Grower Summary

FV 364

Novel approaches for the management of cabbage root fly (Studentship)

Annual 2011

Disclaimer

The results and conclusions in this report may be based on an investigation conducted over one year. Therefore, care must be taken with the interpretation of the results.

Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

If you would like a copy of the full report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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Project Number:	FV 364
Project Title:	Novel approaches for the management of cabbage root fly
Project Leader:	Dr Andy Evans William Deasy (PhD student)
Contractor:	SAC, James Hutton Institute
Industry Representative:	Richard Haacker, East of Scotland Growers
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Previous report/(s):	-
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Project Cost:	£113,234

Headline

Research is ongoing to identify the chemicals that cabbage root fly larvae use to find calabrese roots. These chemicals could be used to divert or prevent colonization of roots by cabbage root fly larvae. Sugars may also be able to ‘switch on’ natural defences against cabbage root fly.

Background

Cabbage root fly, *Delia radicum* L. (Diptera: Anthomyiidae), is an economically important specialist insect pest of plants in the Brassicaceae family. Damage is caused by below-ground larvae feeding on plant roots. Plants can be attacked at any growth stage but the most serious damage is caused to young transplants soon after planting in the field. Crop protection relies almost predominantly on synthetic insecticides, covers and plant resistance. Current pesticide legislation is placing a greater emphasis on Integrated Pest Management (IPM) and alternative control strategies.

Female flies lay eggs at the base of the shoot or in the soil near the roots. Larvae that emerge from eggs move through the soil to locate host-plant roots to feed on in order to survive. While only limited information exists about how *D. radicum* larvae detect and find roots, the consensus is that chemical cues released in Brassica plant root exudates, either as volatiles or in solution, play a key role in root location. Through a combination of techniques, including choice-test bioassays, chemical analysis of root exudates, and detailed behavioural observations, this project aims to identify compounds in root exudates that larvae exploit to locate roots to feed on. This will facilitate testing and development of potential control methods, using attractant and/or repellent compounds, to disrupt normal orientation behavior by larvae for use as part of a sustainable IPM programme.

Plants protect themselves against insect attack using many defense strategies, such as secondary compounds that are toxic, repellent or anti-digestive, or morphological traits, which can negatively affect the performance of the herbivore. Elicitors are compounds that characterise attack and whose perception by the plant can induce a defensive response both locally in herbivore-attacked regions and systemically in undamaged parts. Sugar sensing and signalling pathways interact with plant hormone signalling mechanisms to control metabolism, growth and stress responses. It has recently been hypothesised that sugars occurring outside their normal compartment within plant cells, indicate a disrupted or damaged plant cell, triggering hormone-mediated defense responses within plants. The aims of this work are to investigate how sugar sensing affects Brassica plants’ defense system

and growth, and whether foliar and root applications of sugars can mimic and elicit inducible resistance against *D. radicum*.

Gucosinolate-containing plants in the Brassicaceae family, incorporated into soil as biofumigants, represent a potential source for pest, disease and weed control. Isothiocyanates, products of glucosinolate-myrosinase hydrolysis, are unpalatable and toxic to many generalist and specialist insects. Despite the fact that several specialist insects including *Delia* spp. have evolved mechanisms to cope with the toxicity of these compounds, beyond certain levels even these insects can be repelled and/or deterred. Using glasshouse pot tests and field trials, this work aims to evaluate the effect of an isothiocyanate-containing liquid biofumigant formulation ('Caliente' mustard), applied as a root drench, on *D. radicum* oviposition, egg survival, and larvae, along with resulting crop yields.

Cabbage root fly *(Delia radicum)* control in the UK is currently reliant almost predominantly on pest forecasting (e.g. the HDC Pest Bulletin), pre-planting application of an organophosphorus insecticide (chlorpyrifos), use of crop covers (where applicable), and plant resistance. Current pesticide legislation is placing a greater emphasis on Integrated Pest Management (IPM) programmes. Under an IPM system, growers are encouraged to employ a combination of available chemical, cultural, and biological control methods in order to minimise the harmful side effects that can result from exclusive use of chemical insecticides (Kogan, 1998; Finch & Collier, 2000; Khan *et al*., 2008). The ongoing review and withdrawal of several pesticides as a result of environmental, food safety and operator health concerns, means that growers are faced with fewer chemical control options to utilise while alternatives are being researched and developed.

This project aims to evaluate several alternatives approaches for the management of cabbage root fly, initially using calabrese as a model crop.

Summary of the results and main conclusions

This research aims to utilise the chemicals present in root and plant exudates that newly hatched cabbage root fly larvae use to locate roots to feed on, to disrupt their behaviour and reduce the larval colonisation of calabrese plants. There are plant-derived extracts marketed as plant stimulants that have the potential for activity against cabbage root fly if applied to the soil as a drench at the time of egg hatch. These are likely to contain chemicals that will affect the behaviour of cabbage root fly larvae.

Sugar sensing in plants has recently been discovered to be involved in triggering inducible and systemic resistance to insects, nematodes and fungi. This project will determine whether the application of sugars to foliage and/or seed can induce defence mechanisms in calabrese plants that can protect roots from cabbage root fly damage.

The most effective treatments will be utilised in a novel system of cabbage root fly pest management that disrupts host-plant location by the larvae. This will be evaluated in field trials. The delivery of these treatments will be in the form of incorporation into soil-applied slow-release granular formulations, seed coatings, foliar /soil sprays and/or treated plugs for transplants.

Financial benefits

At this stage in the project (end of Year 1 out of 3) we are not at a stage to be able to give an accurate estimate of financial benefits to growers. The financial benefits will become clearer once data from field trials in Years 2 & 3 have been obtained.

Action points for growers

At this point trials are underway to determine the optimal approaches for the application of these alternative treatments to reduce cabbage root fly damage, so it is too early to offer growers specific action points to achieve significant benefits for cabbage root fly management.