Department of Agriculture, Fisheries and Forestry

Biological control of western flower thrips (WFT) in cut flowers

Summary

- The biology and biological control of western flower thrips (WFT) was examined on gerberas, chrysanthemums and roses.
- WFT survived equally on gerberas, flowering chrysanthemums and roses, but survived poorly on non-flowering chrysanthemums.
- Very few WFT pupated in the growing media and soil moisture did not influence the survival of those thrips that did pupate in growing media for all host plants. Larvae and pupae were most commonly found in the flowers of all host plants.
- The foliage predators, *Typhlodromips montdorensis*, *Neoseiulus cucumeris* and *Orius armatus*, were the most effective. These predators reduced thrips numbers by 30–99% depending on the life stage of thrips and area of host plant, compared to no-predator controls. These predators are most likely to reduce WFT in cut flower crops.
- Soil predators sometimes reduced the number of WFT emerging from soil, but only on one occasion did they reduce the number of thrips on foliage (*Geolaelaps aculeifer* on chrysanthemums). Soil predators will probably only be useful during periods of moderate pressure in combination with a foliage predator.
- Results highlight the importance of removing old flowers from the growing area and management of WFT just prior to and during flowering phases, particularly for annual varieties.

Background

Western flower thrips (WFT) is probably the most important insect pest for the cut flower industry, causing economic loss to chrysanthemums, gerberas, anthuriums, lisianthus, dahlias, roses and other crops. Injury to flower buds and growing points causes scarring, wilt and discoloration, presenting as distortion as the plant grows, ruining the look of the product. The thrips are also a vector for tospoviruses such as tomato spotted wilt virus (TSWV), which causes economic losses in a broad range of potted ornamental, cut flower and vegetable crops.

It is widely recognised that WFT control is difficult due to the insect's high reproductive rate, its tendency to inhabit protected areas of the plant (e.g. the growing tip and flower buds) and its resistance to many insecticides. Therefore, non-chemical methods are required for the sustainable and reliable control of WFT.

The Flower Association of Queensland Incorporated (FAQI) commissioned a project to examine the biology and biological control of WFT on gerberas, chrysanthemums and roses. This was funded through Horticulture Australia Limited (HAL) and producers of biological control agents (Biological Services, Bugs For Bugs, Ecogrow and Manchil IPM Services).

Plate 1: Thrips on a gerbera flower.

Project aims

The initial research focussed on WFT pupation behaviour and the effects of irrigation, plant flowering and vegetative stages on WFT survival.

The effectiveness of commercially available biological control agents for WFT was also examined. WFT predators tested were:

- montdorensis and cucumeris (*Typhlodromips mondorensis* and *Neoseiulus cucumeris*)—predatory mites that eat larval thrips
- orius (*Orius armatus*)—a pirate bug that preys upon thrips larvae and adults on leaves and flowers
- hypoaspis-A (*Geolaelaps aculeifer*) and dalotia (*Dalotia coriaria*)—a soil-dwelling predatory mite and rove beetle respectively. Both eat thrips pupae
- insect-eating nematodes (*Steinernema feltiae*)—soil predators that eat thrips pupae and fungus gnat larvae
- green lacewing (*Chrysoperla rufilabris*)—this predator consumes a wide range of prey, particularly sucking insects.

Results

Biology

Lifecycle

WFT eggs are laid on the plant and the larvae hatch and feed on leaf or flower tissue. After two larval stages, WFT undergoes two non-feeding pupae stages. Pupation occurs either on the plant, on leaves or flowers, or in the soil. Adults then emerge, mate and begin the cycle anew.

Experiments

Experiments were designed to determine where WFT pupate on gerberas, chrysanthemums and roses, the survival rate on each plant species and the effect of irrigation (soil moisture) on survival.

Pupation

Reasons for WFT pupating on or off the plant are strongly related to humidity and suitability of pupation sites (e.g. crevices and flowers).

Plate 2: First and second instar thrips, 0.5–1.0 mm long.

Newly hatched thrips were placed on each plant. After about 10 days, when thrips were pupating, plants were harvested to trap emerging adult thrips from flowers, foliage and soil separately. The majority of thrips trapped—70% of those collected from gerberas and chrysanthemums and 40% from roses—were immature thrips (larvae and pupae) that dropped from flowers as they dried out. WFT survival was about 10 times better on flowering chrysanthemums compared to plants with no flowers.

Of the plant hosts studied, most larvae (more than 70%, often more than 90%) pupated on the plants rather than in the soil. Soil moisture did not effect the survival of thrips that did pupate in the soil. This means that managing soil moisture is unlikely to disrupt the lifecycle and be an effective control measure for WFT in cut flower crops.

WFT survival was comparable on flowering chrysanthemums, gerberas and roses, but was much lower on non-flowering chrysanthemums. The management of WFT should focus on the plants just prior to and during flowering, particularly for annual varieties of cut flowers.

The results support management practices that are well known to reduce thrips populations, including the removal of old or damaged flowers from the growing area.

Monitoring

WFT is more prevalent on flowering plants so it is particularly important to monitor crops for thrips just before and during flowering. To monitor for WFT firmly 'beat' foliage, buds and flowers against a white or black folder, or bucket. Western Flower Thrips shaken loose will give an indication of the population in the crop. Regular monitoring (at least once per week) allows action to be taken while populations are relatively low. Yellow sticky traps can also be used to indicate the number of WFT adults in the crop.

Predator testing

Adult and larval thrips were added to four plants in medium-sized cages. Predators were released twice, one week apart, and the number of thrips assessed at the end of four weeks.

Montdorensis, cucumeris and orius were the most effective predators, reducing thrips numbers by 30–99% compared to no-predator control treatments, depending on the insect stage and location on the plant (i.e. flowers, foliage).

The two predatory mites, montdorensis and cucumeris, were compared in only one trial, but performed equally well. These mites were most effective against immature thrips on foliage and less effective against other stages of thrips on either foliage or flowers. For example, on chrysanthemums, montdorensis reduced the number of immature thrips on foliage by about 99% and on flowers by about 75%, and adults on foliage by 85% and on flowers by 75%, compared to controls.

The pirate bug, orius, also reduced the numbers of adults and immature thrips on foliage and flowers by as much as 90% and, compared to the mites, was more effective against adult thrips.

The green lacewing may contribute to WFT control as it was associated with some reductions in one trial, but may not provide adequate control by itself.

Plate 3. Orius adult (above) and nymph (below) on a chrysanthemum leaves, about 2–3mm.

Perhaps not surprisingly, given the low rate of WFT pupation in the soil by WFT, soil predators were rarely able to reduce the numbers of thrips on the foliage and never reduced the numbers of thrips on flowers of any host plant.

Soil predators in combination with foliage predators did not significantly reduce thrips numbers beyond that of foliage predators alone, although they sometimes reduced the number of WFT emerging from soils and, in one trial, G. aculeifer significantly reduced (by about 40%) the number of adult thrips on the foliage of chrysanthemums. As such, soil predators may assist in managing WFT during moderate pest pressure (when there are relatively high numbers of thrips pupating in the soil media).

Recommended release strategy

During light infestations (or prior to infestations occurring), release foliage predators. During moderate infestations release higher rates of foliage predators, perhaps in conjunction with soil predators. If high numbers of WFT are experienced, reduce the number of thrips present using an IPM friendly pesticide and then release biocontrol agents as appropriate.

Further research is required to determine the most cost-effective rates of release of foliage predators in cut flower crops. However, a structured monitoring program, perhaps in tandem with an IPM consultant, experienced IPM practitioner or biocontrol agent producer, should be able to help growers who seek to use biocontrol to manage WFT populations.

Bugs For Bugs supplies montdorensis and green lacewing, Manchil IPM Services produces orius and cucumeris and Biological Services produces cucumeris.

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Plate 4. Montdorensis (about 0.5 mm) on chrysanthemum flower.

Plate 5. Larval thrips under the sepals of a rose.

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