Susceptibility and behavioral responses of western flower thrips to pesticides used in management of tomato spotted wilt virus

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CALIFORNIA TOMATOES

Introduction

The impetus for this study was the dramatic increase and spread of Tomato Spotted Wilt Virus (TSWV) throughout Southern California's tomato fields. The symptoms initially include necrotic spots and bronzing of the leaves, with subsequent chlorosis and leaf dieback (Fig 1). In 1998 & 1999, fresh market tomato growers lost up to 50% of their plants (Fig 2). While some plants that were lost early could be replaced, yields were substantially reduced and growing costs were increased. The Western Flower Thrips (WFT), *Frankliniella occidentalis*, was identified as the primary vector of TSWV in these fields (Fig 3).

For the past two years, the tomato growers in Southern California have been using mixed applications of Trilogy (a raw neem oil), Neemix, and Success to control WFT pests in their IPM programs. They observed a reduction in the spread of TSWV during the most recent crop, but were unsure of the cause leading to the improvement. Isolating cause and effect relationships for each compound in a commercial field situation is very difficult when the grower is under extreme pressure to save the crop. To address this problem we tested the compounds individually in a controlled laboratory setting and recorded a variety of behavioral responses of WFT. Related field trials are reported in the adjacent poster.

Objectives

The primary focus of this work was to document the behavioral responses of WFT to several insecticides commonly used in tomato IPM programs in Southern California. Specifically, we hoped to identify materials that resulted in behaviors that could suppress the transmission of TSWV, and gain insight on potential compatibility or incompatibility. Our long term goal was to incorporate the materials into a sustainable IPM program that would reduce crop losses while maintaining an acceptable profit margin.

Methods

The three chemical treatments and the control are listed in Table 1. The control leaves were dipped in water plus 0.1% Tween 80. There were 10 replicates per treatment with each replicate consisting of an individual adult thrips on a treated tomato leaf inside of a Munger cell (Figure 4). Each tomato leaf was dipped in the treatment solution at the given concentrations and allowed to dry before use. All behavioral observations were recorded with the Noldus Observer® software program. Each observation lasted 10 minutes. Both the duration and frequency of occurences were recorded for the behaviors listed in Table 2.

Table 1. Treatments and Rates

Treatment	Rate (AI/Acre)[a]
1- Control	—
2- Neemix	4 oz
3- Trilogy	1%
4- Success	6 oz

[a] Based on a 50 gal/acre application
(All treatments had 0.1% Tween 80)

Table 2. Behaviors

1- Searching: actively moving
2- Feeding: rasping at leaf surface
3- Resting: no movement or feeding
4- Probing:Sampling with mandible
5- Off of Leaf
6- Cleaning: grooming mouthparts/legs

Results

The data were analyzed with ANOVA followed by Fisher's Protected LSD test. Results with different letters indicate a significant difference at $P<0.05$. There were no significant differences in feeding duration (mean = 1 to 19 seconds, Fig 5) or probing. However, mean searching times on the leaves treated with Success were greatest, with those on Trilogy-treated leaves spending the least time searching (Fig 6). Figure 7 shows the frequency of resting occurrences on the leaves; the Success treatment had the most incidents of this behavior. In addition, the thrips on the Trilogy treatment spent more time off of the leaves (Fig 8).

Conclusions

In this system, the thrips on the Trilogy-treated leaves spent less time actively searching on the leaves and more time off of the leaves. These data suggest a repellency causing avoidance of treated surfaces. The thrips exposed to leaves treated with Success spent more time searching and resting than in any of the other treatments. This could increase contact and therefore intoxication. Because of the 10 min duration of these tests, no mortality information could be collected. Our tests indicate that Trilogy and perhaps Neemix provide some protection and disruption of WFT behaviors that are useful in reducing TSWV field occurrence. However, additional studies will be needed to determine if the interactions between combinations of these materials are antagonistic, additive, or synergistic in behavioral modification.

Acknowledgements

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Figure 1. TSWV plant.

Figure 2. Infected plants.

Figure 3. Western flower thrips.

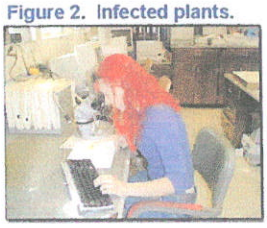

Figure 4. Observations.

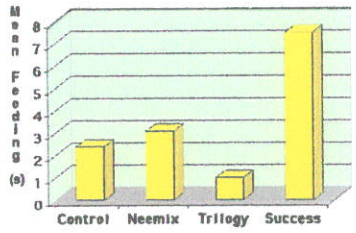

Figure 5. Mean feeding duration.

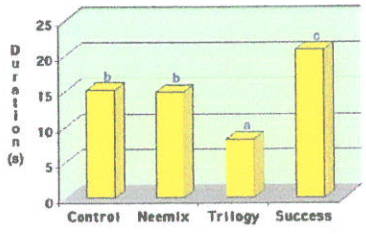

Figure 6. Mean time searching.

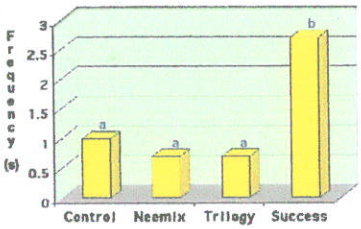

Figure 7. Frequency of resting behavior.

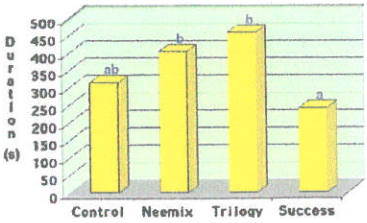

Figure 8. Total time off of the leaf.