Grower Summary

SF 145

Understanding and developing methods for managing spotted wing drosophila (SWD) in the UK: Vital research to maintain the viability of the UK fruit industry

Annual 2015

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Before using all pesticides check the approval status and conditions of use.

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Further information

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Industry Representative:	Marion Regan
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GROWER SUMMARY

Understanding and developing methods for managing spotted wing drosophila (SWD) in the UK: Vital research to maintain the viability of the UK fruit industry

Headline

- A greater understanding of the biology and control of SWD in the UK has been achieved with findings directly relevant to UK soft and stone fruit growers.

Background and expected deliverables

Spotted wing drosophila (*Drosophila suzukii*, SWD) is a new invasive pest to the UK, but has caused considerable losses in fruit crops in Europe and the USA. The overall aim of the project is to monitor the spread of *D. suzukii* within the UK, and to develop measures for its control. To this end five objectives have been set for the project;

1. To determine the distribution and seasonal population dynamics of all life stages of *D. suzukii* in different cropping situations and especially polytunnel crops on fruit farms in the UK.
2. To develop economically and environmentally sustainable treatment and disposal strategies for soft and stone fruit waste to eliminate it as a source of *D. suzukii* infestation and attraction on fruit farms.
3. To develop and evaluate sampling and extraction methods for quantifying *D. suzukii* infestations in different soft and stone fruits.
4. To develop a synthetic lure and attract and kill technology for *D. suzukii* for incorporation into IPM programmes.
5. To obtain evidence for the effectiveness of different plant protection products including biopesticides to aid the development of an insecticide resistance management strategy for SWD.

Summary of the project and main conclusions

Objective 1

To determine the distribution and seasonal population dynamics of all life stages of *D. suzukii.* This was subdivided into two tasks; monitoring of the UK population throughout the year and a habitat survey.

National monitoring

In 2014, the national monitoring of adult *D. suzukii* numbers was continued at a network of 15 sites across the UK (one more than in 2014) using modified Biobest traps with Cha-Landolt bait: five in Kent, including East Malling Research, one in Surrey, three in the West Midlands, two in East England and four in Scotland, including the James Hutton Institute.

Numbers of *D. suzukii* were considerably higher in 2014 than in 2013. The largest catches were in the south east of England, but *D. suzukii* was found at all sites in 2014. The numbers caught in crops peaked in August before falling and then rising again in late October. Numbers then rose in November in woodlands and dense hedgerows, corresponding to a decrease in numbers in the cropping areas.

Habitat survey

The distribution of *D. suzukii* on two farms, including EMR, was studied throughout the winter and fruit growing seasons. Fortnightly or weekly trap samples were taken. Over 50 traps were deployed on each farm in a range of crops and in neighbouring wild areas and woodlands. *D. suzukii* was detected throughout the farms, but especially associated with particular woodlands and hedgerows. Adult *D. suzukii* continued to be trapped throughout the winter. Only two weeks were absent of catches in February, when cold weather probably reduced adult flight activity on both farms. November and December 2014 saw the highest trap catches in hedgerows and wild areas suggesting the movement of flies to denser sheltered areas for the winter.

One very important finding of the habitat surveys was that the traps did not detect *D. suzukii* in cherry crops before eggs were laid in the ripening fruits. This has implications for spray timings and product rotation and will be further investigated in 2015.

To determine if *D. suzukii* could utilise other plants, fruit was collected from potential hosts in areas of known *D. suzukii* activity. Fruit was maintained in ventilated boxes at room temperature and the numbers of emerging adult *D. suzukii* recorded. In 2013, *D. suzukii* were using wild elder and blackberry. In 2014, elder and blackberry were confirmed as breeding hosts, along with yew and black bryony.

By keeping adult *D. suzukii* on fruits collected from a range of plants and monitoring their reproduction, several more possible hosts have been identified including dogwood, sloe, snowberry, red bryony, spindle, rosehip, Guelder rose, cotoneaster, rowan, honeysuckle and nightshade. *D. suzukii* was also found to successfully reproduce in the ornamental plant, Pink Pagoda (*Sorbus hupehensis)*.

Additional research, tracking the development of the ovaries in the female flies, has enabled us to track the reproductive stage of females through the season, indicating times when females are reproductively active and therefore when crops are vulnerable.

In laboratory tests, it was demonstrated that where a choice of different stages of fruit development is available, *D. suzukii* 'prefer' to lay eggs in ripe fruits compared to over ripe fruits, highlighting the need for effective crop hygiene.

Preliminary results from the field (where sentinel fruits were placed in the crops; cherry and raspberry) and laboratory experiments to examine the time of egg laying, suggest diurnal female egg laying activity, with more eggs being laid in two peaks; late morning and in the evening, before dark. However, small numbers of eggs could be laid over the whole 24 hour period.

Objective 2

Researchers in other EU countries highlight the importance of crop hygiene for *D. suzukii* control. Consultations with UK soft fruit growers indicated that ~20% of the strawberry crop and 10-15% of the raspberry crop is currently waste, mainly disposed of in a 'compost heap' which rots down over several months. Cherry and plum waste is not usually collected from under the trees. Quantities of fruit waste produced by individual companies can range from <1 tonne to >100 tonnes per week during peak season.

In replicated tests, fruit fermentation in Dolav bins was effective at killing *Drosophila* larvae. Bins needed to be sealed with plastic sheeting and with the lid in place. This has the effect of

depleting the oxygen within the bins and thus killing larvae within 48 hours at ambient temperatures of 16^{o}C. Longer storage temperatures may be needed at cooler ambient temperatures. The waste product was still found to be attractive to *D. suzukii* after this treatment and hence waste material spread onto land should be incorporated into the soil. Future tests will look at composting with other farm waste materials.

Objective 3

Three low cost methods were trialled to detect *D. suzukii* late stage larvae in fruit (blueberries, cherries, raspberries and strawberries); immersion of crushed fruit in strong sugar or salt solutions or freezing whole fruit overnight. These methods were compared to emergence testing (keeping fruits in boxes at room temperature for 3 weeks and counting adult emergence) and dissecting the fruits to directly count the numbers of larvae.

Sugar and salt immersion were the most successful in detecting *D. suzukii* larvae, with sugar solution slightly more effective. No method gave 100% recovery of the larvae. Freezing overnight generally gave lower counts of *D. suzukii* larvae. Hence, flotation with a strong sugar solution is the most practical way for growers to determine the infestation levels of fruits. A regular programme of emergence testing, although taking longer, could give growers additional information on fruit infestation early in the season and is generally more sensitive than flotation testing.

Objective 4

A wide variety of traps and baits have been developed around the world for *D. suzukii* recording. Work at EMR compared the most promising of the commercially available traps for efficiency and ease of use. The results from 2014 suggest that the most practical of those tested for grower use is the 2014 Biobest trap combined with Dros'Attract liquid bait. However, it was shown that because of the larger entry hole sizes in this trap, a significantly greater number of >4 mm insects are captured making identification of adult *D. suzukii* more time consuming.

For scientific use, the modified Biobest trap used in conjunction with the Cha-Landolt bait system provided high catches of *D. suzukii* and the lowest bi-catch.
A dry bait produced by NRI containing the same 4 components as the Cha-Landolt bait was trialled in a cherry crop and shown to be attractive to *D. suzukii* and more selective for this species, with less by-catch of other insects.

Development of a lure and kill formulation using pesticides combined with an attractant is underway and has positive initial results.

Objective 5

Fruit from unprotected raspberry plants sprayed with field doses of insecticide were assessed using a laboratory culture to determine efficacy and any residual effects. Insecticides tested were: abamectin (Dynamec), acetamiprid (Gazelle), chlorantraniliprole (Coragen), chlorpyrifos (Equity), deltamethrin (Bandu), lambda cyhalothrin (Hallmark), pyrethrins (Spruzit), spinosad (Tracer), thiacloprid (Calypso) and a coded product. These were compared to an untreated control.

The insecticides which caused greatest direct mortality to adults introduced into the boxes of fruit were chlorpyrifos (100%), spinosad (57%) and the coded product (47%). These were also amongst the most successful in reducing subsequent larval emergence, with good control of emergence up to 1-2 weeks after spraying (chlorpyrifos; 1% emergence compared to controls after 14 days, coded product 11% emergence compared to controls after 14 days). This was broadly in agreement with the trial on strawberries in 2013, although spinosad efficacy had declined after the first week in 2014 (from 29% emergence compared to controls at 7 days to 67% at 14 days), potentially because the trial in 2014 was on unprotected raspberry, as opposed to protected strawberry the year before.

Abamectin, acetamiprid, and thiacloprid also significantly reduced larval emergence from treated fruit exposed to *D. suzukii* (<20% emergence compared to controls, on fruit from day of spraying, and next day), even though they had a limited toxicity to adults, especially abamectin (3%).

Of the other tested products, chlorantraniliprole, deltamethrin, lambda cyhalothrin, and deltamethrin gave a degree of control of adults, but no significant control of emergence from fruit.

In 2013, a baseline for resistance (LD_{50}) was set with the laboratory culture. In 2014, field *D. suzukii* were sampled from crops known to have been treated with insecticides and nearby wild areas. There is no evidence of resistance to spinosad from these populations thus far. In addition, sugar is being tested as a possible adjuvant to increase the efficacy of insecticides.

Additional research

Survival of eggs and larval stages through the cold store chain, and the use of hypospectral imaging to detect *D. suzukii* eggs in fruit, was investigated. Further details (Objective 6) can be found in the science section of this report.

Financial benefits

D. suzukii poses a clear threat to the fruit industry and has had a commercial impact on UK grown fruit in 2014. Growers reported significant financial losses in cherry and some soft fruit in 2014.

Action points for growers

- Monitor adults in susceptible crops and wild areas around crops from February onwards so that they can predict the onset of egg laying by *D. suzukii*. Use the recommended trap and bait.
- Deploy perimeter trapping around vulnerable crops before fruit begins to ripen, to delay movement of *D. suzukii* into the crop.
- Monitor for larval infestation in the crop. The floatation technique using sugar solution is recommended for rapid detection of larvae, but growers should consider emergence testing (boxes of fruit at room temperature) for early season detection.
- Crop hygiene should be maintained and waste fruit treated by containing in sealed vessels and then disposed of responsibly.
- Consult BASIS trained advisors for the latest approvals for effective plant protection products.
- Growers can find comprehensive information about spotted wing drosophila (including useful videos on trapping and monitoring) on the dedicated SWD pages of the HDC website www.hdc.org.uk/swd.