Improving our management and control of SWD

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Since 2013, the AHDB has spent more than £1.6 million on research into the management and control of spotted wing drosophila (SWD) and in that time we have greatly enhanced our knowledge and understanding of how SWD behaves in UK growing conditions and the best management and control options available to growers. In addition to monitoring populations and activity of the pest at NIAB EMR in Kent and JHI in Dundee, we continue to fund investigations into novel approaches to control the pest whilst reducing reliance on conventional spray control products. The work is being led by NIAB EMR in association with the James Hutton Institute, Microbiotech and the Natural Resources Institute in Project SF/TF 145a. This document provides an abbreviated summary of the latest findings up until 2020 in this project.

Monitoring SWD populations in England and Scotland

Since 2013, NIAB EMR and JHI have been monitoring the populations of SWD in both England and Scotland with the valuable help of Berry Gardens Growers. This has allowed us to better understand the overall populations of the pest across the UK and how it has spread from its starting point in Kent. It has also improved our knowledge of habitat preferences and the pest biology.

Since the first detection of *D. suzukii* in the UK in 2012, populations of the pest have continued to rise in most regions of England. In contrast, populations in Scotland, in which the pest was first detected in 2014, have been slow to increase. To monitor the pest, modified Biobest traps using the Cha Landolt bait system were deployed in a range of commercial and wild crops from 2013 until 2018 at 14 sites across the UK. Since 2019, monitoring in England has been reduced to maintaining 10 traps in England at NIAB EMR and three traps in Scotland at JHI including one wild area at each site.

Key results from 2020

- *D. suzukii* numbers at NIAB EMR in 2020, overall, were similar to the catch numbers of 2017 and 2018, but 2020's trend most closely relates to 2019's profile.

- As with previous years at NIAB EMR, unprecedented peaks in trap catches occurred in conjunction with uncharacteristic peaks in temperature.

- In Scotland, 2020 total trap catches for the year were lower than 2019.

- Predictive models developed at JHI using monitoring trap catches, have been successful in predicting key SWD events including first spring female peak, with 93.3% accuracy.

Developing a push/pull system using repellents and ‘attract and kill’ strategies

The aim of this work is to combine the use of repellents and attractants, so that the pest can be pushed away from the crop using a repellent and attracted into a trap containing a fatal component.

Identifying repellents

CTP student Christina Conroy has been experimenting with synthetic repellents and attractants. From electrophysiological studies, bioassays and field experiments, three compounds were shown to be repellent to *D. suzukii*. These were taken forward into field trials to test their efficacy in preventing egg laying on strawberries. The three candidate repellents were formulated in polyethylene sachets. In trials on strawberries in experimental polytunnels, two repellents significantly reduced egg-laying by *D. suzukii* at distances over 6 metres. These need to be taken forward into larger-scale field trials.

Identifying attractants

Yeasts are known to attract SWD adults, so in Project CP 171, PhD student Rory Jones at the University of Lincoln has been collecting volatile compounds from yeast species associated with SWD and identifying them with the hope of developing new attractants.

Reducing SWD populations over-winter

SWD is known to over-winter in woodlands during late autumn/early-winter when there is reduced availability of commercial and wild fruit. A trial was established in 2019 to investigate whether the deployment of precision monitoring traps in wild habitats has the potential to reduce *D. suzukii* numbers and minimise the impact in crops in the early spring.

Key findings so far:

- In woodlands (and neighbouring crops) where trapping ‘precision monitoring’ has been applied to control the wild source of *D. suzukii,* fewer *D. suzukii* have been recorded compared to untreated (control) equivalents.

- Preliminary findings show traps positioned on the woodland perimeter caught significantly more male *D. suzukii* than within the main woodland.

- Summer habitat assessments show more *D. suzukii* were caught in traps surrounded by vegetation favoured by the pest.

This trial will continue into 2021, to see if long-term placement of these traps can suppress local *D. suzukii* populations over time.

Developing and optimising bait sprays

Using bait sprays in combination with spray control products should help to attract SWD adults to feed on the spray product, improving the likelihood of control. When compared to a spray control product on its own, it offers the potential to gain the same level of control with a lower rate of product. In field trials on strawberry in 2019, we assessed two baits; a yeast (*Hanseniaspora uvarum*) and the commercially available Combi-protec, both combined with Benevia (cyantraniliprole), with a standard foliar application of Benevia. The baits were applied as a narrow band across the top of the strawberry plant canopy with a specialised nozzle providing course droplets.

- The baits gave comparable control to the foliar spray. The Combi-protec band spraying (half the rate of the foliar spray) was as good as foliar full rate application. Additionally, foliar applications of Benevia (full rate) were effective for two weeks after the last application.
- Similar trials were repeated in 2020 on raspberry, achieving a similar effect. Weekly alternating dilute applications of Tracer at 8 ml in 40L per ha and Exirel at 36 ml in 40L per ha, combined with Combi-protec or molasses baits, were as effective in controlling *D. suzukii* numbers as full field rates of the same products applied at 200 or 900 ml in 500L per ha (i.e. a reduction in product application of 96% with the same *D. suzukii* control effect).
- In the raspberry trials, the products, whether used at full rate or reduced rate with the bait, remained effective at controlling SWD for up to two weeks after application.
- The product costs when applied to raspberry with either molasses or Combi-protec were reduced by 21% and 17% respectively and the application time required for the reduced rate with bait spray was only 10% of that taken with for the full rate application, as the spray was confined to only the central canopy of the plants.
- Residues of spinosad and cyantraniliprole were at least x11 higher in fruit samples taken from plots sprayed with the full field rates of products than from plots sprayed with the dilute rates with baits.

This work will be repeated in 2021 on experimental cherry crops at NIAB EMR. AHDB staff are working with the scientists, manufacturers and CRD to consider how growers can make best use of these research results.

Prolonging spray intervals in cherry

This work investigated whether we might prolong spray intervals beyond 7-10 days. The scientists compared the use of weekly versus fortnightly spray programmes to control SWD in protected cherry.

- Fortnightly sprays gave comparable efficacy to weekly sprays in cherry crops. The work was repeated for a second season and the results were similar.

- It was also noted that where mesh was employed to exclude SWD from the crop, there were fewer adult SWD in the crop.

SWD parasitism in the UK

In associated work which has been part-funded by Berry Gardens and The Worshipful Company of Fruiterers, entomologists at NIAB EMR searched for insects that parasitise SWD. They have been trapping SWD from wild areas and identifying parasitoids emerging from SWD larvae and pupae.

Five species were identified, including two species of larval parasitoids (*Asobara tabida* and *Leptopilina heterotoma*) and three pupal parasitoids (*Spalangia erythromera*, *Pachycrepoideus vindemmiae* and *Trichopria prema*) all of which are generalist parasitoids of Drosophila. Their main period of activity occurred between June and October. Habitat surveys highlighted how landscape diversity could influence parasitoid presence. The pupal parasitoid *Trichopria drosophilae* which is commercially available in Europe for use in biological control, has not yet been identified in the UK, so cannot be released in UK crops.

Further survey work in Scotland and England

In further work at the James Hutton Institute in 2019, parasitoids found were identified as the larval parasitoid *Asobara tabida*. Parasitoids were trapped in highest numbers in July-September in 2019. Further work in Scotland in 2020 identified the same parasitoid species in baited traps in numbers four-fold higher than in 2019.

Survey work done at NIAB EMR in 2020 used sentinel traps to determine the percentage parasitism occurring in the field. The most common species recorded was the pupal parasitoid *Spalangia erythromera,* with a mean parasitism rate of 1.1% (range 0 to 6%), which peaked in August. *S. erythromera* has been recorded in consistent numbers at the same two sites every survey year. It has also shown promise for *D. suzukii* biocontrol, being active from May to October and completing development to adulthood in lab cultures of *D. suzukii*. The survey also identified *Trichopria modesta* for the first time since surveys began in 2017, bringing the total number of native parasitoid species recorded in sentinel traps containing *D. suzukii* up to six.

Waste fruit as a source of parasitoids

It is possible that waste fruit collected at UK soft and stone fruit farms is a potential source of parasitoids which could be used for biological control of *Drosophila suzukii.* If managed effectively, waste fruit could be used to provide a source of parasitoids to control *D. suzukii* without releasing *D. suzukii* into the crop. However, a pilot study using waste fruit collected from farms known to have *D. suzukii* parasitoids, demonstrated that it is unlikely to be a significant source of parasitoids, suggesting this approach is not worth investigating further.

SWD tolerance to plant protection products

In 2018, an increased SWD tolerance to spinosad (Tracer) was detected in raspberries in California and this prompted NIAB EMR to conduct their own studies on the tolerance of both wild and laboratory reared strains of SWD to plant protection products (PPPs). In 2019, laboratory trials were established to identify a baseline level of susceptibility. There were varying levels of susceptibility to three PPPs tested between three wild populations; lambda-cyhalothrin (Hallmark), cyantraniliprole (Exirel) and spinosad (Tracer). Although there was no detection of resistance in the populations tested, there was an increased level of tolerance in some of the populations to one or more of the products tested.

In 2020, further studies were conducted looking at early season strains of SWD (July) – in 2019, strains had been collected later in the season. When looking at the survival probability of the wild strains between years, there was a significant difference between 2019 and 2020 with lower survival in 2020 from all three strains when treated with spinosad and for Wild Strain 1 when treated with lambda-cyhalothrin. If resistance had been developing in the field populations, we would expect 2020 to have higher survival than 2019. It may be that due to the populations being collected early in the growing season in 2020, they have not been as exposed to control products as those collected towards the end of the season, like the 2019 strains.