Status of citrus thrips resistance to spinetoram in the San Joaquin Valley

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Introduction

- Citrus thrips is a key pest of citrus in the San Joaquin Valley (SJV), requiring multiple insecticide applications per season to reduce the rind scarring.
- Repeated use of synthetic insecticides coupled with multiple generations of thrips in a season has led to resistance development to several insecticides, making citrus thrips management challenging for growers.
- Several cases of field failures of spinetoram have been reported, indicating the development of citrus thrips resistance to this insecticide.
- Effective insecticide resistance management requires resistance monitoring of populations to understand the extent and distribution of resistance.
- The objective of this study was to monitor the status of citrus thrips resistance to spinetoram in the valley.

Materials and Methods

- From 2017-2022, citrus thrips populations were collected from 57 orchards using an aspirator (Fig 1).
- Fully open lemon leaves were used for resistance monitoring. Leaves were dipped in 0.16% triton (control), 1, and 10 parts per million (ppm) spinetoram (Delegate®), air-dried, and used (Fig 2).
- The thrips were tapped from vials into Munger cells and sealed using binder clips (Figs 3 and 4), and exposed to treated leaves for 48 hours.
- The Munger cells containing thrips were then held at room temperature (24°C).
- After 48 hours, live and dead thrips were counted using a stereo microscope and percentage mortality was calculated. Percentage mortality was corrected for control mortality using Abbott's formula.
- Percentage survival data is reported. Percentage survival was calculated by subtracting percentage mortality from 100.

Fig 1. Aspirator and vial for citrus thrips collection.

Fig 2. Young lemon leaves for air-drying after dipping into 0.16% tritone solution (control) and 1 and 10 ppm Delegate®.

Fig 3. Components of a Munger cell, washer, and clips.

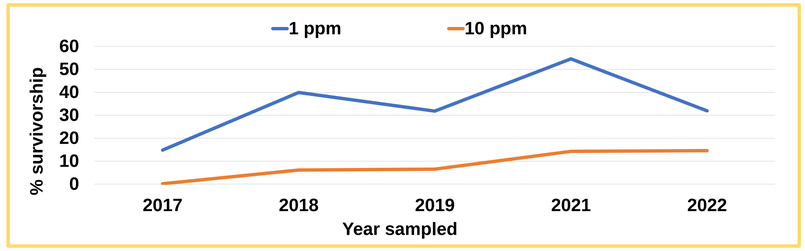

Fig 5. Survival trend of citrus thrips populations at 1 and 10 ppm spinetoram (Delegate®) from 2017 to 2022.

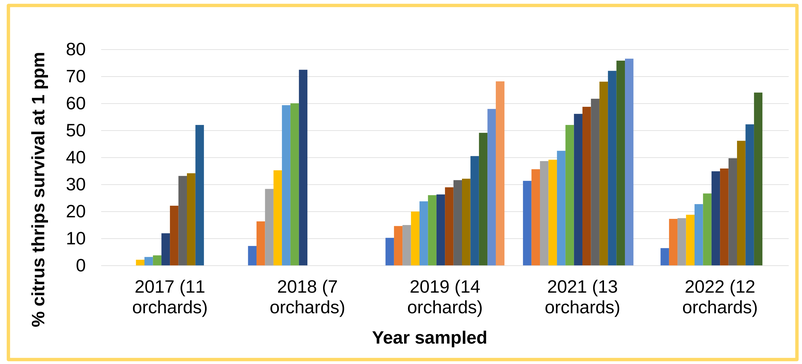

Fig 6. Variation (among orchards) in percent survival of citrus thrips populations exposed to 1 ppm spinetoram (Delegate®). Each bar represents an orchard.

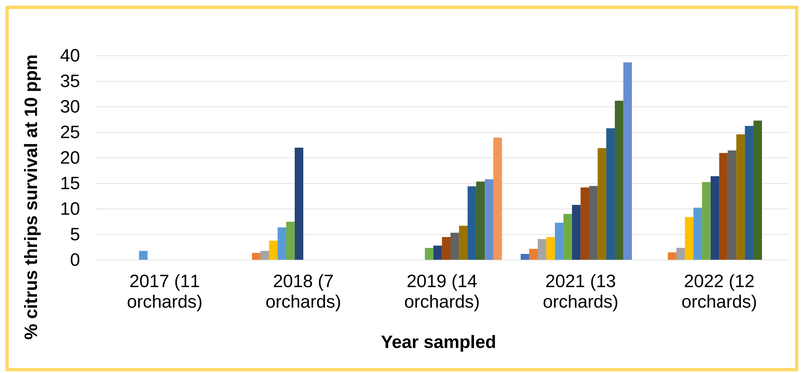

Fig 7. Variation (among orchards) in percent survival of citrus thrips populations exposed to 10 ppm spinetoram (Delegate®). Each bar represents an orchard.

Fig 4. Munger-cell-set for bioassay of citrus thrips resistance to 1 and 10 ppm Delegate along with the control.

Results and Discussion

- Five-year resistance monitoring data shows that citrus thrips resistance to spinetoram have increased over time.
- In general, 32% thrips survived 1 ppm discriminating dose in 2022, compared to 15% in 2017. The highest survival at 1 ppm was 77% in 2021 (Fig 5).
- Among orchards tested, thrips survival ranged from 0–52, 7–73, 10–68, 31–77, and 6–64 for 1 ppm (Fig 6).
- More importantly, the survival at 10 ppm has increased from 0% in 2017 to 15% in 2022. More populations survived 10 ppm in 2021 and 2022 compared to 2017 and 2019 (Fig 7).
- High survival rate at 10 ppm indicates field application rates (40-56 ppm) of spinetoram may not effectively control thrips.
- The orchards managed by a single company had similar resistance levels in 2017, suggesting that cultural practices are affecting the development of spinetoram resistance.

Conclusions and Recommendations

- Citrus thrips resistance is steadily increasing especially at higher concentration (10 ppm), indicating thrips control might be ineffective with spinetoram.
- Reducing the frequency of insecticide applications and rotating insecticide groups are the keys to combat insecticide resistance in citrus thrips.
- Spinetoram (Delegate®) is a group 5 insecticide. Use of insecticides from other groups such as cyantraniliprole (group 28), abamectin (group 6), and flonicamid (group 29) would be helpful.
- Insecticides that suppress thrips such as Movento (group 23) and Sivanto (group 4D) can also be used as rotational products in situations where the thrips pressure is low.
- Spatial and/or temporal variations in thrips survival suggest regular monitoring of field populations are required.
- Research is needed to evaluate alternate means of pest suppression, i.e., mulching, cover crops to mitigate resistance.

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