

## Studentship Project: Annual Progress Report 09/2021 to 09/2022

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<b>Project Title:</b>	Attacking the clones: understanding aphid pest resistance to biological control		
<b>Lead Partner:</b>	Harper Adams University		
<b>Supervisor:</b>	Dr Tom Pope		
<b>Start Date:</b>	27/09/2021	<b>End Date:</b>	26/09/2025

### 1. Project aims and objectives

First, the project aims to characterise potato aphid (*Macrosiphum euphorbiae*) populations collected from strawberry crops grown from a geographic spread within the UK by establishing their genotypic diversity, endosymbiont composition and their susceptibility to their most important parasitoid species (*Aphidius ervi* and *Praon volucre*). Secondly, the project will explore the genetic diversity of the main parasitoids currently used as biological controls of aphids in strawberry crops. Thirdly, the project will explore the role of aphid genetic information, aphid facultative endosymbiont communities and (if possible) behaviour in determining aphid-parasitoid interaction and their role in parasitoid resistance. Finally, the project will assess the impact of the different levels of parasitism susceptibility on aphid biological control efficacy by testing the interactions between aphid genotypes and parasitoid species/genotypes in a middle-term sampling process in the field. The data generated will allow us to gather information for the development and enhancement of integrated pest management of the aphid pests of strawberry crops.

### 2. Key messages emerging from the project

- Potato aphid populations attacking strawberry plants show variation in their genetic background and secondary endosymbiont composition.
- Some *M. euphorbiae* clones due to their genetic and/or endosymbiont composition are less susceptible to the most important parasitoid wasps that are currently used for biological control.
- Low levels of susceptibility in potato aphid to biological control can have a serious impact on strawberry integrated pest management of aphids which can cause serious economic losses to the industry.

### 3. Summary of results from the reporting year

Genotyping of 14 clonal lines collected from a geographical spread of the UK was undertaken using microsatellites. All clonal lines were classified as different genotypes but two lines from Staffordshire that

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The results described in this summary report are interim and relate to one year. In all cases, the reports refer to projects that extend over a number of years.

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shared the same genetic background (genotype 9), and three clones from the same county that shared the same genotype (genotype 14). All the lines were also characterised with their secondary endosymbionts, with 4 lines being infected with *H. defensa*, 3 with *S. symbiotica* and 10 with *R. insecticola*. In addition, 5 lines harboured more than 2 facultative bacteria.

Preliminary parasitism assays were conducted for the 14 clonal lines. Early results (only 3 replicates) showed a considerable variation in aphid susceptibility to *A. ervi*, with parasitism levels ranging from 4-55%. However, two lines showed <10% of parasitism which can be an indicator of parasitoid resistance. Data on parasitoid development has been recorded for the first four lines assayed (susceptible lines) with results showing a non-lethal effect of clonal line on parasitoid development time and sex ratio.

Performance measurements of the same four lines previously mentioned were conducted using clip cages on strawberry leaves and entire strawberry plants. Significant differences in reproduction and development were found between clonal lines and between confinement treatments.

These preliminary results show the existence of intra-specific variation (genetic/endosymbiont) in potato aphid attacking strawberry crops, but also intra-specific variation on performance and parasitism susceptibility.

#### 4. Key issues to be addressed in the next year

Parasitism assays replicates of all the lines with *A. ervi* should be completed to allow statistical analysis of the results. *Praon volucre*, as the second most important parasitoid species used for potato aphid control, will be also investigated.

Performance assays and parasitism assays must be performed for the other 10 clonal lines of aphids, which are currently being cultured under laboratory conditions.

Genotyping of commercial parasitoid lines must be also undertaken to understand the intra-specific variation of the biological controls currently applied to the fields.

#### 5. Outputs relating to the project

*(events, press articles, conference posters or presentations, scientific papers):*

Output	Detail
Conference poster	Harper Adams PhD Colloquium (November 2021)
Conference poster	Association of Applied Biologists Conference (November 2021)
Conference poster	International Congress of Entomology (July 2022)
Conference poster	Harper Adams University Research Conference (September 2022)
Oral presentation	Harper Adams PhD Colloquium (November 2022)

#### 6. Partners (if applicable)

Scientific partners	The James Hutton Institute, NIAB-EMR
Industry partners	Berry Gardens Ltd
Government sponsor	BBSRC