AHDB HORTICULTURE

# Grower Summary

## FV 440

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

Final 2017

## 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 AHDB Horticulture office (hort.info.@ahdb.org.uk), quoting your AHDB Horticulture number, alternatively contact AHDB Horticulture at the address below.

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| **Project title:** | Lettuce and baby leaf salads: Investigation into control measures for Silver Y moth and caterpillars |
| **Project number:** | FV 440 |
| **Project leader:** | Rosemary Collier, University of Warwick |
| **Report:** | Final, March 2017 |
| **Previous report:** | Annual, March 2016 |
| **Key staff:** | David Norman, Colin Carter, Andrew Jukes, David George, Jude Bennison, Jason Chapman, Charlotte Wainwright |
| **Location of project:** | Warwick Crop Centre and commercial growers |
| **Industry Representatives:** | Phillip Effingham, Greentech Consultancy Ltd<br>Andrew Rutherford, KS Coles Ltd<br>Thane Goodrich, Intercrop Ltd |
| **Date project commenced:** | 1 April 2015 |
| **Date project completed (or expected completion date):** | 31 March 2017 |

# GROWER SUMMARY

## Headlines

- Trials have indicated several insecticides with efficacy against silver Y moth and diamond-back 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 showed promise as a method for monitoring the arrival of migrant pest moths of salad and vegetable crops, but requires further development to increase catch sizes.
- Use of citizen science data together with information on wind drection may enable provision of short-term forecasts for pests arriving into the UK from mainland Europe and provide the possibility of a warning network.

## Background

Damage caused by the larvae of the silver Y moth and other species of moth 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 fairly small range of insecticides, some of which have limited efficacy, 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

### Evaluation of insecticides and bioinsecticides

Trials were undertaken with silver Y moth and diamond-back moth.  Although no trials were undertaken with turnip moth, some of the products tested may be effective against this species.

*Silver Y moth:* The aim was to complete four field trials on either whole head lettuce (2 trials) or baby leaf (2 trials).  Treatments were chosen with regard to likely efficacy and potential for registration. All trials were infested artificially with eggs/larvae from moths captured with light traps and all were completed successfully (Tables A & B).

**Table A**. Effect of insecticide and bioinsecticide treatments on silver Y moth larvae in whole head lettuce

| Product | Active | Mean numbers of live silver Y moth larvae 4 (2015) and 6-8 (2016) days after treatment compared with untreated control | |
|---|---|---|---|
| | | 2015 | 2016 |
| | Azadirachtin | Ns | Ns |
| HDCI 089 | Bioinsecticide | Ns | Ns |
| HDCI 090 | Insecticide | *** | * |
| HDCI 100 | Bioinsecticide | Ns | Ns |
| HDCI 102 | Insecticide | - | Ns |
| HDCI 103 | Insecticide | - | * |
| Lepinox Plus | *Bacillus thuringiensis* | Ns | Ns |

**Table B**. Effect of insecticide and bioinsecticide treatments on silver Y moth larvae in baby leaf lettuce

| Product | Active | % mortality of silver Y moth larvae 2 (2015) and 3 (2016) days after treatment compared with untreated control | |
|---|---|---|---|
| | | 2015 | 2016 |
| Warrior (2015), Ninja (2016) | Lambda cyhalothrin | *** | *** |
| | Cyazypyr | *** | *** |
| | Emamectin benzoate | Ns | Ns |
| | Indoxacarb | *** | *** |
| HDCI 091 | Insecticide | *** | Ns |
| Coragen [Previously coded as HDCI 096] | Chlorantraniliprole [Previously coded as HDCI 096] | *** | Ns |

- Ns Larval mortality not significantly higher than untreated control
- *** Larval mortality significantly higher than untreated control (p<0.001)
- * Larval mortality significantly higher than untreated control (p<0.05)

For the trials on whole head lettuce (Table A), in 2015 the insecticide HDCI 090 was the most effective treatment and the only treatment which significantly decreased numbers of live larvae compared with the untreated control. In 2016, plants were inoculated with eggs or larvae before spray treatments were applied. The pre-planting insecticide treatment (HDCI 103) killed all larvae and also significantly reduced the number of feeding holes on leaves. HDCI 090 also reduced larval numbers compared with the untreated control but the level of statistical significance was lower than in 2015, probably because of the small numbers of larvae recovered overall. For the trials on baby leaf lettuce (Table B), in 2015, 2 days and 9-10 days after spraying, all treatments except emamectin benzoate led to lower numbers of larvae versus the control. In 2016, 3 days after spray treatment, lambda-cyhalothrin, indoxacarb and cyazypyr had reduced numbers of larvae compared with the control and emamectin benzoate. After 10 days, all treatments except emamectin benzoate had reduced numbers of larvae compared with the control.

*Diamond-back moth:* In 2016 a laboratory trial on Brussels sprout plants used diamond-back moths from a population maintained at Warwick Crop Centre for a number of years. Three days after spraying all treatments had reduced the percentage of live larvae compared with the untreated control and continued to do so after 6 and 10 days. Tracer (spinosad), cyazypyr, Coragen (chlorantraniliprole) and the bioinsecticide Lepinox Plus (*Bacillus thuringiensis*) were the most effective, treatments with 100% mortality after 3 days. In 2016-7 a glasshouse trial on Brussels sprout plants used diamond-back moths collected from the field in summer 2016 following a large migration of moths and cultured subsequently. It was considered likely that these insects were resistant to pyrethroid insecticides (Steve Foster, personal communication) and this was confirmed in the trial (Figure A) as Hallmark (lambda-cyhalothrin) was ineffective. Three days after spraying Tracer, cyazypyr, azadirachtin, Coragen and Lepinox Plus had reduced the percentage live larvae compared with the untreated control.

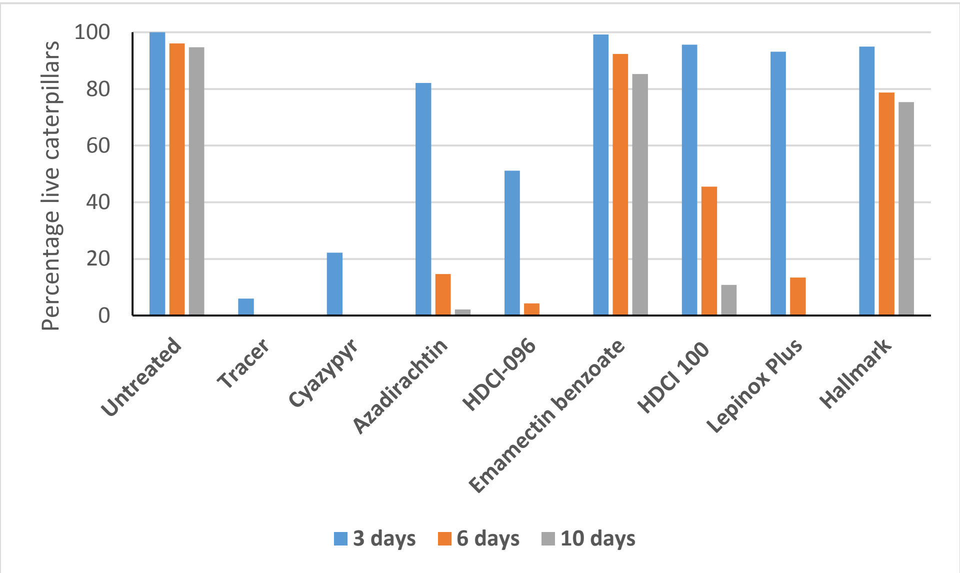


**Figure A.** Effect of insecticide / bioinsecticide treatments on the mean percentage live diamond-back moth larvae 3, 6 and 10 days after spraying, glasshouse trial on Brussels sprout plants, 2016-7. [HDCI 096 = Coragen (chlorantraniliprole)]

**Monitoring and forecasting pest moths to support decision-making**

*Historical data:* Captures of silver Y moth made by the network of light traps run by the Rothamsted Insect Survey over the last 50 years showed that there is considerable variation in overall abundance from year to year; confirmed by the other sets of historical data. Data on diamond-back moth highlighted the very large numbers which migrated into the UK in 2016 compared with other recent years. Monitoring data for 1996 were also available; this was probably the most recent occasion, prior to 2016, when very high numbers of diamond-back moths occurred. Data on turnip moth confirmed that there are two generations per year and that the timing of these generations varies from year to year.

*Monitoring pest moths in 2015-16:* A network of pheromone traps was established to monitor pest moths. The traps were supplied by Trapview (www.trapview.com) and managed by Colin Carter of Landseer. Traps were set up in May-June 2015 and 2016 and consisted of 18 traps for silver Y moth, 10 traps for diamond-back moth and 2 traps for turnip moth. 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 trap hosts.

**Figure B.** Trapview pheromone trap

In general, the Trapview traps were less effective than 'ordinary traps' (Funnel traps for silver Y moth and turnip moth and Delta traps for diamond-back moth). Some modifications were made to the Trapview traps in 2016 and, in particular, a trap that was modified to incorporate a Funnel trap was more effective in capturing silver Y moths. There were a few other small technical problems with the Trapview traps that need addressing but, overall, the network functioned well and all trap hosts were able to view all the traps remotely. All of the traps indicated periods when moths were more abundant but there was considerable variation within a region/locality in the numbers of moths captured. There is no evidence that moths were captured earlier at sites that were further south or further east, for example. Neither 2015 nor 2016 were years when silver Y moth caused major problems in salad crops. Whilst infestations usually followed periods of relatively high moth abundance, there seems to be little scope to develop a threshold based on the numbers of moths trapped as the small number of sets of data available did not suggest that there would be a consistent relationship. Thus moth trap captures can only be used to warn of/highlight periods when significant egg-laying is likely to occur. In the case of this pest there is likely to be an interval between egg-laying and the start of feeding damage by larvae. Using the day-degree sum for the development of silver Y moth eggs (approximately 60 day-degrees above 7.7°C (estimated from published data)) indicated that, for example, eggs laid on 14 June 2015 in Kent would have hatched approximately 9 days later. This type of information might be included in the AHDB Pest Bulletin. A small study by Rothamsted Research on the origin of migrant silver Y moths indicated that in 2015 the major source of moths, on the occasions when possible flight paths were tracked, was northern France.

It seems likely that migrant diamond-back moths are sexually active and able to lay eggs as soon as they arrive. After a very marked influx of moths at the end of May 2016 male moths were soon detected in pheromone traps, although not in the very high numbers that would have been expected from such a large infestation. There was a perception by some growers that in 2016 there was a delay between moth arrival and egg-laying/development of the immature stages. However, the timing of what seems to be a subsequent (second) generation (Figure C) ties in closely with the day-degree sum for development of eggs, larvae and pupae estimated from published data.

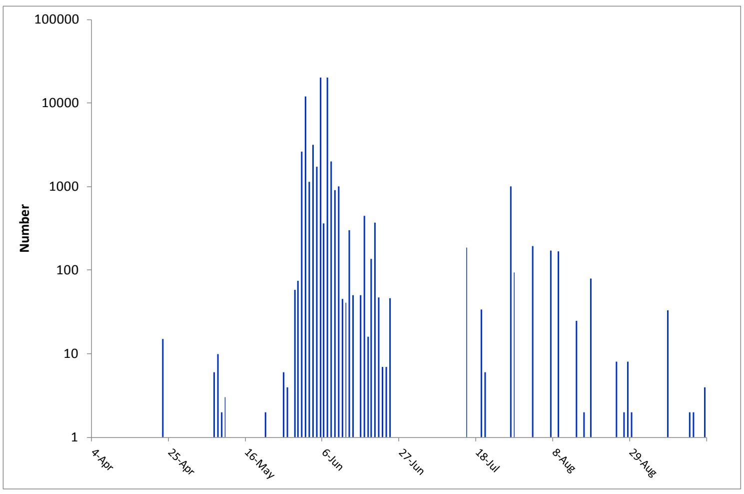


**Figure C.** The numbers of diamond-back moths per day reported on Twitter in 2016.

The project has highlighted the value of information about migrant moths available on web sites and social media (Figure C). This was particularly useful in a second small study done by Rothamsted Research on the source of the large influx of diamond-back moths in 2016. Data from web sites on the continent were used to indicate where infestations of diamond-back moth had been building, which included Scandinavia and Belgium/the Netherlands. To test whether it was possible to identify the source location for the initial incursion of diamond-back moth into the UK on 1 June, the Rothamsted team used the HYSPLIT trajectory model to undertake back-trajectory analysis. The results suggested that the initial incursion into the UK originated from the Norwegian and Danish coastlines. This is somewhat surprising, given that there were significant numbers of diamond-back moths throughout the low countries during this whole period, following a build-up of populations there from mid-May onwards, and the populations there would have a much shorter distance to cover in order to arrive at the UK coastline. However, wind directions were not favourable for this to happen at that time. Use of information on moth sightings in mainland Europe may be valuable to UK growers and this is being explored with AHDB funding in 2017 by providing growers with a web page summarising sightings of silver Y moth and diamond-back moth in northern Europe.

## Financial Benefits

The benefits of the project will be improved quality of crops marketed and fewer crop losses and rejections. The scale of potential losses is exemplified by the impact of the diamond-back moth incursion in 2016 and reported at the AHDB Workshop on 24th January https://horticulture.ahdb.org.uk/diamondback-moth.

## Action Points

- Growers should make themselves aware of the likelihood of egg-laying by pest moths of salad and Brassica crops, either through monitoring themselves or by being part of an information network.
- Growers should also make themselves aware of the relative susceptibility of pest moths to the control methods available to them. In the case of diamond-back moth it is important to obtain as much information as possible about the resistance status of immigrant moths.