Grower Summary

FV 440

Lettuce and baby leaf salads: Investigation into control measures for Silver Y moth and caterpillars

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Project number:	FV 440
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Location of project:	Warwick Crop Centre and commercial growers
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Date project commenced:	1 April 2015
Date project completed (or expected completion date):	15 April 2017

GROWER SUMMARY

Headline

Trials have indicated several insecticides with efficacy against silver Y moth, some of which are novel products. A novel 'remote' monitoring system which uses a small camera located inside a pheromone trap to record moth captures daily shows promise as a method for monitoring the arrival of migrant lepidopterous pests of salad and vegetable crops.

Background

Damage caused by the Silver Y moth and other caterpillar species can result in unacceptable leaf damage in outdoor baby leaf and lettuce crops, where there is zero tolerance for either the presence of, or visible damage from, these pests. Loss of active ingredients has left the industry with a limited list of insecticides which are not effective and all have long harvest intervals. This is resulting in poor control of these pests in UK crops. The overall aim of Project FV 440 is to provide growers of lettuce and baby leaf salad crops with the tools (decision-support and control methods) to improve overall control of silver Y moth and other pest caterpillars.

Summary

The focus of this project is on novel control agents (insecticides and bioinsecticides) and on the use of monitoring approaches to improve the identification of potential problems and aid decision-making with regard to treatment timing.

Trials to measure the efficacy of the chosen treatment regimes (Objectives 1, 2, 3, 4)
Live adult silver Y moths were captured in light traps to produce eggs to set up cultures in the laboratory/greenhouse to infest insecticide and bioinsecticide efficacy trials. Robinson light traps were purchased and set up in Cambridgeshire and at Wellesbourne (4 traps in total). These were run throughout the summer period and checked daily when operating. Small numbers of moths were captured but there were sufficient to start breeding cultures at Warwick Crop Centre and ADAS Boxworth. The moths were allowed to go through several generations to build up numbers.

Three field trials were undertaken in 2015 to evaluate insecticides and bioinsecticides against silver Y moth (2 trials) and diamond-back moth (1 trial). All trials were infested with the target pest insects. Please note that some of the named insecticides do not have approval for application to brassica and/or lettuce crops.

A trial was undertaken at Warwick Crop Centre, Wellesbourne to evaluate insecticides applied as foliar sprays to whole head lettuce (cv Challenge) transplanted on 11 August. There were 7 treatments (6 bioinsecticides and 1 insecticide) x 4 replicates including an insecticide-free control. Small- to medium-sized caterpillars were selected from the laboratory culture and 10 plants per plot were inoculated (6 caterpillars per plant) on 23-24 September. All spray treatments were applied using a knapsack sprayer fitted with 02F110 nozzles in 300 l/ha water on 24 September. The plants were assessed for damage due to caterpillar feeding on a 0-5 scale on 28 September. Inoculated plants were sampled destructively as many of the living caterpillars had eaten into the lettuce. There was a statistically-significant effect of treatment on the numbers of dead caterpillars ($p<0.01$) and the numbers of live caterpillars ($p<0.001$). The coded insecticide HDCI 090 was the most effective treatment in both respects. All of the other treatments were bioinsecticides and did not provide significant levels of control. There were no overall statistically-significant effects of treatment on the mean damage score.

A second trial on silver Y moth was undertaken at Stockbridge Technology Centre using babyleaf lettuce (cv Solavia). There were 7 treatments (all insecticides) x 4 replicates including an insecticide-free control. Caterpillars were received from Warwick Crop Centre on the morning of 29 September and were used immediately to infest the plots. Thirty caterpillars were placed in the central rows of each plot, and left to settle for at least four hours. On the afternoon of 29 September, plots were treated with product, or a water control, by application at 3 bar pressure using an Oxford Precision Sprayer and F01 110 flat fan nozzles. Relatively low numbers of caterpillars were recovered (less than 50% of those released). With the exception of emamectin benzoate, all insecticide treatments resulted in greater mortality of caterpillars than the water-only control and this was a statistically significant effect both 2 and 9-10 days after treatment.

A third trial was undertaken at Warwick crop centre to compare foliar spray treatments (6 treatments and untreated control) for control of diamond-back moth. Brussels sprout plants (cv Faunus F1) were transplanted on 23 June. In the absence of a natural infestation the decision was made to infest the plots artificially. Over the period 4 -24 September, 7 plants were inoculated on 2 occasions each with eggs and caterpillars from the culture maintained at Warwick Crop Centre. All spray treatments were applied using a knapsack sprayer fitted with 02F110 nozzles in 400 l/ha water on 25 September. The plants were assessed for damage due to caterpillar feeding (numbers of feeding holes) and the numbers of caterpillars were counted on 1 October. However, the numbers of caterpillars recovered during assessment of the plots were too low (<1 per plant) for meaningful analysis of the data. As

the field trial on diamond-back moth in 2015 was unsuccessful due to low recovery of caterpillars, laboratory tests were planned and the first replicate has been completed.

Monitoring activity of adult moths (Objective 5)

A network of pheromone traps was established in England and Scotland to monitor silver Y moth, diamond-back moth and turnip moth. The traps were supplied by Trapview (www.trapview.com) and the network was supported and managed by Colin Carter of Landseer. A total of 30 traps were set up in May-June 2015 and consisted of 17 traps for silver Y moth, 10 traps for diamond-back moth and 2 traps for turnip moth plus an 'experimental' trap used for trap development. The traps were hosted by growers of salad and brassica crops. Each trap contained a pheromone lure for the appropriate species, a sticky base to capture the moths and a small camera which photographed the sticky base once each day. The camera was powered by a solar cell. The image was downloaded onto the website managed by Trapview and the images of the captures by all the traps were visible to all the trap hosts. Generally there were two 'replicate' traps in each area. 'Ordinary' funnel pheromone traps were run in parallel to the 'Trapview traps' with at least one at each site. The lures in all traps were replaced at the recommended intervals and the sticky bases were replaced as and when necessary. The data from the Trapview traps were downloaded from the Trapview site and checked and corrected by reviewing the images. Data from the other traps were sent to Warwick Crop Centre at the end of the season.

Silver Y moths were captured in the Trapview traps between May and October with the periods of most intense activity in mid-June and mid-July (Figure 1). The data require further analysis but there is no evidence that moths were captured earlier at sites that were further south or further east, for example.

A relatively large number of funnel traps were deployed in crops of lettuce grown by G's in Cambridge and Norfolk. This was to obtain more detailed information on silver Y moth activity both from using traps and by monitoring crops. The main period of activity was between mid-June and mid-July and a maximum of 36 moths was captured in one week.

There was considerable variation between locations in the pattern of moth activity represented by trap captures. The captures of silver Y moths by Trapview traps were compared with captures by funnel pheromone traps. Overall the patterns of activity were similar but not identical. The data require more detailed analysis but the differences in the pattern of captures may be simply a reflection of background variation from trap to trap, as capture of moths is

essentially a random process. There was evidence that, at least in some locations, captures by the Trapview traps were considerably smaller than by the funnel traps.

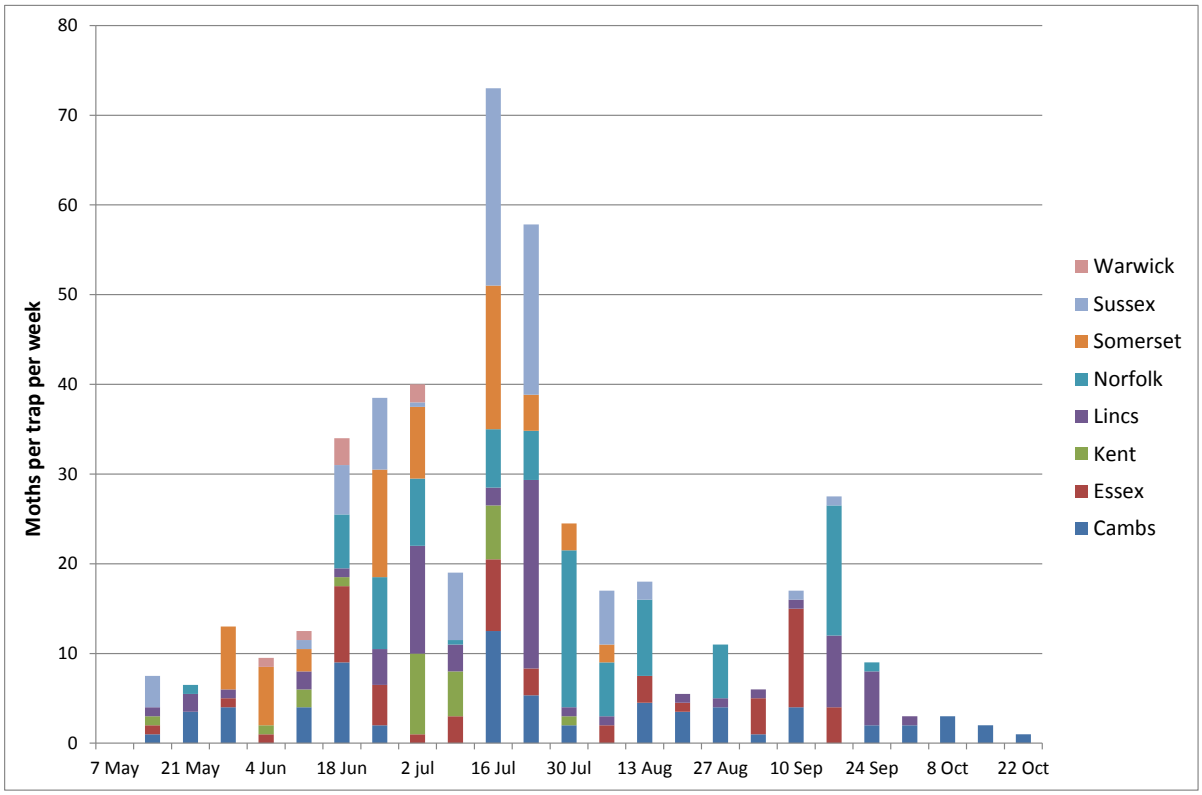

Figure 1. Captures of silver Y moths by Trapview traps in 2015 – sorted by county.

Relationship between captures by pheromone traps and infestation of crops by caterpillars

Captures of silver Y moths in 2015 were relatively low overall and so infestations in lettuce crops were not severe. However, where available, crop walking data were compared with trap captures to determine how much 'warning' they might provide and whether there were indications that a threshold might be developed. In Lincolnshire, caterpillars and damage were observed in July, with the first caterpillar seen in Week 27 (first week of July), which coincided with the period of greatest moth activity. For the crops grown by G's in Cambridgeshire and Norfolk respectively, peak numbers of caterpillars were observed in mid-July which seemed to tie in most closely with an influx of moths in the traps around 23 June.

Relationship between the timing of moth captures and the detection of caterpillars in crops

In order to try and understand the relationship between the timing of moth captures and the detection of caterpillars in crops, published data on development of the different stages of silver Y moth at different temperatures were summarised. From these data, the estimated threshold temperatures for the egg, larval and pupal stages were 7.6, 9.2 and 7.7°C respectively. Using the estimates of development time at 13 and 18°C, egg development required approximately 60 day-degrees above 7.7°C.

As an example, four sets of weather data collected for the AHDB Pest Bulletin in 2015 were used to estimate the daily day-degrees above 7.7ºC between mid-June and mid-August. Overall, the largest numbers of moths were captured from 13 June until towards the end of July. Using the day-degree sum for egg hatch of approximately 60 day-degrees above 7.7°C indicated that, for example, eggs laid on 14 June in Kent would hatch approximately 9 days later.

Diamond-back moth

Very low numbers of diamond-back moths were captured in the Trapview traps. Data from ordinary (Delta) pheromone traps is so far only available from the sites at Warwick and in Fife. Captures were very low in both locations and too low to undertake any meaningful analysis of the data. As for the silver Y moth, published data on the development times of diamond back moth at a range of temperatures were summarised. At a temperature of 16ºC, egg development took 6.4 days and a complete generation took approximately 33 days.

Turnip moth

Two Trapview traps were run at G's and it was possible to compare the catches from these traps with the data from 13 funnel traps. Not all of the funnel traps were run over the full period, but even so they give a clear indication of the pattern of activity, with two distinct adult generations. The Trapview traps captured relatively low numbers of moths compared with some of the funnel traps.

Performance of the Trapview traps

The Trapview traps are still in the development phase and there were a few problems with them which can be improved on in 2016. The surface of the sticky inserts was not sufficiently sticky to hold some of the silver Y moths firmly (and the same may be true for turnip moths) and there was evidence that the moths had moved around and sometimes escaped from the trap. It seemed that once a few moths had been captured the performance of the traps declined – possibly because the available area for capturing moths had decreased. The

camera is relatively heavy and in some cases the trap became distorted, which affected the view of the sticky surface. On some days the signal was insufficient for the image to be downloaded to the Trapview web site.

Historical data

Some of the grower participants, particularly G's, have historical records on silver Y moth abundance and this information has been collated and forwarded to Warwick Crop Centre for further summary and analysis.

Other approaches to monitoring and control (Objectives 5 and 6).

Other information on movement of adult silver Y moths is available from Rothamsted Research. This consists firstly of the captures made by the network of light traps run by the Rothamsted Insect Survey. A summary of captures by these traps over the last 50 years showed that there is considerable variation in overall abundance from year to year. Rothamsted Research also have considerable expertise in relation to the impact of weather conditions, particularly wind on the trajectories of migrating moths and they will be using this expertise to interpret some of the trapping data collected in 2015. It may also be possible to use the light trap data and historical pheromone trap data to explore the relationship between pheromone catches and light trap catches.

Financial Benefits

The benefits of a successful outcome to the project will be improved quality of crops marketed and fewer crop losses and rejections.

Action Points

There are no specific action points from this project at present but it has highlighted the importance of monitoring moth activity to indicate periods when crops may be particularly at risk from infestation.