Grower Summary

CP122/21101220

Viral Pathogens suitable for the Control of Drosophila Suzukii in the UK

Final report, October 2017

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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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AHDB Horticulture RESEARCH REPORT

Project title:	**Viral Pathogens suitable for the Control of *Drosophila* Suzukii in the UK**
Project number:	CP122/31101220
Project leader:	Dr Darren Obbard (University of Edinburgh)
Report:	Final report, October 2017
Previous report:	N/A
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Location of project:	University of Edinburgh, Edinburgh and East Malling Research, Kent
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Date project commenced:	September 2014
Date project completed (or expected completion date):	February 2018

GROWER SUMMARY

Headline

New viruses discovered in Drosophila pest: the first steps on the road to a novel biopesticide.

Background and expected deliverables

Drosophila suzukii (Matsummura), also known as the spotted wing drosophila (SWD) is an invasive pest of soft and stone fruit crops. Its recent invasion of the fruit growing regions of North America and Europe and the damage it is causing there is driving interest in finding new control solutions. Conventional crop protection methods have many drawbacks and are difficult to implement within integrated pest management (IPM) programmes; consequently, the development of an alternative, IPM compatible biopesticide would be beneficial for growers, consumers, and pest management professionals alike.

The viruses of SWD offer good potential candidates for the development of a microbe-based bioinsecticide yet, to-date, the viruses of SWD remain almost completely unstudied. This study describes the viral diversity of SWD and aims to identify a pathogen suitable for the control of this pest in UK fruit crops. A combination of approaches, both innovative genetic techniques and traditional lab based investigation, will be used to identify the viruses infecting SWD from large samples of wild flies.

Summary of the project and main conclusions

This study characterises the viral diversity of SWD with the aim of identifying a pathogen suitable for the control of this pest in UK fruit crops. To do this we first used a metatransciptomic approach to identify viral genetic sequences from wild SWD. This was achieved by collecting large numbers of flies over three years in the UK, with additional samples from France (2014) and Japan (2016), extracting all genetic material, sequencing those samples and then reconstructing virus genomes from these datasets. The existence of viruses in the original samples was then confirmed by lab based methods. Through this process we have identified 18 new viruses from SWD alone. We describe members of the Picornavirales, Mononegavirales, Bunyavirales, Chuviruses, Nodaviridae, Tombusviridae, Reoviridae, and Nidovirales, and discuss their evolutionary relationships with previously known viruses. The new reovirus, ‘Eccles virus’ belongs to a family of viruses previously advocated for biological control in China. Eccles virus may represent the most promising candidate for further investigation of insecticidal activity. Our results were submitted for publication in the journal ‘Applied and Environmental Microbiology’ and are currently available online at https://www.biorxiv.org/content/early/2017/09/26/190322. We then assessed the mortality of viral biocontrol candidates by injection of viral extracts from wild flies or isolated cultures of our best candidates from other Drosophila species. Unfortunately, the process of experimental infection did not yield a lethal viral extract and further work will be necessary to

fully explore the potential of other viruses discovered. In light of this disappointing lack of mortality we also assessed the susceptibility of SWD to viral infection by exploring its immune response to two different viruses. To do this we conducted a comparative analysis of immune system gene expression between SWD and the closely related Drosophila melanogaster. Results are still under analysis but we have identified a number of genes that change expression significantly upon infection with virus. Finally, we are investigating the patterns of virus infection in several species of wild British Drosophila. To do this we have surveyed a large number of Drosophila from five different species giving us a picture of virus ecology and host specificity.

Financial benefits

The impact of this pest on the European horticultural industry has already been substantial, with SWD damage resulting in losses of over €8 million in fruit crops in Northern Italy in 2010 and 2011 and more than €1.5 million for French strawberries in 2011 (FERA, 2015). The European and Mediterranean Plant Protection Organisation (EPPO) in a recent 'Pest Risk Analysis' deemed this organism to be a potential threat to crops in its region. Potential damage is described as "massive" and the regions ability to control it as "with much difficulty" (EPPO, 2010). In the Pacific fruit growing regions of the USA, the estimated damage due to SWD has been calculated at over €400 million/year (Bolda et al., 2010). In Californian raspberries specifically, the damage caused by SWD between 2009 and 2014 has been calculated at $US 39.8 million in revenue losses, equivalent to 2.19% of realized revenues (Farnsworth et al., 2017). With damage estimates for the UK slow to emerge, it is hard to quantify the exact financial damage that this pest has done since its establishment here.

A key consideration for the damage caused by this pest is the effect of disrupting already established IPM programmes. Changes in management techniques, necessitated by the presence of this pest, often include the use of products incompatible with IPM programmes. Without IPM compatible products, damage is not limited to that done by the pest itself but also extends to secondary pest damage caused by the use of broader spectrum or longer persistence products.

Action points for growers

Because of the exploratory nature of this project, there are no action points for growers to date.