

Murdering Thrips with Marigolds, Fungi & Mites

Research Summary - University of Vermont Entomology Research Laboratory

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Fig. 1. Marigold GPS in a test greenhouse. Thrips lure on sticky card (arrow) (A).

Our research evaluated a plant-mediated IPM system for thrips in spring bedding plants. The system combines predatory mites, granular insect-killing fungi, a thrips pheromone lure and marigolds into a guardian plant (GPS) (Fig. 1). A GPS is based on the concept that adult thrips are attracted out of the crop to the flowering marigolds, where they reproduce. This attractiveness may be enhanced by the addition of a pheromone lure (Fig. 1A). Once adults are attracted and reproducing, the eggs and immatures serve as prey for the predatory mite, *Neoseiulus cucumeris*, sustaining them and encouraging their dispersal throughout the crop. In the absence of thrips, the mites survive on the marigold pollen. Thrips that escape predation drop to the soil to pupate, where they may become infected with the fungus. The granular formulation enables the fungus to colonize the potting mix, eliminating the need for reapplication.

This is a low-cost, easy-to-use, non-chemical pesticide system, suppressing thrips populations through a holistic system: ATTRACT, SUSTAIN & KILL. Because fungal treatments and mite releases are applied to the GPS rather than the entire crop, management costs are reduced, while control is maximized. The result is production of higher quality plants with a greater value and fewer insecticides. This reduces use of chemical insecticides, thereby prolonging their efficacy, and minimizes human and environmental health risks.

Methods

Marigold (var. Hero Yellow) GPS trials were conducted throughout the 2012-2014 spring growing seasons at six sites in VT and NH. At three of the sites, trials were in single gutter-connected greenhouses (approx. 10,000 sq. ft each). At three sites, trials were in three separate, side-by-side, greenhouses (approx. 2,000 sq. ft. each). All of the test greenhouses contained the following treatments, each repeated three times in each house: 1) marigold with experimental strain of *B. bassiana*, thrips lure and predatory mites (EXP), 2) marigold with GHA strain of *B. bassiana*, thrips lure and predatory mites (GHA), 3) marigold with thrips lure only, 4) marigold only, 5) yellow sticky card with thrips lure, and 6) yellow sticky card without lure. Marigolds and sticky cards were monitored bi-weekly for 12 wks for thrips and mites. Foliar damage was assessed on a scale of 0 (no damage) to 5 (76-100% damage). Three plants located within 3 ft of each marigold were inspected for thrips, mites and damage. At each sampling date, two blossoms per marigold were collected and dissected to determine the number of thrips and predatory mites. At the start and end of the experiment, soil samples were taken to determine the level of fungal inoculum.

Problem & Potential Solution

Western flower thrips (WFT) are major pests of greenhouse ornamentals. Substantial loss can result from their foliar and flower feeding or virus vectoring. Few effective insecticides are available for management and resistance is a serious problem. Many insecticides require direct pest contact to be effective; yet thrips can escape contact when they drop to the soil to pupate. Thrips are difficult to detect, but when found early before damage occurs, growers have greater chance to successfully manage them with biological control or spot pesticide applications.

Plant-mediated IPM systems use plants in combination with other suppression tactics to manage arthropod pests. These systems are developed to:

- 1) improve early pest detection (indicator or sentinel plants);
- 2) attract pests off the crop where they're targeted for management with bio-control, chemical insecticides or by removing and destroying them (trap crop), or
- 3) provide habitat, food and shelter for biological control agents (habitat, insectary or banker plants).

When a system is used for multiple purposes, it is often called a guardian plant.

Objectives

1. Evaluate effectiveness of marigold guardian plant system for WFT in greenhouse-grown bedding plants.
2. Assess persistence of predatory mites to determine how often they must be reapplied.

Results Summary

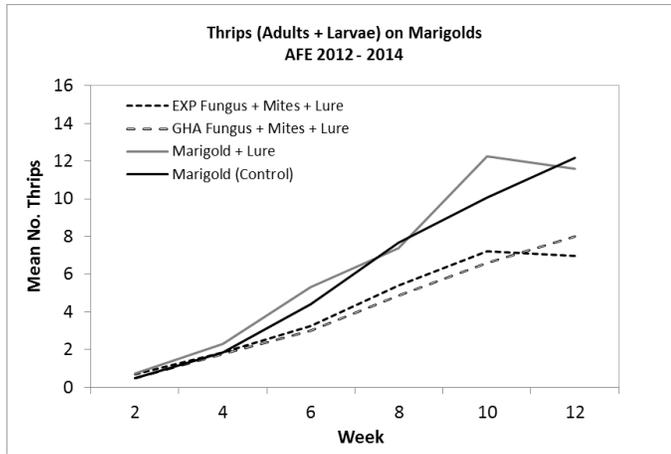


Fig. 2. Thrips on marigolds with different treatments.

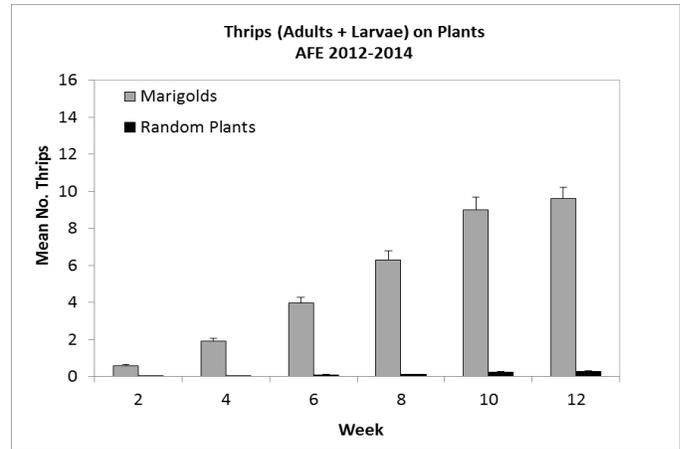


Fig. 3. Thrips on marigolds and randomly inspected plants within 3 ft of the test marigold.

Is the Marigold Guardian Plant System Effective for Managing Western Flower Thrips?

- More thrips were found on the marigolds with no mites or fungal treatments (controls) than on those treated with mites and fungi (Fig. 2).
- Over the 12-wk test period, higher numbers of thrips were detected on marigolds than on random crop plants located within 3 ft of the marigolds (Fig. 3). More thrips damage was observed on the marigolds than on the crop plants.
- After 12 weeks, marigolds without mites and fungi generally had over 50% foliar damage, whereas nearby crop plants had less than 10% damage (Fig. 4).
- At some sites, thrips numbers on marigolds without the fungi or mites increased rapidly after 8-10 wk after and had to be removed to prevent possibly reinfesting the crop. Foliar damage of over 75% was observed on those plants.
- Both fungal treatments (GHA and EXP) provided a similar level of thrips suppression, suggesting there is no significant difference in their efficacy.
- The pheromone lure showed no significant effect on thrips numbers on sticky cards when averaged over the study period (mean=8 thrips/card with lures vs. mean=7 thrips/cards without lures).
- More thrips were found in marigold blossoms (mean=6 thrips/blossom) without treatment (controls) than in those treated with mites and fungi (mean = 3 thrips/blossom) when averaged over the 12-wk study period.



Fig. 4. The proof is in the plants! Marigold GPS after 12 wk with fungi and mites (left) and without (right).

Do Treatments of Predatory Mites and Granular Fungal Materials Persist?

- Low numbers of mites were detected with plant tapping throughout the test.
- Mites were not found on randomly-inspected crop plants adjacent to the GPS, suggesting limited mite dispersal.
- Mites were observed in marigold blossoms throughout the 12 wks, demonstrating that they are sustained on pollen and/or thrips.
- In all years, both fungal strains persisted within the GPS soil throughout the 12-wk test period. The EXP strain showed a superior persistence within the system when compared to the GHA strain.

Summary

This marigold Guardian Plant System has numerous desirable traits: 1) the granular fungal material leaves no toxic residues, is generally harmless to beneficials and poses minimal risk to humans and the environment; 2) it offers a way to sustain biocontrol agents when pest populations are low or absent, using a fungus for the below-ground stages of the pest, and a predator for the foliar phases, 3) it can lower biocontrol costs by reducing the number of releases over the season.