Marigolds, Fungi & Predatory Mites, Oh Boy!

Plant-Mediated IPM Systems for Managing Western Flower Thrips
Research Summary 2008-2011

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Introduction

Western flower thrips (WFT) [*Frankliniella occidentalis*] are one of the most persistent and damaging pests of greenhouse ornamentals. Their cryptic behavior and rapid rate of reproduction make management difficult. Feeding results in significant cosmetic damage and they can also transmit deadly plant viruses. Chemical pesticides are commonly used against WFT, often requiring frequent reapplications. Despite repeated chemical sprays, growers find it difficult to keep populations below damaging levels due to increasing resistance and their ability to avoid direct contact with sprays. Several biological controls are available, but their effectiveness has been inconsistent.

Currently, insect-killing fungi are commonly sold as wettable powder (WP) or suspension concentrate (SC) formulations. A major drawback is their requirement for direct contact with the pest for good control. A large portion of the WFT population is in the soil, protected from direct contact with the fungal spores. Targeting the soil stage with a fungus could improve management by reducing the number of adults that emerge. Fungi can be formulated as granules that have advantages over a spray when targeting a soil-borne insect. Nutrients can be added to granules to support fungal growth and sporulation. Granules do not need to be incorporated throughout a potting mix, but only in the top few inches of soil where thrips generally pupate.

We have been conducting tests in commercial greenhouses on a novel way to manage WFT in bedding plants, using a combination of predatory mites, a granular formulation of an insect-killing fungus on marigold plants. This serves as an effective plant-mediated IPM system in which the adult thrips are attracted away from the crop to the flowering marigolds. A portion of the immature WFT that are produced serve as prey for the predatory mite, *Amblyseius* (=*Neoseiulus*) *cucumeris*, sustaining the mite population, and encouraging dispersal throughout the greenhouse. A portion of the WFT that escape predation (A few always get away!) drop to the soil to pupate, where they come in contact with the fungus, which infects them. The fungus colonizes the potting mix, eliminating the need for repeat applications. This represents a low-cost, easy-to-use, non-chemical pesticide approach, suppressing WFT populations through a holistic system: ATTRACT, SUSTAIN & KILL. Because fungal treatments and mite releases are applied to the guardian plants (GPS) rather than the entire crop, management costs are reduced, while control is maximized.

Marigold plant-mediated IPM system in commercial greenhouse.

Methods

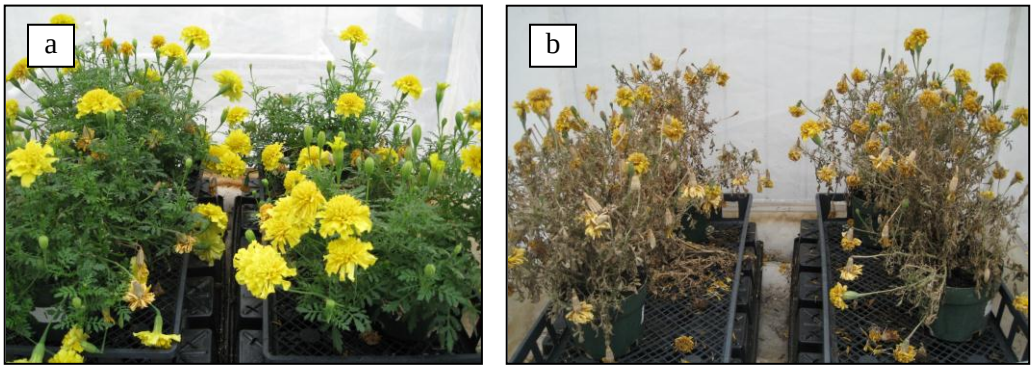
First, in caged trials we tested different strains and rates of granular fungal formulations (two experimental isolates and the isolate found in Botanigard, the commercial fungal product). The fungal grains were mixed into the upper surface of the potting mix of marigold plants to target WFT. After determining the most effective strains and rates for reducing the number of thrips, we tested the effect of combining a fungal treatment to the soil with predatory mites on the marigold foliage. Based on the promising results, we are now conducting trials in several commercial greenhouses with bedding plants. The work will continue for the next 2 years, but results to date show promise.

Key Findings

- In caged trials testing different fungal isolates, after 6 weeks, WFT populations were 90% less on plants treated with the experimental isolate than the untreated controls. WFT numbers on plants treated with the commercial isolate was only 15% less than the controls.
- Damage on plants treated with the experimental isolates was 29-43% compared with 86% on plants treated with the commercial isolate, and 99% for the untreated control.
- Many of the live WFT collected on foliage from plants treated with a fungus were infected, indicating that adults that emerge from the soil may transmit the fungus to others on the foliage.
- WFT populations were significantly less on plants treated with the highest rate of fungal grains tested (0.3 oz). After 6 wks, there were 10 WFT per plant in the highest treatment rate compared with 40 per plant in the controls.
- When predatory mites were added to the marigolds in combination with a fungus in the potting mix, there were fewer WFT and damage was less than for treatments without mites. After 5 wk, WFT populations were 3.0 – 3.8 WFT per plant compared with 36 per plant in the untreated plants.
- At all of the test sites, damage on the marigolds and crop plants located near the marigolds were less than 10%, suggesting that the marigolds attracted WFT out of the crop and that WFT populations were kept at low levels on the marigolds with the biological control agents on those plants.
- Predatory mites thrived in marigold blossoms feeding on pollen and thrips over the 6-10 week test period.
- The fungus persisted for at least 6-10 weeks after application to the potting mix, indicating that repeat applications were not necessary.

This research demonstrates the great potential of insect-killing fungi against WFT when a highly virulent fungus is used together with predatory mites within a marigold plant-mediated IPM system. This approach contributes to protecting human health and the environment by reducing growers' use of chemical insecticides. It offers economic benefits by reducing WFT damage to crops, increasing plant quality, and minimizing production costs with a sustained source of biocontrol agents.

The proof is in the plants!



Results of caged greenhouse trials 10 wk after thrips release; a. marigolds treated with experimental granular fungus in the soil; b. marigolds not treated with fungal soil.

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