Grower Summary

SF 120 (HL 01107)

Biological, semiochemical and selective chemical management methods for insecticide resistant western flower thrips on protected strawberry

Annual 2012

Disclaimer

The results and conclusions in this report may be based on an investigation conducted over one year. Therefore, care must be taken with the interpretation of the results.

Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

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 HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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Headline

A combination of early releases of *Neoseiulus cucumeris* plus releases of *Orius laevigatus* gave good control of western flower thrips (WFT) throughout the season and reduced fruit damage.

Background and expected deliverables

The development and spread of pesticide resistant strains of WFT which cannot be controlled with pesticides, seriously threatens the viability of the UK strawberry industry. In 2009 serious outbreaks occurred in several high value crops in southern and central England causing serious loss. The aim of the proposed project is to develop a comprehensive range of new effective methods for managing insecticide resistant western flower thrips (WFT) on tunnel-grown strawberry in the UK. The methods will include an improved semiochemical monitoring trap with attendant damage thresholds, a computer-based population and risk forecasting model, new selective pesticide treatments, new biopesticides and novel, more cost-effective strategies for using existing predators. These components will be integrated into a comprehensive management strategy for the pest which will be tested on a commercial scale in the later stages of the project. The objectives of the project are as follows:

Objective 1: To develop an easy to use, pest-specific monitoring method and attendant damage thresholds for WFT in strawberry crops in Spanish tunnels.

Objective 2:. To develop a computer based model of thrips population development for predicting risk of WFT infestation and rapidity of population increase

Objective 3:. To determine reliable and cost-effective methods for using predators for biological control of WFT

Objective 4:. To evaluate pesticide products, adjuvants and entomopathogenic fungi for control of WFT in strawberry, the latter in flowers versus in the soil

Objective 5:. To optimise the use of the above components in a joined up IPM programme for WFT control on strawberry and to evaluate and refine it on a commercial scale

Summary of project and main conclusions

Progress on each objective of the project is summarised below:

Objective 1 (Pheromone)

A series of experiments were done to see whether the existing pheromone could be improved by testing different ratios and release rates of the two compounds and their enantiomers produced by male WFT (neryl (*S*)-2-methylbutanoate and (*R*)-lavandulyl acetate). The pheromone neryl (*S*)-2-methylbutanoate alone, significantly increased trap catches through all the experiments, but by small amounts (between x 1.2 and x 3.4 in replicated experiments in Spanish pepper crops and x 1.5 in field monitoring of UK strawberry crops). No improvements were identified by the addition of (*R*)-lavandulyl acetate, which actually reduced trap catches.

The plant volatile methyl isonicotinate (an analogue of a flower odour) resulted in similar small increases in two trials (x 1.36, x 1.2). The combined use of pheromone and plant volatiles consistently resulted in higher trap catches than either alone but there was no evidence that the presence of plant volatiles increased the performance of the pheromone.

Trap colour had a large effect on the numbers of WFT caught. The blue traps attracted significantly more thrips than the yellow traps (x 2.4), clear traps (×9) and black traps (×35). The pheromone increased the catch in inverse proportion to the attractiveness of the trap colour (blue ×1.3, yellow ×1.7, clear x1.9, black x3.4) which could be used to increase the specificity to *F. occidentalis* as the pheromone attracts WFT but not *Thrips* spp. Wet glue on traps caught more thrips than dry glue traps (x 1.4). Placement of traps about 10 cm above the crop, facing south to catch more light, resulted in the highest trap catch.

In a controlled experiment, fruit damage increased with increasing numbers of adult thrips per flower. Initial monitoring of UK strawberry crops suggests that downgrading of fruit can occur from about 4-8 adult thrips per flower. The lower threshold of 4 thrips per flower occurred when there were few natural enemies in the crop and the higher threshold occurred when the establishment of *N. cucumeris* was good. Mean thrips per flower was a better predictor of damage than mean trap catch.

Objective 2 (Model)

The model evaluations showed that the conditions for activating over-wintering adults are critical for predicting seasonal phenology of WFT. This will be addressed in 2012. Experiments are in progress to determine rates of development of WFT at fluctuating temperatures and to determine when WFT are first caught in sticky traps in the field. Results will be used to modify the model.

Objective 3 (Predators)

In an ADAS experiment, the combination of *Neoseiulus cucumeris* and *Orius laevigatus* gave good control of thrips throughout the season. Only slight thrips damage to fruit occurred in August and no fruit was downgraded. Alyssum banker plants flowered well between May and late August and provided a source of pollen between the two strawberry flower flushes. They acted as a 'trap' plant for thrips and allowed *O. laevigatus* establishment in the flowers by early July. Although numbers of *O. laevigatus* per strawberry flower were highest in the plots with alyssum banker plants, there was no significant difference between treatments. Thus there was no evidence that alyssum banker plants led to more *O. laevigatus* or less thrips per strawberry flower. However, it is possible that *O. laevigatus* adults dispersed from the alyssum to all experimental plots due to their active flight activity.

In an EMR experiment, numbers of *N. cucumeris* emerging from sachets in early March, when temperatures were often below freezing and the mean temperature over the six weeks of the experiment was 10°C, were very low. Thus it is unlikely that releases of the predator at this time would establish in the crop. Reasonable numbers of *N. cucumeris* emerged from sachets set up on 16 March; mean temperature experienced by this batch was 13.4°C.

N. cucumeris released into strawberry plants on 6 April established and numbers increased to 0.5 per flower on 19 May; numbers were higher in the 2 x sachets release treatment than in the early sachet + late loose treatment. Both release strategies for *N. cucumeris* reduced numbers of thrips larvae and adults compared with the no-release control; this effect was seen until early June. There was no clear effect of *O. laevigatus* release on thrips populations. Fruit damage increased over the picks. Damage was greater in plots where no *N. cucumeris* had been released.

Objective 4 (Pesticides and biopesticides)

Seven treatments were evaluated for their effects on WFT populations maintained on strawberry plants housed in mesh cages in a polytunnel. The treatments were as follows: four bio-insecticides; two novel chemical insecticides; spinosad; an untreated control. Assessments were done on the size of WFT populations after treatment, and effects on flower and fruit damage.

Significant reductions in the WFT population and the numbers of damaged flowers were observed with the two novel insecticides and with spinosad. The bio-insecticides did not have a significant effect.

We would conclude from these results that the two novel pesticides have potential for WFT control on tunnel-grown strawberries and would be worth investigating further. A key area is to establish why the bio-insecticides did not give significant control, because they are known to be able to kill thrips and some have given very good control on protected crops in other studies.

Financial benefits

Strawberry production in the UK is intensive and the crop is of high value, the UK industry being amongst the most effective in Europe. In 2007, 50,739 tonnes of strawberries, worth approximately £212 million were produced from approximately 2,922 ha grown in Britain. A further estimated 41,126 tonnes, worth approximately £174 million, were imported.

The development and spread of pesticide resistant strains of WFT which cannot be controlled with pesticides seriously threatens the viability of the UK strawberry industry. In 2009 serious outbreaks occurred in several high value crops in southern and central England causing serious loss. The average everbearer crop yields 20,000 kg of class 1 fruit over one season with a current value of £2.70 per kg (£54,000 per ha). On some farms in 2009, WFT damage to everbearer fruit was so severe following failure of spinosad to control the pest that total crop loss occurred for the latter third of the season, i.e. a loss of £18,000 per ha. Even on farms where spinosad is still effective, WFT damage can lead to at least 20% of the fruit being downgraded to class 2 for half of the picking season. The value of class 2 fruit is less than £1.50 per kg. Thus, WFT currently causes minimum estimated financial losses of approximately £3,000 per ha per season. There is great concern that UK everbearer crop losses will escalate with the further spread of spinosad-resistant strains of WFT. Furthermore, WFT is favoured by hot summer weather conditions. If the 2009 summer weather had been hot it is possible that losses would have been much more extensive.

This project will deliver a new sustainable cost-effective IPM strategy for management of WFT on tunnel-grown everbearer crops which is vital to the survival of the UK strawberry industry. The development of a reliable IPM strategy for successful control of WFT would benefit growers by preventing crop losses and fruit downgrading due to WFT damage. In this project we aim to develop a range of complementary methods for managing WFT. For instance, using WFT predators which may include two releases of *Neoseiulus cucumeris* in sachets (costing up to £325 per ha) and two releases of *Orius laevigatus (*costing up to £600 per ha). If this strategy prevented fruit downgrading due to WFT damage for the whole everbearer season, use of the two predators could give a minimum potential 324% return on investment. On farms with spinosad resistance the benefit of investing in a reliable IPM strategy would be much greater as it could prevent entire crop losses.

Action points for growers

- Bronzing damage to strawberry fruit increased with increasing numbers of adult thrips per flower. Significant damage that might result in downgrading of fruit corresponded to an average of about 4 to 8 adult thrips per flower.

- When monitoring for thrips the selection of flower age and position affects population estimates. Select flowers of medium age (all petals present, pollen shed) from the top of the plant for monitoring thrips adults, as young (petals fresh, pollen not shed) or senescent (petals dropping) flowers will result in an underestimation. Select senescent flowers when monitoring for thrips larvae.

- Blue sticky traps are very effective at catching thrips, each catching several hundred (and up to 2200) thrips per week in Spanish tunnels in the UK. In strawberry the best position for traps is to mount them onto a post (a cheap bamboo cane is sufficient, held in place with a rubber band) with the bottom of the trap (landscape orientation) about 10cm above the top of the crop (one hand width), orientated to face south so that it catches more light.

- The addition of a pheromone lure to a blue trap increased the trap catch by an average x1.5 in weekly monitoring in UK strawberry through the season and by between x1.2 and x 3.4 in replicated field trials in Spanish pepper crops.

- *N. cucumeris* emerge in reasonable numbers from abs sachets if placed in the crop when mean temperatures in the crop are above 13°C.

- Early releases of *N. cucumeris* from sachets followed by a release of either sachets or loose product after 6 weeks can reduce numbers of thrips in the crop, but numbers of the pest may increase later in the season.

- A combination of early releases of *N. cucumeris* and *O. laevigatus* can give good control of thrips throughout the season and reduce fruit damage.

- Alyssum banker plants, if flowering between May and late August, can provide a source of pollen between strawberry flower flushes to aid establishment of *O. laevigatus*.