Grower Summary

BOF 075

Novel insecticide treatments to control large narcissus fly

Final 2014

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Further information

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GROWER SUMMARY

Headline

One novel insecticide and one bio-insecticide showed potential as foliar sprays for the control of large narcissus fly, but further work is required to evaluate them under field conditions.

Background

The large narcissus fly (*Merodon equestris*) is the most important insect pest of narcissus crops in the UK. The larvae feed and grow inside the bulbs. Exports to both EU and non-EU countries are essential to the economy of the bulb industry. Narcissus fly infestation levels as low as 1% may jeopardise the export of bulbs. Current control measures are nowhere near 100% effective, and the control strategy uses just one active ingredient, chlorpyrifos, which is unpleasant to use, may not be available in the longer term and because it is used in the hot-water treatment only protects bulbs for a single season. The aim of this project was to evaluate new insecticides against adult flies in laboratory tests and against larvae in a small field trial. Flies were obtained from infested bulbs growing at Wellesbourne. Insecticides were last evaluated for large narcissus fly control in 2004-5 and several new active ingredients have become available since then and are being evaluated currently for edible crops in a Horticulture LINK project (SCEPTRE). If none of the insecticides are effective then there will be no point in pursuing further field experiments. However, if some of the insecticides are effective then they could be evaluated subsequently in the field. The insecticides to be tested were applied as foliar sprays, the adult flies being the main targets. However, one of the novel insecticides is extremely mobile within plants and it may be that a foliar spray treatment with this insecticide would have some activity against large narcissus fly larvae.

Summary

The aim of this project was to evaluate new insecticides against adult flies in laboratory tests and against larvae in a small field trial.

Obtaining the test insects

Large narcissus flies are currently infesting bulbs in the narcissus plots at Warwick Crop Centre, Wellesbourne. Several thousand bulbs were dug up and screened for narcissus fly damage in winter 2011-12. The infested bulbs were re-buried in field plots that were covered subsequently with large field cages. Adult flies were expected to emerge into these cages during May-July 2012. The aim was to capture flies on the day of emergence and hold them

in the laboratory for use in insecticide trials. Capture of the flies depends on their being active, which in turn depends on there being warm sunny weather. The procedure was repeated in winter 2012-13.

Determine whether insecticides applied to narcissus foliage at commercially viable rates kill adult large narcissus flies

The test treatments consisted of three novel conventional insecticides and two bio-insecticides. All novel treatments were coded. Hallmark (lambda-cyhalothrin), which had been identified as most effective insecticide treatment in BOF 53, was used as a standard treatment in one test.

Insecticide solutions were prepared at commercially viable rates. Narcissus foliage at the appropriate stage of development was sprayed with the insecticide treatments, allowed to dry and then the samples of foliage were brought into the laboratory and placed into 'test' cages. Samples of untreated foliage were used as control treatments. Adult flies collected from the emergence cages in the field plot were released into the test cages. The flies were supplied with a source of food and water. Fly mortality was recorded over a period of up to seven days. To determine whether fly mortality was increased by the addition of baits (food additives) to the spray solution, the experimental procedure outlined was repeated, but this time the insecticides were applied in a solution containing sugar (1% solution of sucrose) as bait, as an experimental treatment. In a further set of tests, insecticide sprays were applied directly to the flies, which were contained in mesh cages.

Determine whether a very mobile novel insecticide applied as a foliar spray has any activity against narcissus fly larvae

In spring 2013, small plots of *Narcissus* were marked out within one of the larger blocks of narcissus at Wellesbourne (2 rows x 3.3 m). Half of the plots were sprayed with the novel insecticide at an appropriate test rate, whilst the other half were left insecticide-free. All plots were exposed to the local population of large narcissus fly and were also infested at similar rates with eggs obtained from the flies collected for the laboratory tests at a rate of 4 eggs per bulb. Samples of bulbs were taken from each plot in winter 2013-14 and assessed for the presence of large narcissus fly larvae.

Results

In 2012, the first flies were found on 22 May. However, the very wet summer in 2012 limited the number of flies that were collected (they hide when it is cool and wet) and restricted the work that could be undertaken. The field trial, which was originally scheduled for summer 2012, was not undertaken because of the poor weather. In 2013, flies emerged between 31 May and 15 July. Again, fly numbers were relatively low, probably a result of the poor weather in the previous year restricting mating and subsequent egg-laying. Laboratory tests were done in both years using the flies available.

Experiment 1

In Experiment 1, flies were exposed to foliage treated with insecticides, either HDCI 050 or HDCI 051, and there was an untreated control. Neither HDCI 050 nor HDCI 051 caused high knockdown fly mortality.

Experiment 2

In this experiment, flies were exposed to foliage treated with either HDCI 050 or HDCI 051 in a 1% sucrose solution (as an experimental treatment) and there was an untreated control. Flies exposed to HDCI 050 suffered a high level of mortality after 5 days but there was no rapid knockdown.

Experiment 3

In this experiment, flies were exposed to foliage treated with one or other of the two bio-insecticides (HDCI 052, HDCI 054) applied alone or in a 1% sugar solution (as an experimental treatment) and there was an untreated control. HDCI 052 was ineffective when applied in this way, with or without sugar. HDCI 054 was more effective, especially when applied with sugar (Figure 1.1).

Experiment 4

In this experiment, flies were sprayed directly with insecticide solutions. HDCI 050 and Hallmark caused high mortality after 1-2 days. Hallmark had the most rapid effect (Figure 1.2).

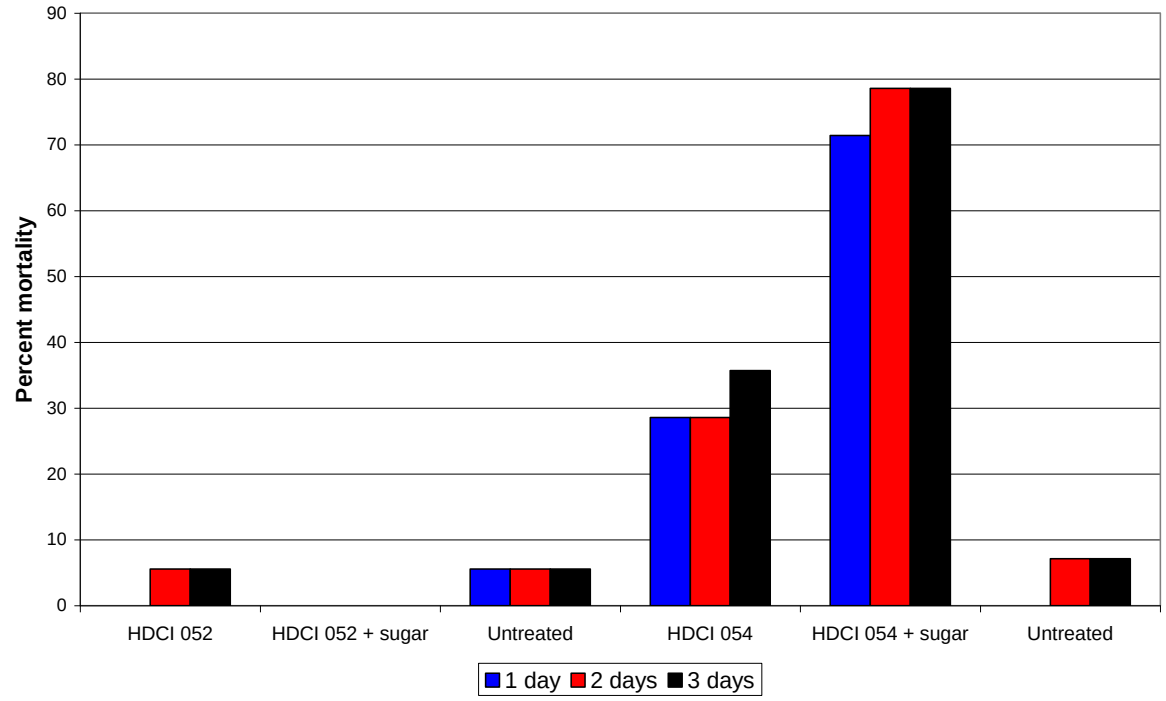

Figure 1.1 Percentage mortality of flies exposed to foliage treated with two novel bio-insecticides alone and in a 1% sugar solution experimental treatment (summarized over 2 tests per bio-insecticide).

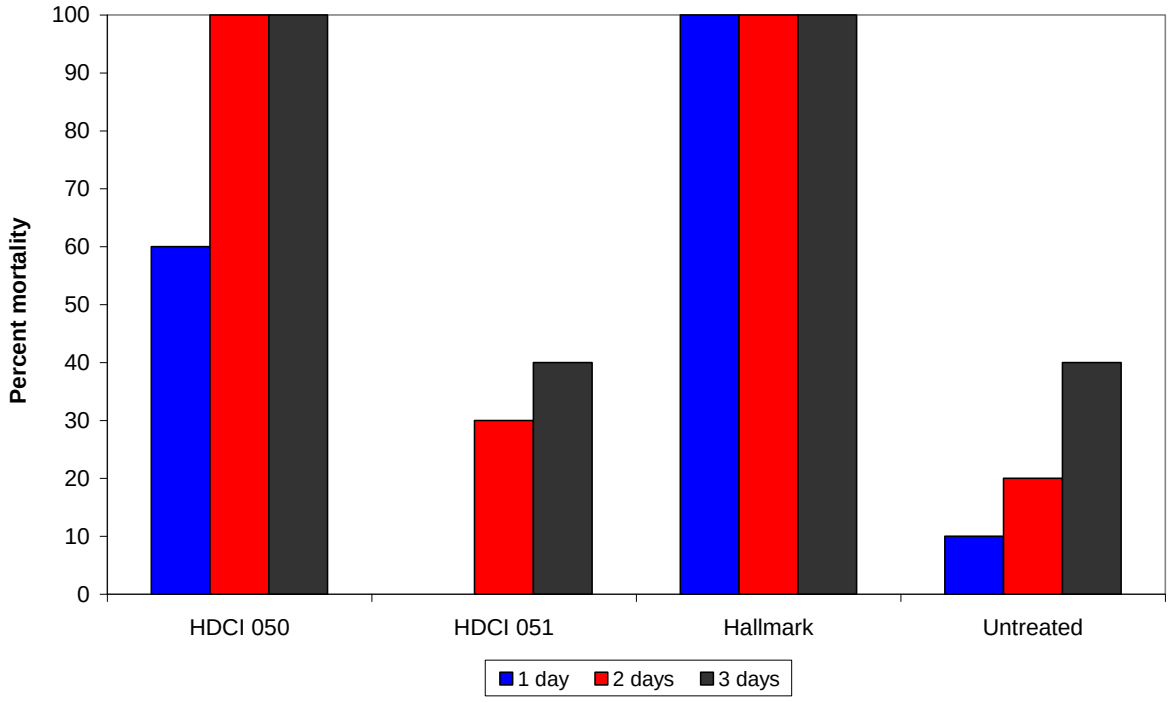

Figure 1.2 Percentage mortality of flies sprayed directly with insecticide solutions.

Experiment 5

In this experiment, flies were sprayed directly with solutions of some of the other novel products. The bio-insecticides HDCI 052 and HDCI 054 caused high mortality after 2 days.

Experiment 6

Overall, an average of 84 and 72 larvae per plot were recovered from the treated and untreated plots respectively. An average of 36% of bulbs was damaged, irrespective of treatment and 21 and 20% of bulbs from the treated and untreated plots respectively contained larvae. There was little difference between the two treatments and since good numbers of insects were recovered it is reasonable to conclude that this treatment was ineffective.

Discussion

Unfortunately the very wet weather conditions had an adverse effect on this project because it was impossible to collect flies in 2012 when the weather was cool and wet. In addition, the weather was so poor that it was not possible to undertake the field trial. An extension to the project was agreed and further work was carried out in 2013-4. It was apparent that the field population of narcissus fly in 2013 had also been reduced by the bad weather in 2012, which would have prevented mating and egg-laying. Overall, the bad weather in 2012 had an impact particularly on the numbers of flies that were available for the insecticide tests in the laboratory in both years. Based on the limited numbers of flies, every effort was made to obtain as much information as possible, but it is recognized that fly numbers were too low to undertake conventional statistical analyses.

In contrast, the numbers of damaged bulbs and larvae recovered from the field trial undertaken in 2013 showed how well large narcissus fly can survive when conditions are favourable, since over one third of the bulbs were damaged and over 900 larvae were recovered. Although this trial worked extremely well, and was appropriate for statistical analysis, there was little point in doing this as there was so little difference between the treatments.

All of the results are summarised in Table 1.1 and include some information on Hallmark from BOF 53 for comparison. In general, addition of sugar to sprays applied to foliage as an experimental treatment increased fly mortality, presumably because it encouraged the flies to probe and take up more of the product. Direct application of an insecticide or bio-insecticide was the most effective way of killing the flies, provided the product had some activity. Overall, assuming that it will be quite difficult to contact many flies directly when applying a

field spray, one novel insecticide (HDCI 050) and one bio-insecticide (HDCI 054) show potential for control of large narcissus fly. Further work is required before these insecticides would be suggested as suitable for use on a field-scale.

Table 1.1 Overview of the efficacy of the insecticide and bio-insecticide treatments evaluated in 2012 and 2013.

	Application to foliage	**Application to foliage with sugar (experimental)**	**Direct application**	**Application as field spray**
HDCI 050	No rapid knockdown	Effective (no rapid knockdown)	Effective	Ineffective
HDCI 051	No rapid knockdown	Partially effective	Ineffective	-
HDCI 052 (B)	Ineffective	Ineffective	Effective	-
HDCI 053	-	-	Ineffective	-
HDCI 054 (B)	Partially effective	Effective	Effective	-
Hallmark (lambda-cyhalothrin)	Partially effective (BOF 53)	Effective (BOF 53)	Effective	-

Financial Benefits

Exports to both EU and non-EU countries are essential to the economy of the bulb industry and it is vital that bulbs are not infested. Data from Crane *et al.* (2014) (Farm business survey 2012/13. Horticulture production in England) give an annual value of £11 million for UK bulb exports. The presence of large narcissus fly may also put constraints on bulb sales within the UK, which are worth a further £11 million annually. Narcissus fly infestation levels as low as 1% may jeopardise the export of bulbs. Current control measures are nowhere near 100% effective, and the control strategy is based on one active ingredient, chlorpyrifos, therefore the identification of other pesticides which give control is crucial.

Action Points

There are no action points for growers arising from this work at present.