EIP IPDM –Biological controls for soft fruit pests.

Table of Contents

General Key points for using biological controls effectively.

- Don't blindly follow a calendar and apply at the same time each year. Biological controls rely on certain conditions in order to use them effectively. If you do not meet those then the application will be less effective. Having an understanding of the conditions at application is critical.
- Follow the manufacturer advice for application carefully
- Rates will vary heavily depending on crop, crop size/ condition and pest pressure. Consult an advisor on the best approach to take depending on crop.
- The most effective use of most biological controls is preventatively. Most will struggle to cure heavy infestations of pests without high rates. It is therefore more cost effective to use them preventatively especially on pests that you know are regular problems.
- Once delivered most biologicals need putting out into the crop as soon as possible, long term storage is rarely an option. Where storage is necessary be very careful to follow manufacturer instructions to ensure proper storage for best results.
- Make sure that staff selected for the introduction of biological controls are trained and competent, easy mistakes can lead to costly reintroductions.
- Regular crop monitoring is important to allow time for biological orders to be made.

Phytoseiulus persimilis

Purpose

Phytoseiulus persimilis is a predatory mite that provides control against Two-spotted spider mite (Figure 1). It preys on all lifecycle stages of the mite but prefers eggs, piercing the egg and feeding on its contents. *Phytoseiulus* can attack adult spider mites but are not as effective, the smaller stages of *Phytoseiulus* will only feed on smaller prey.

Phyoseiulus will only feed on TSSM and will not provide control for anything else. Its populations will only survive if there is an existing population of spider mite. The larval stage of this predator does not feed but the following nymph stage does.

Figure 1: Two-spotted spider mite (TSSM), Tetranychus urticae

Biology

The adult female can lay up to 60 eggs in her 50 day life time when temperatures are between 17-27°C, low humidity (<60% rh) will negatively impact egg survival.
It can take around 10 days for the eggs to develop into adults at 20°C, or five days at 30°C. Below 15°C the predators are slow and can eventually starve. If given its optimum conditions each adult *Phytoseiulus* can consume five adult TSSM or 20 eggs or juvenile mites per day.

Applications

They have a short life expectancy so it is vital that they are introduced to the crop as soon as possible after receiving them, if they need to be stored for any reason then they should be stored for no more than 2 days between 8-10°C out of direct sunlight in the dark with the bottle stored horizontally. Storing horizontally avoids the mites distributing themselves unevenly in the bottle, this can cause issues with distribution in the crop if not corrected.

These are most often supplied in shaker bottles, before applying the bottle needs to be rotated gently to ensure that the predators are evenly distributed throughout the container.
Be mindful of predator runoff when applying to a crop canopy, the mites need to be in the crop in order to get the best results.

A ballpark aim is for 1-3 *Phytoseiulus* per mature strawberry plant per introduction. This will depend on pest pressure and age of the crop. The risk is likely to be lower in a 60 day crop compared to a fleeced everbearer crop and this will result in different rates needed. Raspberries would need around 5-10 per pot at low levels of TSSM increasing to 10 – 20 for moderate infestations, again depending on size of plant.

Critical points

- *Phytoseiulus* will only control TSSM, without TSSM the population will collapse.
- Less than 60% relative humidity egg survival is severely hampered.
- Regular temperatures less than 15°C will result in sluggish mite activity, leading to starvation.
- If having to store, keep them out of direct sunlight for no more than 2 days at 8-10°C.

Neoseiulus cucumeris (formerly known as *Amblyseius cucumeris*)

Purpose

Neoseiulus cucumeris are small predatory mites that provide control of thrips larvae, two spotted spider mite and tarsonemid mite. It's mobile in the crop and can also feed on pollen, allowing it to survive in the absence of prey. They are known to feed on the immature life stages of thrips species, due to their size however, they are typically not able to consume adult thrips. They will also consume two spotted spider mite eggs, but care should be taken before relying on them for control of this pest.

Figure 2: Western flower thrips larvae.

Due to these properties they mostly offer preventative thrips control when numbers are low and should not be relied on for curative control. As they only feed on the larval stages of thrips, they need to be introduced early, before a large breeding population of adults establish. They also will not work on species of thrips that do not breed in the crop and so are more commonly used against Western flower thrips (*F. occidentalis,* WFT, Figure 2).

Biology

This predator can be applied all year round as it is not susceptible to diapause, however relative humidity should be above 75% and the temperature should be above 20°C for some hours of the day. Temperature of 35°C or above can be lethal to the eggs and young mites. Humidity should also be above 70% relative humidity, the eggs will die at lower humidity. Larger canopy crops typically have high enough humidity around the leaf hairs, flower parts and crown centres. At optimal temperatures adults can live up to 30 days, with females laying 1-3 eggs a day.

Applications

They can be purchased in sachets or loose. Rough guides are that sachets should be placed every 2m in a row, and they can also be purchased loose and should be applied at a rate of 125-250 mites per m^2.

They can also be purchased in tubes which contain bran, these have predators will be at several different stages of development (eggs, juveniles and adults) and flour mites to act as a food source. Tubes containing vermiculite can also be purchased, these will just contain mites at the adult and juvenile stage. These tubes should stay in the crop for several days to allow any mites that may have stayed in the crop time to leave.

<u>Critical points</u>

- They only feed effectively on larval stages of thrips, not adults.
- Relative humidity and temperature should be above 20°C for some hours of the day.
- Control is achieved preventatively, it will struggle to cure large infestations once WFT are established.

Orius laevigatus

Purpose

Orius laevigatus is a predator for the control of thrips species, it feeds on all life stages including adults. It is able to feed on aphids, spider mite, butterfly eggs and pollen when no thrips are present. This makes it a good choice for preventative control as long as other food sources are present, making it vital to apply once the first flowers have opened. They can be used for curative actions, applied directly to the hotspot areas even if no other food sources are present.

During their development *Orius* nymphs can consume 50 thrips larvae, with the female adult able to kill 20 thrips nymphs or 6 adult thrips a day and will often kill more than needed for feeding.

Figure 3: Two-spotted spider mite (TSSM), Tetranychus urticae

Biology

Temperatures between 20-30°C are best for development with 25°C being optimal, at this temperature the lifecycle can complete to adulthood in around 20 days. A minimum of 15°C is required for egg laying and feeding, lower temperatures inhibit the O*rius's* ability to operate and establish. As their eggs are laid on side shoots their introduction should be made after any removal of foliage to ensure that no eggs are lost. A female can lay around 125 eggs during her lifetime.

Applications

They will often come in a bottle mixed with buckwheat husks and vermiculite, and can come in bottles of 500-2000. The bottle should be turned horizontally a few times before opening to ensure that it is mixed evenly. Piles of 75-100 *Orius* can be introduced to the leaves of the crop, a loose leaf can be placed underneath to help catch any that may miss the target site. In hotspots they can be sprinkled directly overhead to the site or the surrounding foliage. Leave the bottle in the crop for a few days after application, there may be some remaining in the bottle.

After release it will take a few weeks for a population to establish, nymphs and adults on the flowers and foliage are a good sign of this. If shrivelled and drained corpses are found, this is a good sign that predation is happening and that the population should be growing.

<u>Critical points</u>

- Correct temperature conditions are very important for establishing *Orius* well. Under 15°C. Will lead to no egg laying and starvation.
- *Orius* feed on adult and larval thrips as well as a range of other pests. Additionally they can survive on pollen in the absence of pests.
- *Orius* nymphs also consume
- Avoid removing excess foliage where possible to avoid removing laid eggs.

Parasitoid wasps

Purpose

Parasitoid wasps are a good first line of defence against aphids, the term parasitoid wasp encompasses a wide range of different species. They lay their eggs inside living aphids, killing them and turning them into parasitised mummies. Parasitoids will emerge from these and search for living aphids to continue the cycle. Correct identification of aphid species can be important as different species of parasitoid are often more effective against different species of aphid. Some products are mixes of multiple parasitoid species to help cover a range of aphid species making their use easier.

Parasitoid wasps can fly and so are highly mobile in a crop, searching for aphid colonies. This makes it less important on getting an even distribution in the crop compared to other biologicals.

Figure 4: Aphid mummies on white strawberry fruit.

Biology

As parasitoid wasps are from a number of species the biological information here will be more general to cover them. Mostly the optimal temperature is between 16°C and 30°C. Parasitoid wasps are frost sensitive so avoid applying if there is a risk of frosts or variable weather, parasitoids in general do not operate well at low temperature. Some of the main parasitoids belong to the genus *Aphidius.* Many of them can lay up to 100 eggs within their lifetime, mostly their lifecycle takes around 3 weeks at 20°C.

Praon volucre has one of the widest target ranges of aphid species of the parasitoids currently available. It is currently only present commercially in species mixes.

Applications

Single species releases for preventative control should use a rate of 0.25 per m^2 as soon as the crop starts to grow, with parasitized mummies being present on the crop around two weeks after the first introductions when aphids are present. For curative use of single species introduce them at a rate of 0.5-1.0 per m^2 per week. When using a species mix one tube should be placed every 200m^2 three times for preventative control, most parasitoids are mobile and will search aphids out so the greater distance recommended for mixes is acceptable. For light curative action this should be doubled, it should be noted that it will take some time for a curative effect.

Critical points

- They are best used preventatively in the early stages of crop development.
- Determining aphid species can be important unless using a species mix, predicting which aphid species may appear can be done by looking at previous years but doesn't always work.
- Parasitoids are frost sensitive and generally operate best between 16°C and 30°C.