Grower Summary

Radio tracking earwigs to understand the breakdown in successful woolly apple aphid, *Eriosoma lanigerum* (Hausmann), control

Annual report 2021

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Project title:	Radio tracking earwigs to understand the breakdown in successful woolly apple aphid, *Eriosoma lanigerum* (Hausmann), control
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Project leader:	Dr Tom Pope, Harper Adams University
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Date project commenced:	28 September 2020

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[The results and conclusions in this report are based on an investigation conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.]

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AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

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GROWER SUMMARY

Headline

This project aims to provide ways for growers to enhance the natural biocontrol of woolly apple aphid, and utilise the widespread UK insect, the common European earwig, in apple orchards.

Background

Common European earwigs (*Forficula auricularia*, Linnaeus) (unless specified 'earwig' refers to this species) are generalist predators that live in many UK apple orchards and consume a wide variety of other invertebrates, as well as plant matter. Research has shown that they may be particularly important for controlling the woolly apple aphid (*Eriosoma lanigerum*, Hausmann) (WAA). WAA has previously been controlled as a side effect of insecticide spraying for codling moth (*Cydia pomonella*, Linnaeus). However, as broad-spectrum insecticide use is being reduced due to regulatory restriction, WAA is of increasing concern to apple growers.

WAA attacks the woody tissue of apple trees. Compounds in the aphid's saliva cause the tissue of apple trees to swell up into galls which disrupt the plants internal transport systems. These galls can also split or become pulpy, providing an opportunity for pathogens to infect the tree. Gall formation happens both on the branches and trunks of apple trees, but also on the roots where WAA colonies form to avoid cold winters.

Studies have shown that biocontrol can keep WAA populations low enough that they are not a problem for apple growers, often when earwigs are present alongside other natural enemies of WAA such as the parasitoid wasp, *Aphelinus mali* (Haldeman). However, successful biocontrol often required high numbers of earwigs (more than five per tree), for earwigs to be present early in the growing season, or for somewhat WAA resistant varieties of apple to be used.

Earwig foraging behaviour is poorly understood due to their nocturnal lifestyle. Remote monitoring using passive radio frequency identification (RFID) tags attached to earwigs may help fill this gap in our understanding. Better information on how earwigs hunt for WAA has the potential to provide new ways for apple growers to use this species as a biocontrol agent for WAA.

Experimental approach:

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A survey was conducted to map the spatial distribution of WAA within a commercial apple orchard, with the aim of targeting future research in areas that were more likely to contain WAA.

A second survey was conducted in an experimental apple orchard to investigate if corrugated cardboard refuges tied to the trunks of trees increased the number of earwigs foraging in those trees, and if this led to a decrease in WAA colonies. The effect of historic applications of broad-spectrum insecticides on the populations of WAA and earwigs was also investigated.

An experiment was carried out where 80 earwigs marked with fluorescent powder were released into a commercial apple orchard, and then their positions recorded with the use of a UV torch at night. This experiment aimed to measure the earwigs' dispersal from their release point. The direction of their dispersal was also measured. This was done to test the effectiveness of using fluorescent powder to measure the speed of earwig dispersal. The experiment provided early data on the speed of earwig dispersal along planting rows, as well as the frequency at which earwigs cross between rows.

Summary

Two orchards were identified which had populations of WAA present. These will be used for future field trials.

The addition of corrugated cardboard shelters in orchards increased earwig numbers. However, this did not lead to a decrease in the number of WAA colonies found on trees.

The historical application of broad-spectrum insecticides had a long-term impact on the number of WAA colonies found on trees. In contrast, earwig numbers had either recovered or were not significantly affected.

Releasing fluorescent earwigs showed that they dispersed within the orchard quickly. Marking with fluorescent powder was a suitable way of finding earwigs, and this method could be repeated to learn about how different orchard conditions affect their dispersal.

Financial Benefits

This project cannot currently provide this kind of information.

Action Points

This project cannot currently provide this kind of information.

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