Project title:	Developing a ‘push-pull’ strategy for the management of *Drosophila suzukii*
Project number:	CTP_FCR_2017_1
Project leader:	Daniel Bray, University of Greenwich., Charles Whitfield, NIAB-EMR., Michelle Fountain, NIAB-EMR. and David Hall, University of Greenwich, NRI.
Report:	Annual report, October 2019
Previous report:	October 2018
Key staff:	Christina Conroy (Formally Faulder)
Location of project:	Greenwich University, Medway Campus and NIAB-EMR.
Industry Representative:	Harriet Duncalfe
Date project commenced:	October 2017

DISCLAIMER

While the Agriculture and Horticulture Development Board seeks to ensure that the information contained within this document is accurate at the time of printing, no warranty is given in respect thereof and, to the maximum extent permitted by law the Agriculture and Horticulture Development Board accepts no liability for loss, damage or injury howsoever caused (including that caused by negligence) or suffered directly or indirectly in relation to information and opinions contained in or omitted from this document.

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.

Christina Conroy

PhD Student

University of Greenwich, NRI

Signature .... Cconroy ..... Date.....21st Oct 2019.....

Charles Whitfield

Crop Protection Engineer

NIAB EMR

Signature ..... Charles Whitfield Digital signature ..... Date .....21st Oct 2019.....

GROWER SUMMARY

Headline

- Work towards developing a ‘push-pull’ strategy for the management of *D. suzukii* has tested fourteen putative repellent compounds and demonstrates efficacy in the laboratory and field conditions.

Background

Drosophila suzukii, also known as spotted wing drosophila, is the major insect pest threating European fruit production (Asplen *et al.*, 2015; Cini *et al.*, 2012). This invasive fruit fly was first found in the UK in 2012 and has quickly spread (Harris and Shaw, 2014). *Drosophila suzukii*, lay their eggs in ripening fruit (Goodhue *et al.*, 2011). The eggs hatch and the larvae cause the fruit to collapse through feeding. Secondary damage is caused by pathogens which enter the fruit through the oviposition hole in the fruit skin (Calabria *et al.*, 2012). Currently the pest is controlled through a combination of monitoring, crop hygiene, and mesh barriers, but there is still a reliance on conventional insecticides.

There are two distinct forms of *D. suzukii*: a summer morph, and an overwintering winter morph. The larvae develop into the winter morph in response to lower temperatures and reduced exposure to light (Toxopeus *et al.*, 2016). The winter morphs is adapted to survive these conditions and is the primary source of fruit crop infestation at the start of the growing season (Panel *et al.*, 2018) as it moves from its winter habitat to the fruit crops in spring. To date, most research has focused on control of the summer morph. However, preventing the winter morph from entering a crop from early in the fruit growing season may prevent escalations in population growth and fruit damage.

In this project, we are developing a push-pull strategy for year-round control of *D. suzukii.* Push-pull employs repellents to ‘push’ pest insects from the crop and attractants to ‘pull’ them into a trap or onto a non-target plant (Cook *et al.*, 2007). In Year 1, we conducted electrophysiological assays to identify chemicals which can be detected by the antenna of *D. suzukii*. In year two, laboratory bioassays and semi-field experiments were conducted to identify chemicals which may function as repellents against both the summer and the winter morphs. As the two morphs have different behaviours, ecologies, and may respond differently to chemical stimuli (Kirkpatrick *et al.*, 2018), putative chemical repellents were tested against both morphs.

Summary

In the first year of this project electroantennography (EAG) was undertaken to establish which of the 14 chemicals were detected by *D. suzukii* antenna. The 14 chemicals were puffed over the antenna of ten summer or winter morphs and the antennal response was recorded. Three chemicals elicited a different magnitude of response in the summer and winter morphs. In the second year of this PhD behavioural bioassays were undertaken to establish which of the 14 chemicals were able to repel *D. suzukii* from a fruit and yeast bait. The bioassay was composed of a two-way choice test and replicated ten times. Each chemical was trialled against the summer and winter morphs at three concentrations. Overall four repellents significantly reduced the number and emergence of *D. suzukii* summer and winter morphs. The most effective four repellents were trialled in semi-field polytunnels.

Two red *D. suzukii* (Biobest) traps were positioned one at each end of 12 meshed flight tunnels, which were 12 m in length. The red traps contained fresh raspberries as an attractant. One of the traps in each tunnel was surrounded by five repellents; the other was an untreated control. Laboratory reared *D. suzukii* were released into the centre of the tunnels. After 48 hours the traps were removed, adult flies were counted, and fruit was incubated to assess *D. suzukii* emergence. The trial showed that three of the chemicals reduced numbers of *D. suzukii* and subsequent oviposition in raspberry fruits.

A questionnaire is currently underway targeting UK growers to gain information on attitudes towards current *D. suzukii* control methodologies and opinions on future pest management strategies. Twenty-seven grower responses have been gathered.

Main Conclusions

- Using electroantennography (EAG) 14 putative repellent compounds were detected by summer and winter morph *D. suzukii*; three chemicals elicited a different level of response in the winter morphs compared to the summer morphs.
- In the laboratory, seven putative repellents were effective on *D. suzukii;* four of these were repellent to both the summer and winter morphs.
- In a semi-field experiment three of these chemicals reduced numbers of *D. suzukii* and subsequent oviposition in raspberry fruits.
- One of the chemical repellents reduced *D. suzukii* egg laying in polytunnels containing strawberries.

- A questionnaire aims to understand grower attitudes to current and future *D. suzukii* pest management strategies.

Financial Benefits

This project will help meet a need within the soft and stone fruit industry to reduce crop damage by *D. suzukii* using an approach that can be used in integrated pest management.

Action Points

There are no grower action points at this early stage of the project.

