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Avocado Thrips Subproject 2: Pesticide Evaluations and Phenology in the Field.

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Benefit to the Industry

Being a new pest, the field dynamics of avocado thrips in response to temperature, humidity, leaf flush, and fruit set are poorly understood. Also, natural enemy impact, and interaction of other factors such as persea mite damage and management practices on thrips populations are unknown. Increased knowledge on the basic biology of the thrips and its natural enemies in the field, the effectiveness of different pesticides on thrips population growth and natural enemy survivorship will greatly help with management strategies for this pest.

Objectives

The objectives of field studies conducted in Ventura County have been:

1 Conduct field pesticide efficacy studies with sabadilla and other registered and unregistered materials for control of avocado thrips.

2 Monitor the phenology of avocado thrips at 3 sites in Ventura County. Specifically, the movement and densities of thrips on foliage, bloom, fruit and soil over the course of 1 year will be studied.

3 At each study site, the presence and densities of natural enemies and their impact on avocado thrips will be monitored.

4 Evaluate the interaction between persea mite infestations and avocado thrips damage.

5 In cooperation with Hoddle, monitor the impact of field releases of commercially available natural enemies identified from laboratory studies or collected from foreign exploration efforts.

6 Evaluate various practices (such as fertilization, irrigation and pruning) which might reduce avocado thrips levels and severity of damage.

Summary

Pesticide screening. On June 5, a large pesticide screening trial was conducted at a Moorpark site on 2-year-old avocado trees infested with avocado thrips. Fifteen pesticides, including 8 pesticides which are not registered for use on avocados, were evaluated for effectiveness against the thrips. The pesticides included a broad range of chemistry: from botanicals such as neem products and sabadilla, to fermentation products like abamectin, to oil and synthetic pyrethroids. An unsprayed control and a water control were also included in the test. Five trees were treated with each pesticide; the treatments were randomly assigned after a pre-spray count of thrips on leaves. Thrips populations on leaves were monitored at 1-day, 4-days, 1-week, 2-week, 3-week, 4-week and 5-week post-treatment. PC As and avocado industry personnel volunteers helped with counting.

Trial results showed that several pesticides gave good knockdown of the thrips for several weeks. Particularly, narrow-range 415 oil and sabadilla as separate treatments gave good results. This trial needs to be repeated before selecting two or three products for continued evaluation. Unfortunately, thrips' populations dropped to such low numbers during the summer that we could not find an adequate testing site to repeat the trial. Subsequently, rain has made pesticide screening impossible up to the time of this report.

One of the problems of counting thrips in the field is that it is time-consuming. Dew and time of day can exacerbate the problem. Several trials were conducted to evaluate different sampling techniques which would accurately reflect the numbers and different life stages of the thrips. Leaf dipping techniques with different concentrations of either soap or alcohol were evaluated in comparison to hand lens field counts and lab counts. A 2% soap solution leaf dip with a subsequent filtering of the dipping solution consistently recovered more thrips and accurately represented the larval and adult life stages found on leaves than did different concentrations of alcohol. Leaf dipping, although faster than hand lens leaf counting, is a destructive technique. It should prove to be a valuable technique for larger test trees.

Seasonal development and behavior. Three monitoring sites were established in May 1997, two sites inland near Somis and Moorpark and one coastal site in Carpinteria. These unsprayed sites allowed for natural population dynamics to occur. Leaves and fruit were monitored for thrips populations and damage. Thrips natural enemies were monitored and temperature and relative humidity data were recorded.

A large fruit drop in mid-May required re-tagging of fruit. Approximately 85% of the tagged fruit was lost by early June and had to be retagged. Thrips activity was high in May and June at the inland sites. Mean number of thrips larvae at the Somis site was 5.2 per fruit on July 1. Mean percent scaring on the tagged fruit was only 2%, mean percent scaring on 100 randomly selected fruit was 11 %. Apparently, scarring occurred early in fruit development and re-tagging of selected, unscarred fruit resulted in a lower mean scar assessment.

In the second week of July, thrips populations dipped to nearly 0 at the inland sites and

remained low throughout the summer. This coincided with daytime temperatures exceeding 90° F (32°C) and greater than 50% relative humidity. We have not finished analyzing these climatic data.

Thrips populations remained active during the summer and fall in the coastal areas. The Carpinteria site in July had 6% mean scarring on fruit, however, 33% of the fruit had a scar of 5% of the fruit surface or greater, which the grower considered an economic loss. Thrips larvae and adults moved off this fruit and continued to feed on new leaf flush. A second monitoring site was established in Carpinteria in October 1997 to monitor pest activity on off-bloom fruit. This site has confirmed that thrips activity on fruit continues until immature fruit are about 2 inches (5 cm) long.

Some proportion of the avocado thrips pupal population have been presumed to pupate in the soil or leaf mulch. In modified "Phillips/Rogers" incubators, mulch samples from different trunk distances have been sampled. In 3 separate incubation trials, adult emergence from field-collected mulch occurs after 6 days at room temperature. Numerous other organisms emerged from this material, including spiders, collembolans, mites, weevils, centipedes, sowbugs and moths. We are currently in the process of determining at what depth pupation occurs within the mulch or soil.

Natural enemies. Several natural enemies have been observed preying on avocado thrips. Populations have been recorded when observed during thrips sampling times and a collection of specimens is being assembled for educational purposes. The most prominent avocado thrips predator is the predacious thrips *Franklinothrips vespiformis.* This interesting predator responded to the avocado thrips in large numbers and could be found almost anywhere the avocado thrips were present. Other predacious thrips, such as six-spotted thrips, as well as the predatory mite *Eusieus hibisci* and green lacewing larvae *(Chrysoperla* sp.) have been observed attacking the avocado thrips.

We have also made an important discovery of a small stingless wasp, *Ceranisus menes* (Hymenoptera: Eulophidae), a generalist thrips parasitoid that is native to California. This wasp was observed attacking avocado thrips larvae in the field and brought back to the lab. This is the first recorded avocado thrips parasitoid and we hope to find other such parasitoids in our studies.

In Burlese funnel work, numerous mite species have been identified in the mulch. In a sampling, 3 families (Anystidae, Eupodidae, and Raphignathida) and 1 order (Mesostigmata) of predatory mites have been identified. Many of these are still unidentified, have had little research done on their biology, but as a group are notable for their predatory ability. Several of these may be important in controlling the pupal stage of the avocado thrips.