are ripe. Females lay clusters of eggs in the environment but actively choose areas where rodents are likely to occur. This includes burrows, dens, nesting materials, and tunnels that have chemical evidence of the preferred rodent species.

Larvae develop within the fertilized eggs in about a week; however, they do not hatch until they detect a sudden increase in temperature and carbon dioxide (indicating the presence of a rodent). Eggs in the cluster do not all hatch at once—a protective mechanism in case the warmth and CO₂ comes from a rodent unsuitable as habitat for the larvae. The tiny-hatched larvae are attracted to moisture and heat and are thus well adapted to finding and entering rodents through their eyes, nose or small skin wounds. The larvae can digest their way through almost any tissue inside the rodent as they migrate to their preferred site in the body. They generally end up under the skin in the groin or chest regions.



Distribution in Alberta

Nose bots and caribou warbles are well established throughout the circumpolar range of caribou. Both are present in caribou in Alberta. Warbles are most conspicuous in late winter when the larvae reach their maximum size (up to 2.5 cm) and turn golden brown just before they drop out of the skin.

Caribou warble larvae occasionally occur in moose in areas where moose range overlaps with that of caribou. In moose, the larvae show up as small (5 mm), oval, yellow to black, firm nodules on the underside of the skin. Tanned hides of such moose have tiny round holes—the breathing holes used by the larvae. There is one case of warbles in a mule deer in Alberta. It was apparent that the habitat in mule deer was barely able to support the tiny shrivelled larvae. And some of the larvae ended up in the deer's lungs.

In contrast, nose bots are common in white-tailed and mule deer throughout central and northern regions of the province. They occur less frequently in moose and elk. The larvae are relatively small during the hunting seasons and thus are often overlooked. Besides, who really looks closely at the back of their deer's throat?

Bot larvae in rodents rarely are seen but probably occur quite frequently. In Alberta we have seen the larvae in red squirrels, deermice, muskrat, chipmunks, meadow voles, and ground hogs. Dave Gummer (Provincial Museum) saw them fairly regularly in local populations of kangaroo rats in southern Alberta (up to 34% of 454 individuals in the Suffield National Wildlife Area). Most kangaroo rats provide habitat for 2 or 3 larvae but some carry up to 11. Just think about the competition for space among all those larvae under the skin of one tiny kangaroo rat!



Fly Larvae in Alberta

(various species)

Importance for Wildlife Management

Bot and warble flies are natural components of ecosystems around the world and their larvae occur in a wide range of wildlife species. Caribou, in particular, are preferred habitat for both bots and warble larvae. Not surprisingly, the buzzing of adult flies is enough to send caribou into a frenzy, resulting in a number of side effects.

The caribou use up significant amounts of stored energy while trying to get away from the flies. They may abandon feeding grounds and move to windy hillsides or snow patches where flies are less active. This reduces their fly infestations but also reduces foraging opportunities.

Avoidance of flies is considered one of the factors associated with the post-calving migration of caribou herds. Similarly white-tailed and mule deer react violently to the buzz of bot flies.

There is some evidence that fly larvae may have subtle effects on their host habitat. Warble capsules may be associated with a drain on the immune system and thus increase the risk of disease or infection. In situations of nutritional stress (i.e., when suitable or available food is scarce), increased numbers of warble larvae may further weaken an infected individual.

Summary

Nasal bots, skin bots, and skin warbles are larvae (maggots) of flies that infect a variety of big game, especially caribou and deer, as well as various rodents. Some species are irritating but apparently no species is seriously harmful.

Additional Information

Colwell, D. D. (2001). Bot flies and warble flies (order Diptera: family Oestridae). Chapter 3 in *Parasitic Diseases of Wild Mammals*, Edited by WM Samuel, MJ Pybus, and AA Kocan. pp. 46-71.

Gummer, D. L., Forbes, M. R., Bender, D. J., and Barclay, R. M. (1997). Botfly (Diptera: Oestridae) parasitism of Ord's kangaroo rats (*Dipodomys ordii*) at Suffield National Wildlife Area, Alberta, Canada. *Journal of Parasitology*, pp. 601-604.

Some rodent bot larvae may seriously interfere with reproduction. *Cuterebra emasculator* in eastern chipmunks and squirrels occurs in the scrotal sac and may affect production of sperm in some individuals. Similarly bot fly larvae may lead to reduced growth, reproduction, and survival of individual kangaroo rats—a species of special concern in Alberta and across Canada.

However, in general, bot and warble fly larvae are not a significant management concern.

Public Significance

These fly larvae do not infect humans, livestock, or pets. Note that the warbles in caribou are NOT the same species as the one found in cattle.

Prevention/Control

Prevention or control of bots and warbles in wildlife is neither possible nor warranted. These animals are a natural part of the biodiversity of our ecosystems. Limited situations involving endangered species may be of special concern, although control measures probably are not feasible.