Grower Summary

CP 089

Maintaining the expertise for developing and communicating practical Integrated Pest Management (IPM) solutions for Horticulture

Annual 2015

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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.

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GROWER SUMMARY

Headline

- Rose thrips, *Thrips fuscipennis* has damaged strawberry fruit in different UK geographic locations, on crops where western flower thrips has been well controlled by the predatory mite *Neoseiulus cucumeris*. At present this species is susceptible to spinosad (Tracer) but due to the risk of the development of resistance to this pesticide, reliable IPM methods are needed.

Background

Rose thrips, Thrips fuscipennis

Knowledge gained by ADAS during 2013/14 in the IPM Fellowship confirmed that native thrips species were causing strawberry fruit damage in various commercial crops and geographic locations. The rose thrips, *Thrips fuscipennis,* was been identified in both 2013 and 2014 as commonly occurring in large numbers associated with rapidly-occurring fruit bronzing and malformed fruit, in crops where western flower thrips, *Frankliniella occidentalis,* had been well controlled by *Neoseiulus cucumeris* (Figure 1).

Figure 1 Damage on strawberry associated with *T. fuscipennis*

T. fuscipennis adults are darker in colour than those of WFT but are very similar to other *Thrips* species that can be found in strawberry flowers (Figure 2a and 2b).

Figure 2a Rose thrips, *Thrips fuscipennes* (left) **2b** western flower thrips, *Frankliniella occidentalis* (right)

Growers have often applied spinosad (Tracer) which has given effective control. However, growers are concerned about the risk of insecticide resistance and would like a biological control option. In addition, growers are likely to wish to reserve Tracer for use against SWD if needed, as the number of applications per crops are currently limited to four per year on protected strawberry. Some growers consider that as these species seem to migrate into the crop as adults in large numbers they are not controlled by *N. cucumeris* which only feeds on first instar WFT larvae. It is unknown whether *N. cucumeris* can successfully predate *T. fuscipennis* larvae.

In this year's Fellowship the following work has been carried out by Gemma Hough on *Thrips fuscipennis*:

- Monitoring *Thrips fuscipennis* at a commercial strawberry site
- A literature review on current knowledge of *T. fuscipennis* biology, overwintering sites and natural enemies
- Comparing damage by *Thrips fuscipennis* (rose thrips) with *Frankliniella occidentalis* (western flowers thrips, WFT)

Potential of the predatory beetle Atheta coriaria for biological control of vine weevil

Vine weevil (*Otiorhynchus sulcatus*) is one of the most serious pest problems in both soft fruit and hardy nursery stock crops. Adult weevil damage to leaves and the presence of larvae around roots can make containerised ornamental plants unmarketable. Root damage caused by larvae in both ornamental and soft fruit crops leads to reduced plant vigour and yields and if damage is severe, to plant death.

Growers of susceptible soft fruit crops such as strawberry and raspberry commonly use entomopathogenic nematodes for vine weevil control, usually applied through drip-irrigation systems. This method is usually effective in substrate-grown crops but not in field-grown crops. Growers of containerised hardy ornamentals have until recently largely relied on the use of persistent insecticides in the growing media for vine weevil control. However, the choice of insecticides is now very limited due to recent EC restrictions on the use of neonicotinoid insecticides and in addition, growers are under pressure to reduce reliance on pesticides in favour of IPM. Entomopathogenic nematodes are used in containerised ornamentals for vine weevil control but drip irrigation is little used in these crops, therefore nematodes have to be applied using a drench. This method is labour-intensive and drenching can be less effective on large, closely spaced plants, when much of the drench can end up on the floor rather than on the target substrate in the pots. The entomopathogenic fungus *Metarhizium anisopliae* (Met52) is available for incorporation in growing media for vine weevil control, but its temperature requirements limits its use in ornamentals and the current formulation is impractical for use in soft fruit.

There is a need to improve biological control of vine weevil and a potential candidate for supplementing other biological control methods is the predatory beetle *Atheta coriaria*. This predator is commercially available for biological control of sciarid and shore flies in protected crops, where it feeds on both eggs and larval stages. In CRD-funded project PS 2130, ADAS demonstrated that in the laboratory, both *A. coriaria* adults and larvae predated young vine weevil larvae, although they did not feed on the eggs. The predator was investigated further in a semi-field experiment.

Summary

Monitoring *Thrips fuscipennis* at commercial sites

During 2014 an ADAS fruit consultant sent in samples of thrips which were damaging everbearer fruit at a commercial site. It was confirmed that the thrips species responsible was *Thrips fuscipennis*. Visits were made to the site to monitor thrips numbers.

The first visit was made on 17 July 2014 and 20 flowers were sampled randomly across the crop to determine the mean number of thrips per flower. One medium-aged flower sticking up from the top of the plant was selected and visual counts of thrips adults and larvae were then carried out. Following the initial visit on 17 July the grower treated half the crop with spinosad (Tracer) and the other half with a release of the predatory bug *Orius laevigatus.* Following the treatment, a return visit was made on 1 August 2014 and 24 flowers were sampled from each

treatment area to determine the mean number of thrips and *O. laevigatus* per flower. Twenty four flowers were sampled systematically and some were brought back to ADAS, Boxworth so the thrips species could be identified. .

On the first visit prior to treatment a mean of six thrips adults per flower was recorded.

O. laevigatus treatment area

Following releases of *O. laevigatus*, there was an average of 1.1 and 0.25 thrips adults and larvae per flower respectively. There was also a mean of 0.04 *O. laevigatus* adults per flower (equivalent to one every 25 flowers) and 0.21 *O. laevigatus* nymphs per flower (equivalent to one every five flowers) which is equivalent to 25% of the flowers sampled having *O. laevigatus.*

Tracer treatment area

Following treatment with spinosad (Tracer) there was a mean of 1.17 and 0.21 thrips adults and larvae per flower respectively in the Tracer treatment area. There was also a mean of 0.13 (equivalent to one every 7.7 flowers) *O. laevigatus* adults and 0.13 *O. laevigatus* nymphs per flower which is equivalent to 25% of the flowers sampled had *O. laevigatus* on.

The numbers of thrips per flower and *O. laevigatus* per flower was similar between the treatments indicating that there was no difference between the two treatments. The data suggested that both treatments were effective in reducing the numbers of thrips per flower, as the numbers of thrips adults reduced from six per flower prior to treatment, to around one per flower following treatment in both treatment areas. However at the same time as this crop was being monitored, thrips species were also being monitored on other commercial crops, where growers who had experienced high numbers of thrips including *T. fuscipennis* were reporting a natural decline in thrips numbers. Therefore, it is cannot be confirmed whether the decline in thrips numbers was a treatment effect or a natural population change. This work did confirm that *O. laevigatus* provided control of *T. fuscipennis* as it was present throughout the monitoring period and was observed predating thrips on the strawberry flowers. It also confirmed that *T. fuscipennis* was reproducing on strawberry as larvae were present.

A literature review on current knowledge of *T. fuscipennis* biology, overwintering sites and natural enemies

Distribution and host range

Thrips fuscipennis, commonly known as rose thrips, is widely distributed across Europe and further afield including China and western North America. It has a wide host range including various ornamentals, fruit crops, legumes and cucumbers. Specific fruit crops include blackberry, strawberry and various fruit trees but *T. fuscipennis* has not previously been considered an important pest on these crops, with control measures considered unnecessary. Other important hosts include hedge weeds commonly found surrounding fruit crops such as bind weed (*Calystegias sepium*) and meadowsweet (*Filipendula ulmaria)*.

Biology and recognition

Thrips fuscipennis is reported to have up to four generations per year and is often found in association with *Thrips major* populations. *Thrips fuscipennis* adults are dark brown in colour and have seven antennal segments compared to those of *Frankliniella occidentalis* (western flower thrips) which is lighter in colour with eight antennal segments. Other *Thrips* species e.g. *T. major* can also occur in strawberry flowers and distinguishing *T. fuscipennis* from other *Thrips* species requires detailed examination of various morphological features under a high powered microscope using a diagnostic key.

In spring, the *T. fuscipennis* adults emerge from their overwintering sites which include the trunks of trees and amongst herbage. It has also been recorded overwintering together with *Thrips major* in bark crevices e.g. of chestnut. Once the adults have emerged they lay eggs on host plants from May onwards and the adults and larvae feed on leaves, shoots and in flowers until September. Males are reported to be present between June and October.

Control

Monitoring of *T. fuscipennis* is reported to be effective using blue traps and can be combined with Lurem-TR® which is a semiochemical (methyl isonicotinate) attractive to both males and female thrips species including *T. fuscipennis*. Work carried out in strawberry crops in the Netherlands indicated that *Thrips major* was the main species found on blue sticky traps with the Lurem-TR® attractant, although small numbers of *T. fuscipennis* were present in some sampling weeks.

Currently, *T. fuscipennis* remains susceptible to applications of spinosad (Tracer). However, growers of strawberry are concerned that this species may develop resistance to spinosad and are keen for a biological control solution.

Biological control agents are available for controlling thrips, such as the predatory mite *Neoseiulus cucumeris* which is widely used for WFT control on strawberry and on protected edible and ornamental crops. However, there is no published information on whether these also predate *T. fuscipennis* larvae. ADAS work in this project (CP 89) indicated that *Orius laevigatus* provided control of *T. fuscipennis* on a protected strawberry crop in 2014.

Overall there is very little published information available on this species with regard to its biology and control. Further knowledge on its biology would help to inform the development of effective integrated management strategies.

Comparing damage by *Thrips fuscipennis* (rose thrips) with *Frankliniella occidentalis* (western flowers thrips)

Following reports of *Thrips fuscipennis* causing damage on strawberry crops during 2014, a trial was carried out to confirm that *T. fuscipennis* causes damage on strawberry and whether the damage differs to that caused by western flower thrips. The experiment consisted of three treatments consisting of replicate thrips-proof mesh cages containing either western flower thrips (*Frankliniella occidentalis*), rose thrips (*Thrips fuscipennis*) or no thrips (control).

Each cage contained four strawberry plants. Before adding the plants to the cages the plants were grown under horticultural fleece in a polytunnel to stop natural infestation of thrips occurring.

Once the strawberry plants were put into the thrips- proof cages, *T. fuscipennis* was collected from a commercial site on 17 July and 10 were released into each *T. fuscipennis* cage on 18 July. Ten western flower thrips were also released into each of the WFT cages which were collected from the ADAS laboratory culture. An additional 15 of each thrips species were released into the cages on 1 August. Assessments were carried out on 15, 29 August and 12 September where the number of flowers, ripe fruit, thrips per flower and damage was assessed. Although no thrips had been released to the untreated cages, thrips were found on the plants with a mean of 0.01, 0.6 and 0.5 per flower on 15, 29 August and 12 September respectively. The untreated cages were always sampled first to prevent cross contamination with the other cages and therefore the plants must have been infested when they were covered with fleece while growing in the polytunnel. On the final sampling date, samples of the thrips were taken from the cages and it was confirmed that 100% of the seven thrips collected from the untreated cages were the onion thrips, *Thrips tabaci*. This confirms that the plants were naturally infested prior to them being moved into the thrips-proof cages as *T. tabaci* was not released in this experiment.

In the WFT cages, the numbers of thrips per flower increased at each sampling date with 0.01, 0.6 and 1.1 thrips per flower on 15, 29 August and 12 September respectively. In the WFT cages, 62.5% of the eight thrips collected were WFT and 37.5% were *T. tabaci*. No cross contamination between WFT and *T. fuscipennis* occurred in the WFT cages.

In the *T. fuscipennis* cages, the numbers of thrips per flower increased at each sampling date with 0.06, 0.5 and 1.4 thrips per flower on 15, 29 August and 12 September respectively. When thrips samples were taken, it was confirmed that 30% of the 10 thrips collected were *T. tabaci* and 60% were *T. fuscipennis*. In one of the cages one potential WFT/ *Frankliniella intonsa* was also identified (10%).

Due to the natural contamination of the plants with *T. tabaci* it was very difficult to compare fruit damage caused by WFT and *T. fuscipennis* as it may have been caused by *T. tabaci. Thrips tabaci* is known to cause fruit damage on strawberry and this was confirmed in the untreated cages where damage was observed by the final assessment. It was also difficult to interpret the reproductive rate of *T. fuscipennis* and WFT on the strawberry plants as the *Thrips* species larvae could have been *T. tabaci.*

Potential of the predatory beetle Atheta coriaria for biological control of vine weevil larvae

Laboratory experiments carried out in the CRD-funded project PS 2130 demonstrated that *A. coriaria* adults and larvae predated a mean of 6.5 and 3.3 vine weevil larvae respectively over a three day period when offered eight 1-4 day-old vine weevil larvae.

An experiment was conducted in this project to assess whether vine weevil control could be achieved in more realistic conditions. Potted fuchsia plants were infested with vine weevil eggs and *A. coriaria* were applied at vine weevil egg hatch. The experiment consisted of two treatments; an untreated control (fuchsia plants infested with vine weevils) and an *A. coriaria* treatment (infested fuchsia plants treated with *A. coriaria*). Each plant was covered with an insect-proof mesh cage to prevent *A. coriaria* moving between plants and other pests or predators reaching the plant.

On 7 August each fuschia plants were infested with 15 vine weevil eggs. In total 30 adult and 30 larval *A. coriaria* were then released to each plant with five adults and larvae being released on 15 August, 10 adults and larvae being released on 16 August and a final 15 adults and larvae being released on 20 August.

Assessment of the plants took place on 21 October when they were assessed for numbers and weights of vine weevil larvae, number of *A. coriaria*, plant and root vigour and root weight.

There were no significant differences between the treatments in the number or weight of vine weevils, plant or root vigour, or root weight, indicating that *A. coriaria* did not provide control of vine weevil larvae in this experiment.

Financial Benefits

- Growers and agronomists will benefit from being aware that both WFT and *T. fuscipennis* can damage strawberry fruit.
- Soft fruit agronomists have already benefitted from the training in recognition of thrips species that can occur in strawberry flowers given at the HDC soft fruit agronomist's day on 12 February 2015.
- Growers and agronomists will benefit from being aware that *T. fuscipennis* is currently susceptible to spinosad (Tracer), unlike many populations of WFT on soft fruit farms.
- Improved knowledge of thrips recognition will reduce the unnecessary use of Tracer against spinosad-resistant WFT populations and allow growers to reserve the permitted number of applications of Tracer per year for control of spotted wing drosophila (SWD) if required.
- Growers and agronomists will benefit from the results of this project which showed that during late July and August 2014, *Orius laevigatus* established in strawberry flowers infested with *T. fuscipennis* where the predators were observed eating thrips and numbers of thrips per flower were reduced.

Action Points

- Strawberry growers and agronomists should be aware that different thrips species can infest strawberry flowers and both WFT and *T. fuscipennis* can damage fruit.
- Use a preventive programme of the predatory mites *Neoseiulus cucumeris* from first flowers in the spring.
- Consider starting releases *Orius laevigatus* to supplement control by *N. cucumeris* once temperatures are above 15°C (preferably above 20°C) for a few hours each day and during a flower flush to help them establish.
- Get your thrips species confirmed by an Entomologist. ADAS can help with this, contact gemma.hough@adas.co.uk or jude.bennison@adas.co.uk for details of the samples required. Species confirmation will help to plan an appropriate insecticide if needed as a back-up to biological control agents in your IPM programme.

- Hardy nursery stock growers using *Atheta coriaria* for the control of sciarid and shore flies may gain some incidental control of young vine weevil larvae, but *A. coriaria* should not be relied upon for biological control of vine weevil.