Spider Mite and Natural Enemy Research in the Lower San Joaquin Valley

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Miticides for Pacific Spider Mites

Mite densities In 2016 we evaluated nine different miticides when applied with 1% 415 oil for their impacts on Pacific spider mites. Plots treated with Vigilant, Kanemite, Onager, Magister, and Biomite reduced mite densities by 68-92% respectively but were not statistical different compared to the untreated checks (Fig. 1).

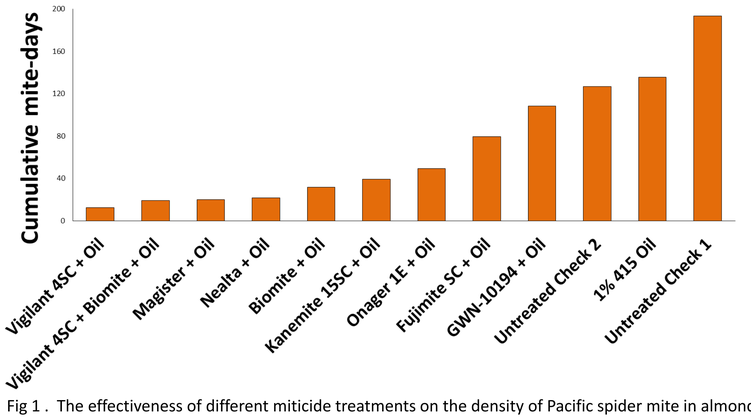

Fig 1 . The effectiveness of different miticide treatments on the density of Pacific spider mite in almonds.

Sixspotted thrips biology

Literature searches were used to find information on sixspotted thrips biology. Of the approximately one dozen articles found, half were on coastal avocado production and the other half were laboratory studies. Listed below is some information we found relevant.

- **Biological Parameters** (Coville and Allen 1977)
  - **Longevity** approximately 29d (59°F) to 67d (86°F)
  - **Generation time** for egg to egg 18d (86°F) to 51d (68°F)
  - **Eggs per female** was between 90 (68°F) to 166 (86°F)
- **Development** of sixspotted thrips entirely on leaf (Bailey 1939)
- **Mite Egg consumption** by females was 7.3 (59°F) to 49.7 (86°F) eggs/female/day (Coville and Allen 1977). Naher et al. 2005 also found that in laboratory conditions thrips consumed approx. 58 eggs/day, but also consumed on average 38 immatures/day and 16 adults/day for both female and male.
- **Overwintering sites**
  - Surveys were conducted and evaluations are still in progress.
  - To date we have not been able to find an overwintering site of sixspotted thrips. This has also been shown by Bailey 1939 in the late 1930's. No other literature was found on overwintering site(s) of sixspotted thrips.

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Sticky card monitoring for beneficials

- During 2016 we evaluated seven different sticky cards (Table 1) for monitoring sixspotted thrips and other beneficials at four sites in McFarland, Kern County.
  - Average trap counts ranged from 15 to over 1000 sixspotted thrips per week.
  - The yellow or green cards captured the most beneficials per cm^2.
  - The yellow strip card captured the most beneficials per week.
  - Evaluations of different sizes and brands of yellow traps had varying results for spider mite destroyer beetles and sixspotted thrips. (Fig. 2-5)

Table 1. Trap, Size , and manufacture of the seven traps used in the trial.

Trap	Size of Card	Brand of Card
Green	3" x 5"	Alpha Scents
White	3.5" x 6"	Alpha Scents
Yellow Whitefly	4" x 6"	Seabright Laboratories
Blue	4" x 6"	Seabright Laboratories
Yellow Strip	6" x 12"	Great Lakes IPM
Large Yellow	6" x 9"	Alpha Scents
Small Yellow	4" x 6"	Alpha Scents

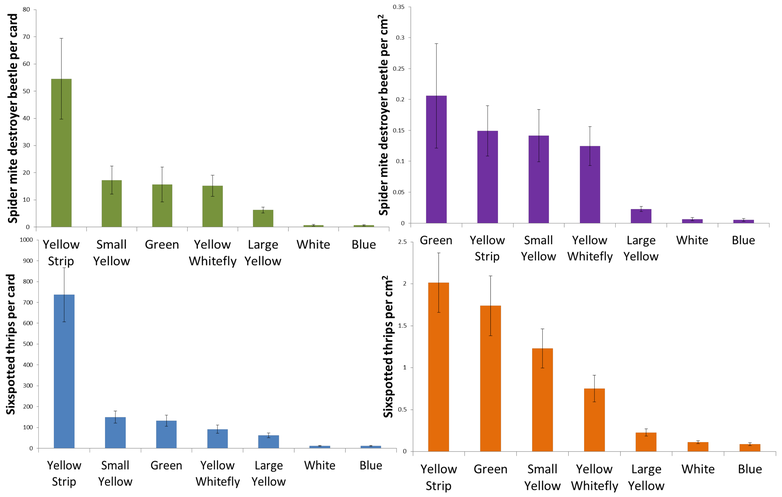

Fig 2-5 . Spider mite destroyer beetle and sixspotted thrips per card and per cm^2

Monitoring for spider mite predators with herbivore-induced plant volatiles (HIPVs)

During 2016 we evaluated four different HIPVs (Methyl Salicylate, Geraniol, Phenyl Ethanol, Combo of all three) for their effectiveness in attracting beneficials into an almond orchard. The trial was conducted within a 400-acre commercial almond orchard with 4 replications. Each plot was 20 acres with 16 HIPV lures in the middle 10 acres and 4 traps per plot. We were unable to document any differences in the mite or beneficial populations in any treatments.

References: Naher, N., W. Islan, and M. M. Haque. 2005. Predation of three predators on two-spotted spider mite, *Tetranaychus urticae* Koch (Acari: Tetranychidae). J. Life Earth Sci. 1: 1-4.

Coville, P. L. and W. W. Allen. 1977. Life table and feeding habits of Scolothrips sexmaculatus (Thysanoptera: Thripidae). Ann. Entomol. Soc. Am. 70: 11-16.

Bailey, S. F. 1939. The Six-Spotted Thrips, *Scolothrips sexmaculatus* (Perg.). J. Econ. Entomol. 32: 43-47.

Natural Enemies impact on spider mites

- **In 2016 we evaluated the impacts of beneficials on mite populations (Fig. 6).**
  - **Mite density** was low until mid July in all three areas.
  - **Sixspotted thrips density** started to spike toward mid to late July.
  - **Stethorus density** started a small period after the thrips around late July.
- **Mite to Sixspotted Correlation** We are currently correlating mite populations to sixspotted thrips on cards, so we can investigate further if this correlation could be used to predict increases or decreases of mite populations in the field.

2016 Case Studies

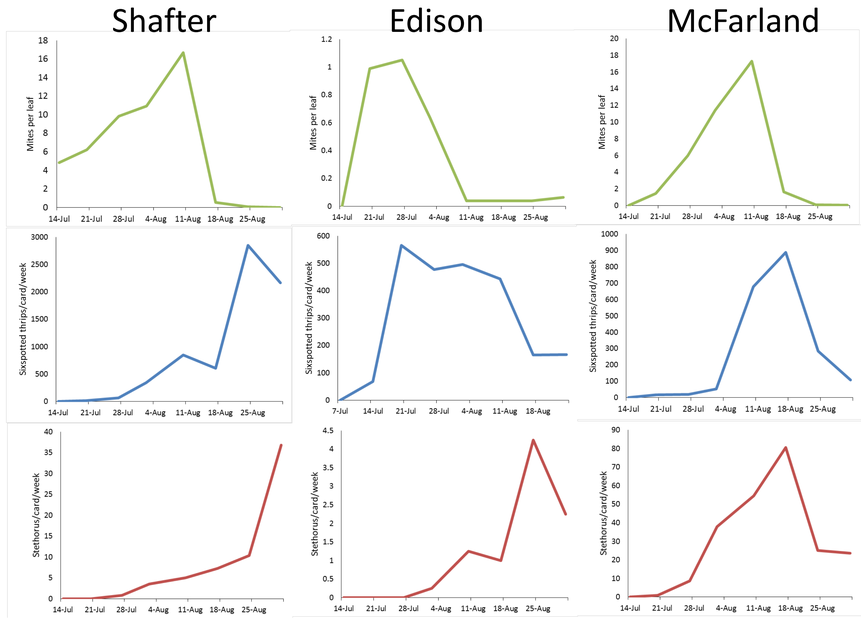

Fig 6. Mites per leaf and beneficials per card in almond orchards in three different areas of Kern County

Research Almond Orchard

We continue to maintain a 7-acre almond orchard in Shafter, CA with partial support from the Almond Board of California. Between the years of 2010 and 2016 this orchard and a sister orchard in Fresno County (that in 2015 was repurposed for non-pest management research) were used for a total of 59 different field experiments on pest of almonds. In 2016 the Shafter Research Farm had eleven research projects conducted within the almond orchard.

Acknowledgements

Special thanks to the Almond Board of California for the continued support and funding for these research projects. Also, a big thank you to the several grower cooperators and their PCAs for allowing us to conduct some of these research projects within their almond orchards. And thank you to all the support staff Minerva Gonzalez, Chelsea Gordon, and Joseph Aguilar because without their help collecting and processing samples the projects would not have been accomplished. With all this help and support, we were able to conduct several successful research projects in almonds in 2016.