

# Research News

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## Getting to the root of the maggot problem

BY SEAN MOORE  
Research Promotion

Although his wife calls them animated eyelashes, the small beetles Neil Holliday studies may be the finest assassins Canadian canola farmers could employ, but the alien species hasn't earned its visa yet.

The beetle is *Aleochara bipustulata* and it has no common name. It hails from Europe, is predominantly black, and both the adults and larvae feed on the cabbage root maggot, a pest that came from Europe and, in some years, causes Alberta \$100 million in lost canola yields.

"The cabbage root maggot first showed up in prairie canola in 1958 and it was ignored until 1980, which was when it began destroying canola in Alberta. Since then, it's been on the rise, in a general trend sort of way, throughout prairie Canada," Holliday, Head of the Department of Entomology, said.

The cabbage maggot (*Delia radicum*) attacks the crop in the middle of the season. Adult females lay eggs at the base of the thickest stems they find and their larvae burrow down to feed on the roots. No legal insecticide works against them so the only useable tactics come from the playbooks of cultural and biological control.

Cultural controls involve changing crop densities and rotations to make canola crops less attractive to egg-laying females. But these options require farmers to make various economic sacrifices so are unlikely to be adopted. Biological control is thus the most feasible option and Holliday has been examining it since 1999.

To deal with a pest from Europe, you go to Europe. A graduate student collected, recorded, and tagged a total of 25,000 cabbage maggots from Europe and the Canadian Prairies and individually reared them to see what parasites emerged. Most parasites showed up on both continents, but only the European maggots played host to *Aleochara bipustulata*.

The odd thing is, long ago



Photo by Sean Moore

Neil Holliday, Head of Entomology, examines a container of *Aleochara* beetles. Since 1999 he has been studying if, and how, the beetle *Aleochara bipustulata* could be used to arrest the spread of the cabbage root maggot, a pest that can destroy canola crops.

entomologists recorded *A. bipustulata* to be present in Canada.

Before 1986 there was no certain way to determine whether you held an *A. bipustulata* in your hand, or one of its relatives. But in 1986 the distinguishing characteristics were found to be in the genitalia. So Holliday borrowed over 150 beetles from museums in Canada and the U.S. – in fact, all the known specimens from North America that were labeled as *A. bipustulata* – and dissected them. None, he found, were what their label indicated – they were all *A. verna*, a species already known to be in Canada.

*A. bipustulata* attacks cabbage maggots in two ways. The adults feed on the eggs (and sometimes on larvae), and *A. bipustulata* larvae invade and eat maggot pupae.

Many aspects of this beetle, like its cold-hardiness, make it a good candidate for introduction. So Holliday's lab is investigating the would-be outcomes of its introduction.

To see if *A. bipustulata* would add to overall parasitism rates, it was put in cages of maggot-infested canola with *A. blatticola*, a parasite that already resides in Canada and can kill 40 per cent of cabbage maggot pupae. When *A. bipustulata* was added to the mix, parasitism in cages increased from 35 per cent to nearly 60 per cent of maggots.

"That increase could tip the balance and be enough to curb the long-term trend of increase in the cabbage maggot population," Holliday said.

But would *A. bipustulata* parasitize non-target species too? To find out one of Holliday's students put *A. bipustulata* in vials with selected species of pupae. Called the no-choice test, the larva can attack the pupa or starve, which is a rather rigorous indicator of its tastes. Out of 17 non-target species (ones not intended to be harmed by biological control) it

entered only four, suggesting it is not polyphagous, which adds yet another point to its immigration file.

But past literature suggested this beetle would eat a beneficial insect found in forests. Sure enough, it invaded these pupae in the laboratory. But later experiments showed this beetle does not venture into forests, and so would not encounter the beneficial species in the wild.

Holliday's lab is about to start studying how chemicals, sulphurous ones in particular, impact the beetle's behaviour with a goal of understanding why and where the beetle travels, and how it finds its prey.

Some people may think it unwise to introduce alien species to an ecosystem on purpose. But Holliday notes that classical biological controls are employed on 10 per cent of all world crops, and deleterious errors have occurred in less than two per cent of the 5,000 introductions already made. His role in this matter, he said, is to provide information so regulators can make informed decisions, both now and in the future.

"By publishing all the information, people can come back in 2020 if the problem is worse, and decide if the benefits of introduction then outweigh risks. The information doesn't die, it will still be there."



Photo by Lars Andreassen

An *Aleochara bipustulata* adult feeds on a cabbage maggot larva.

## Bringing Research To Life

Research News is Published  
by the Office of the Vice-President (Research)  
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