Grower Summary

CP 171

The use of highly attractive yeast strains for controlling *Drosophila suzukii* (spotted wing drosophila).

Annual report 2019

Project title:	**The use of highly attractive yeast strains for controlling *Drosophila suzukii* (spotted wing drosophila).**
Project number:	CP 171
Project leaders:	Rory Jones (author) Michelle Fountain (NIAB EMR) Matthew Goddard (University of Lincoln)
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Key staff:	Rory Jones (author) Paul Eady (University of Lincoln)
Location of project:	NIAB EMR and University of Lincoln
Industry Representative:	Harriet Duncalfe (H&H Duncalfe)
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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.]

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.

Michelle Fountain

Deputy Head of Pest and Pathogen Ecology

NIAB EMR

Signature .....M.Fountain..... Date.....25 September 2019.....

Rory Jones

PhD student

University of Lincoln/NIAB EMR

Signature  Date 25 September 2019

Report authorised by:

Harriet Duncalfe

H&H Duncalfe

Industry representative

Signature .Harriet Duncalfe..... Date. 20:10:2019.....

GROWER SUMMARY

Headline

Four combinations of yeast have been found as attractive to *D. suzukii* in laboratory choice tests, three of which are also attractive in the field. Additionally, three single yeasts previously shown to be attractive in the laboratory in the previous year of this project also proved to be attractive in the field. Work has begun characterising the microbial communities on fruit as they ripen.

Background

Since being identified in the UK, in 2012, *Drosophila suzukii* has caused considerable damage to commercial fruit resulting in yield losses and increasing expenditure on control methods. Currently *D. suzukii* is controlled through the use of plant protection products, crop hygiene measures and insect exclusion mesh. With more stringent measures being increasingly implemented on the use of plant protection products, often resulting in the withdrawal of particular products combined with the threat of insecticide resistance from a limited number of active ingredients, new control methods need to be developed and optimised.

There are complex interactions between fruit, microbes and *Drosophila* species, and understanding these is important for the control of *D. suzukii*. Yeasts are an essential source of nutrients for *Drosophila*; they are important for oviposition and larval development. Some yeast species, most notably *Hanseniaspora uvarum,* are attractive to *D. suzukii* and have the potential to produce highly attractive and selective baits. There are two potential approaches for yeast in *D. suzukii* control.

Firstly, precision monitoring, where numerous traps capture adult *D. suzukii.* This is widely available and easy to implement although it is labour-intensive. To date, this method has not been demonstrated to reduce crop damage. Trapping is recommended for the monitoring and detection of *D. suzukii* and lure-and-kill strategies could be used in integrated pest management of *D. suzukii*. However, more attractive and selective baits are needed to reduce the capture rates of non-target species. This would also make detecting *D. suzukii* females easier as they can be mistakenly identified for other *Drosophila* species without the aid of a microscope.

Secondly, attract-and-kill strategies, which combine yeast with plant protection products thus attracting flies to kill them, could be part of an IPM programme. This may enable a reduction in the amount of synthetic plant protection products applied whilst simultaneously increasing the targeted exposure of *D. suzukii.* This could reduce exposure of non-target species to plant protection products and reduce residues on fruit. A study of the literature and AHDB project SF 145 have both shown that combining plant protection products with the yeast species *H. uvarum* increases mortality and reduces egg laying compared to plant protection products alone.

Yeast has been used to trap *Drosophila* for many years; typically, dried baker's yeast has been used in fermentation-based baits. Recently, since 2012, there has been a focus on the potential use of *H. uvarum*, which is associated with *D. suzukii*, for controlling this pest. Although, *H. uvarum* is known to be attractive to *D. suzukii* not many other yeast species have been tested for attractiveness. This project will not only test the attractiveness of yeasts from an existing culture collection but also yeasts that will be isolated from ripening fruit (strawberries, raspberries, blueberries and cherries). Unlike the majority of *Drosophila* species, *D. suzukii* oviposit in ripening fruit, therefore yeast from ripening fruit may not only be attractive but selectively attractive to *D. suzukii.* In nature, microbes on the surface of fruit are complex and, currently, only single yeasts have been tested for attractiveness. This project will also test the attractiveness of combinations of yeasts.

The main aim of this project is to identify highly attractive yeast species alone and in combination, and then utilise these in the control of *D. suzukii.* Additionally, this project will aim to characterise microbial communities on ripening fruit and investigate identified yeast for attraction to *D. suzukii* as well as ability for use in control strategies.

Summary

Yeasts vary in their attraction to *Drosophila* species and previous work in 2017/18 identified four candidate yeast species attractive to *D. suzukii*: *H. uvarum*, yeast coded 218, 164, and 190*. D. simulans* was indifferent to all four but *D. melanogaster* was attracted to all four. Both are common non-target species often captured in *D. suzukii* monitoring traps; highlighting the potential for yeast to produce attractive and selective baits for *D. suzukii.* Additionally, multiple strains of *H. uvarum* were attractive to *D. suzukii*. This is a yeast species that, in the context of *D. suzukii,* has received a lot of attention in the literature and is known to be attractive to *D. suzukii*, both in the literature and project SF 145. Building on this work, we tested the attractiveness of ferments of these yeasts in the field using standard commercially available traps. Three yeasts were attractive in the field, yeast coded 190, and two strains of *H. uvarum*.

In addition, combinations of yeasts were screened, both in the laboratory and the field. Of the combinations tested, four proved to be significantly attractive in the laboratory; 201+164, 190+201, 190+218+201, and 190+218, but in the field only the latter three combinations attracted *D. suzukii*. Currently, none of the yeast-based attractants tested in the field proved significantly more attractive than commercial Gasser lure. It is worth noting that these field-based trials were conducted between late October and early December.

Microbial communities on ripening fruit are also currently being investigated. Fruit samples were collected in 2018 from four ripening stages of blueberries, cherries, strawberries and raspberries. Fruits were surface washed to collect microbes; DNA was extracted and ITS regions (conserved across fungal species) were amplified and sequenced. Cherry and blueberry samples have been sequenced, and analyses begun. However, the strawberry and raspberry samples have only recently been sent for sequencing. Once all data is collated this will be analysed using 2-way Permanova for both presence/absence as well as abundance, indicator species and UniFrac analysis. Preliminary analyses have revealed that for cherries there was a significant effect of ripening stage on fungal species (OTUs) present, but for blueberries this was not the case.

Financial Benefits

D. suzukii is an economically damaging pest that causes loss to soft and stone fruit yields. This project has the potential to improve *D. suzukii* control and reduce residues in fruits. The attractive yeast species and strains identified by this project could potentially be exploited in monitoring and control of *D. suzukii* in IPM strategies to more effectively combat this pest.

Action Points

There are currently no action points that growers need to implement at this stage.