

Chlorpyrifos Resistance in Cabbage Maggot (*Delia radicum*)

Introduction

Vegetable brassicas, such as cabbage, broccoli, cauliflower and rutabaga, are well suited to the cool climates of many regions across Canada, and are grown in every province. The cabbage maggot (*Delia radicum*), is widespread through temperate regions and is one of the most chronic and challenging agricultural insect pests facing vegetable growers in Canada (Dixon et al. 2014). For more information on cabbage maggot, please visit <http://www.perennia.ca/wp-content/uploads/2018/04/cabbage-maggot.pdf>

Insect resistance often occurs due to the over-emphasis on control agents with similar modes of action. In British Columbia, in 2013, 75% of the cabbage maggot populations tested in three growing regions were found to be chlorpyrifos-resistant. Agriculture and Agri-Food Canada Pest Management Centre's Pesticide Risk Reduction Program, in conjunction with Perennia, is undertaking a new project to determine the status of chlorpyrifos-resistance in Nova Scotia. Even if the current situation in Nova Scotia is not as dire as that in BC, the availability of only one effective active ingredient means resistance in cabbage maggot populations is almost certain to become more widespread in the future. There are few, if any, new insecticides currently under development to address this pest.

Management of the cabbage maggot is challenging and integrated pest management (IPM) tools remain rudimentary. Despite a strong theoretical understanding of cabbage maggot ecology, there are few economic thresholds and limited management options. This, combined with the reliance on a single insecticide, leaves growers in an economically vulnerable position. Canadian researchers continue to work on finding effective IPM tools for cabbage maggot. Uptake of these technologies has so far been limited, although they may increase if resistance to chlorpyrifos increases or the product is deregistered.

Also relevant to IPM decision-making around cabbage maggot is the prevalence of other *Delia* species in vegetable brassica fields and their role in damaging crops. The damage recognized as cabbage maggot damage is generally attributed to *Delia radicum*, although species such as seedcorn maggot (*Delia platura*), and bean seed maggot (*Delia florallega*) have also commonly been found in fields exhibiting cabbage maggot damage.



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Where chlorpyrifos resistance is established, informed growers can use cultural management practices to reduce cabbage maggot damage. Crop residue should always be incorporated post-harvest to reduce pest populations. Fall tillage will also expose over-wintering pupae to predation and desiccation. Prolonging rotations between susceptible crops will also prevent pest populations from building up. When possible, plantings should be timed to avoid the first, most destructive, flight of *Delia*. Capital intensive solutions such as insect netting are also a promising option. Where chlorpyrifos resistance is still at low levels, growers can use chlorpyrifos judiciously, and consider cultural practices to delay the increase in resistance, such as providing unsprayed refuge as a continued source of susceptible flies.



Figure 1. Kale.



Figure 2. Insect netting used as a barrier against cabbage maggot flies.



Figure 3. Early signs of crop damage from cabbage maggot.

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Sept. 2015

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