2. REPORT: sub-report 1

Project Title

Management Approaches for Thrips and Garden Symphylans in Lettuce 1

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This report is divided into two sub-reports for each pest.

1. Sub-report: Thrips

Abstract

Data show that the thrips were abundant in all three crops (lettuce, broccoli and cauliflower) in high numbers from all regions of the Salinas Valley. This indicate that thrips are more likely seeking refuge in broccoli and cauliflower fields, although thrips are not known to cause feeding damage or viral disease on brassica crops. However, whether these thrips are reproducing on these brassica hosts was not investigated. Sub-samples of thrips from these crops at three growing seasons (spring, summer and fall) indicate that 100% of the thrips were western flower thrips (*Frankliniella occidentalis*) in all three crops. Preliminary data from insecticide trial suggest that zeta-cypermethrin and avermectin B1, and cyantraniliprole might have some activity against adult thrips and deserve further investigation. From the previous work, it is known that spinetoram and spinosad have a good activity against adult thrips and were consistent in this trial as well.

Objectives

1. Season pattern of western flower thrips in lettuce.
2. Efficacy of insecticides to thrips in lettuce.

Procedures: *Objective 1 Season pattern of western flower thrips in lettuce.*

This survey project was conducted in three regions of the Salinas Valley: North (Salinas/Chualar), central (Gonzales/Soledad) and South (Greenfield/King City). Three fields, each of lettuce, broccoli and cauliflower were identified in each region with a total of nine fields at a given time. Five yellow sticky traps were deployed at spacing of 50 feet on a bed in the edge zone of the field. These traps were monitored from February to October 2013. Total number of thrips was quantified on each yellow sticky trap.

Results and Discussion

Data show that the thrips were abundant in all three crops in high numbers in all regions of the Salinas Valley (Figure 1-3). This indicate that thrips are more likely seeking refuge in broccoli and cauliflower fields, although thrips are not known to cause feeding damage or viral disease on brassica crops. However, whether these thrips are reproducing on these brassica hosts was not investigated. Sub-samples of thrips from these crops at three growing seasons (spring, summer and fall) indicate that 100% of the thrips were western flower thrips (*Frankliniella occidentalis*) in all three crops (Table 1). Western flower thrips transmit tospoviruses (*Impatiens Necrotic Spot Virus* and *Tomato Spotted Wilt Virus*) on lettuce, which cause disease characterized by a suite of symptoms that affect marketability of lettuce. Direct feeding damage is also equally reported on lettuce. Moreover, presence of thrips residues is not desirable in the end products for certain markets because of religious beliefs and inherent very low tolerance set by certain countries.

This project is ongoing.

Procedures: *Objective 2 Efficacy of insecticides to thrips in lettuce.*

The study was conducted in leafy lettuce in Gonzales, CA. Seeds were planted tight (lower spacing) on July 5, 2013 but later thinned to 12-inch spacing on July 25, 2013. The soil type is Placentia sandy loam. Four replicates of each treatment were assigned to a 25-feet long 80"bed (with six seed lines/bed) according to a completely randomized block design. First broadcast-spray application of insecticides was done on August 9 followed by a second broadcast-spray application on August 21 using a four-boom sprayer at 30 PSI. The water volume used for both the applications was 40 gal/acre. Dyna-mite (Spreader) was added at 0.25% v/v to all the treatments. The details on insecticide products, and rates are shown in Table 2 and 3.

Ten plant samples were randomly collected from each plot at 3 and 7 days after each application and were transported to the lab for evaluation. Two variables were evaluated and they were number of: (a) adult thrips; and (b) larval thrips. Each plant was cut into individual leaves and every leaf was washed under running water to dislodge all the thrips. These thrips were collected by filtering the wash water through a fine mesh screen. Adult and larval thrips trapped were removed from the mesh screen, stored in alcohol and later quantified.

Results and Discussion

Counts of the number of adult thrips after three days of first application indicated, relatively less incidence of thrips in spinetoram, spinosad, and zeta-cypermethrin and avermectin B1 treatments than in spirotetramat + *Chenopodium* extractor untreated check (Table 2). The rest of the treatments were not significantly different from the untreated check treatment. Four days later (7 days after application), number of adult thrips was significantly lower in cyantraniliprole, zeta-cypermethrin and avermectin B1, and methomyl treatments than in untreated check or *Chenopodium* extract treatment. Spinetoram and spinosad treatments continued to suppress adults compared with *Chenopodium* extract treatment. On August 23 (3 days following second application), number of thrips was not different among treatments. However, 3 days later (7 days after second application), all the insecticide treatments, except *Chenopodium* extract suppressed adults compared with untreated check. The lowest number of thrips was found in spinetoram treatment than in untreated check, although number of thrips in spinetoram treatment was not significantly different from spinosad, methomyl, tolfenpyrad, tolfenpyrad + spirotetramat or zeta-cypermethrin and avermectin B1 treatments.

On August 12 (3 days after first application), number of thrips larvae was significantly lesser in spirotetramat + *Chenopodium* extract, cyantraniliprole, spinetoram, spinosad, methomyl, tolfenpyrad+ spirotetramatand zeta-cypermethrin and avermectin B1 treatments (Table 3). Between *Chenopodium* extract and untreated check treatments, there was no difference in number of larvae. The trend was similar four days later (seven days after first application) too. No statistical difference in number of larvae was detected among treatments after three days of second insecticide application. On the sample collected after seven days of second application, all the treatments, except zeta-cypermethrin and avermectin B1 and *Chenopodium* extract had significantly lesser number of larvae than untreated check.

The thrips numbers (both adult and larvae) were unusually low and inconsistent in the sample collected after 3 days of second application. However, the exact reason is uncertain.

Based on this preliminary data, it appears that spinetoram, spinosad, zeta-cypermethrin and avermectin B1, methomyl, and cyantraniliprole, could provide some level of suppression on adults. *Chenopodium* extract did not show any activity against thrips in this trial. On thrips larvae, although most of the insecticides except *Chenopodium* extract provided reasonable suppression, the lowest number of larvae was collected from methomyltreatment especially after 3 and 7 days of first application. It is noteworthy that cyantraniliprole, flonicamid, zeta-cypermethrin and avermectin B1, and spirotetramat when combined with *Chenopodium* extract or tolfenpyrad, provided suppression of larvae.

From the previous work, it is known that spinetoram and spinosad have a good activity against adult thrips and it is consistent in this trial as well. Preliminary data from this trial suggest that zeta-cypermethrin and avermectin B1, and cyantraniliprole might have some activity against adult thrips and deserve further investigation. Growers and pest control advisors need more effective options (active ingredients) that are readily available to use as they could rotate them in their program to manage thrips in lettuce in the Salinas Valley.

This project will be repeated.

Table 1. Percentage of thrips sub-samples from yellow sticky traps deployed in various crops during vegetable growing periods of the Salinas Valley.

Crop	Spring	Summer	Fall
Lettuce	100% WFT[1]	100% WFT	100% WFT
Broccoli	100% WFT	100% WFT	100% WFT
Cauliflower	100% WFT	100% WFT	100% WFT

[1]WFT = western flower thrips.

Table 2. Mean (± SE) of adult western flower thrips on leafy lettuce treated with various insecticide treatments.

Treatment	Amt formulated/ acre	Days after first insecticide application (date)		Days after second insecticide application (date)	
		3 (Aug. 12)	7 (Aug. 16)	3 (Aug. 23)	7 (Aug. 30)
Spirotetramat	5 floz	41.5 ± 8.6bc	37.3 ± 9.3ab	23.3 ± 5.5a	34.0 ± 5.4bc
Spirotetramat + **Chenopodium* extract	5 floz + 2 qt	80.3 ± 14.1a	27.0 ± 4.9b-d	3.0 ± 0.0a	29.3 ± 6.3b-d
**Chenopodium* extract	4 qt	50.5 ± 16.4bc	41.8 ± 5.1a	27.0 ± 0.0a	43.0 ± 6.1ab
Flonicamid	2.8 oz	41.8 ± 10.5bc	21.3 ± 2.3c-e	8.0 ± 0.0a	26.3 ± 3.7cd
Cyantraniliprole	20.5 floz	46.3 ± 5.2bc	11.3 ± 2.6e	23.6 ± 6.7a	37.3 ± 6.9bc
Spinetoram	8 floz	25.8 ± 4.8c	16.3 ± 3.7c-e	13.5 ± 1.2a	10.3 ± 0.3e
Spinosad	8 floz	28.5 ± 7.9c	17.0 ± 4.5c-e	17.0 ± 0.0a	24.3 ± 4.9c-e
Methomyl	3 pint	38.0 ± 12.2bc	13.8 ± 4.7de	13.5 ± 0.5a	16.3 ± 4.6de
Tolfenpyrad	21 floz	35.8 ± 8.9bc	24.3 ± 3.8b-e	14.0 ± 9.0a	25.0 ± 2.2c-e
Tolfenpyrad+ Spirotetramat	3 + 5 floz	51.0 ± 14.3bc	26.8 ± 5.8b-d	19.0 ± 6.0a	22.3 ± 5.3c-e
[a]Zeta-cypermethrin and Avermectin B1	19 floz	23.0 ± 8.6c	13.0 ± 3.7e	15.0 ± 0.0a	25.8 ± 7.1cd
UTC	Water	58.8 ± 10.4ab	28.8 ± 4.9a-c	17.3 ± 5.8a	54.0 ± 10.3a

Received two applications on August 9 and August 21. Dyna-mite (0.25% v/v) was added in all treatments. Means within columns followed by the same letter are not significantly different according to ANOVA and LSD test at $\alpha = 0.05$. *Extract of *Chenopodium ambrosioides* near *ambrosioides*. [a]Single formulation.

Table 3. Mean (± SE) of western flower thrips larvae on leafy lettuce treated with various insecticide treatments.

Treatment	Amt formulated/ acre	Days after first insecticide application (date)		Days after second insecticide application (date)	
		3 (Aug. 12)	7 (Aug. 16)	3 (Aug. 23)	7 (Aug. 30)
Spirotetramat	5 floz	66.0 ± 14.8a-c	46.8 ± 9.9bc	12.6 ± 5.3a	18.5 ± 6.4cd
Spirotetramat + **Chenopodium* extract	5 floz + 2 qt	31.3 ± 8.4c	29.3 ± 2.8cd	11.0 ± 0.0a	12.0 ± 2.7d
**Chenopodium* extract	4 qt	119.5 ± 64.8a	82.8 ± 20.5a	22.0 ± 0.0a	38.7 ± 3.3ab
Flonicamid	2.8 oz	50.0 ± 8.5bc	40.8 ± 3.9b-d	8.0 ± 0.0a	17.7 ± 7.8cd
Cyantraniliprole	20.5 floz	27.8 ± 11.8c	32.5 ± 7.2cd	9.0 ± 1.5a	14.5 ± 4.6cd
Spinetoram	8 floz	19.0 ± 7.5c	27.3 ± 4.0cd	11.5 ± 2.9a	20.3 ± 1.9b-d
Spinosad	8 floz	17.3 ± 2.1c	21.5 ± 3.4cd	12.0 ± 0.0a	25.3 ± 5.7a-d
Methomyl	3 pint	9.8 ± 5.5c	14.8 ± 3.0d	7.0 ± 3.0a	13.3 ± 5.4cd
Tolfenpyrad	21 floz	47.3 ± 14.3bc	42.3 ± 8.5b-d	17.0 ± 5.0a	16.0 ± 3.8cd
Tolfenpyrad+ Spirotetramat	3 + 5 floz	43.0 ± 15.2c	34.0 ± 8.6cd	18.5 ± 0.5a	12.0 ± 4.4d
[a]Zeta-cypermethrin and Avermectin B1	19 floz	28.5 ± 18.2c	41.3 ± 9.7b-d	21.0 ± 0.0a	31.5 ± 10.7a-c
UTC	Water	111.0 ± 37.1ab	67.8 ± 20.1ab	16.6 ± 3.2a	43.0 ± 12.6a

Received two applications on August 9 and August 21. Dyna-mite (0.25% v/v) was added in all treatments. Means within columns followed by the same letter are not significantly different according to ANOVA and LSD test at α= 0.05. *Extract of *Chenopodium ambrosioides* near *ambrosioides*. [a]Single formulation.

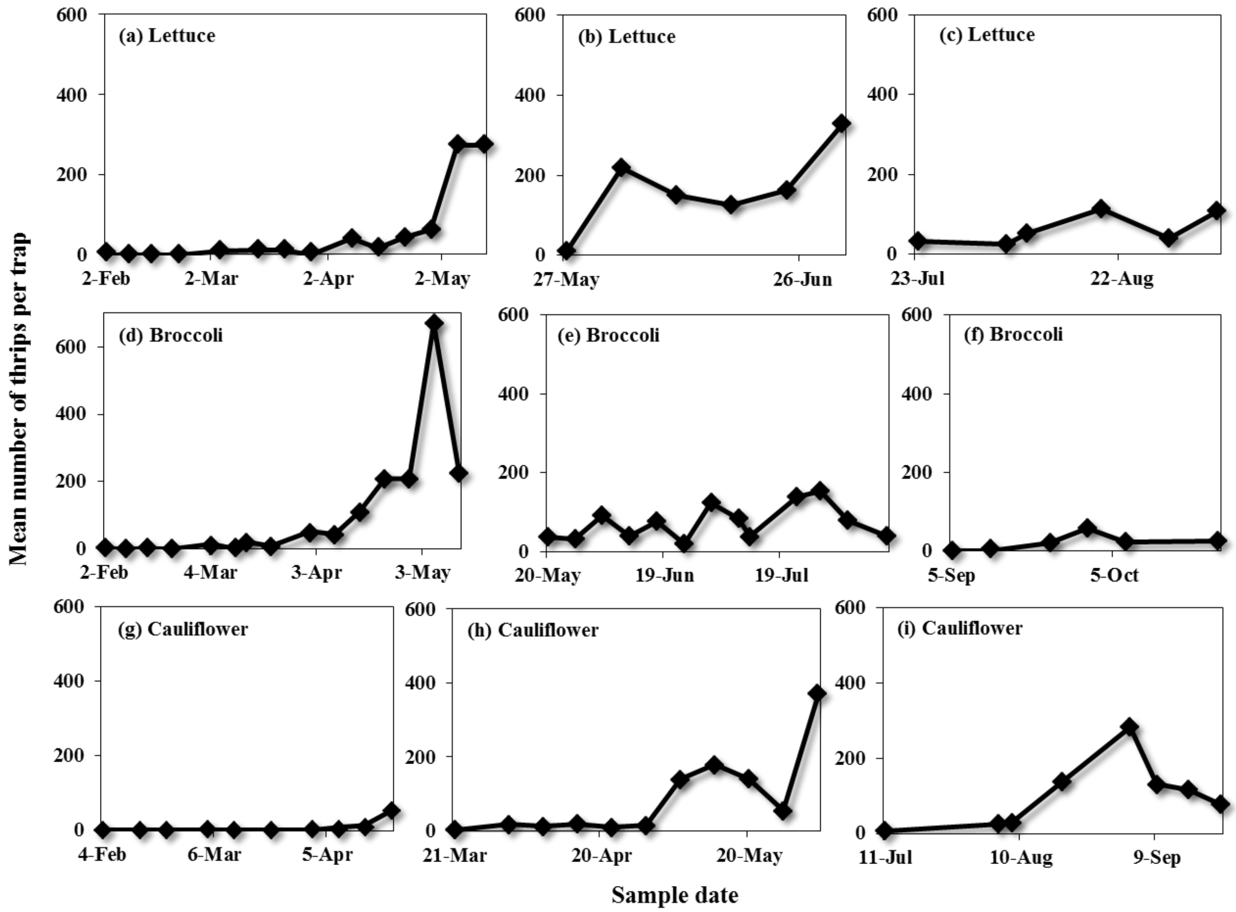

Figure 1. Mean number of thrips collected from various fields (a-c) leafy lettuce, (d-f) broccoli, and (g-i) in Salinas/ Chualar areas.

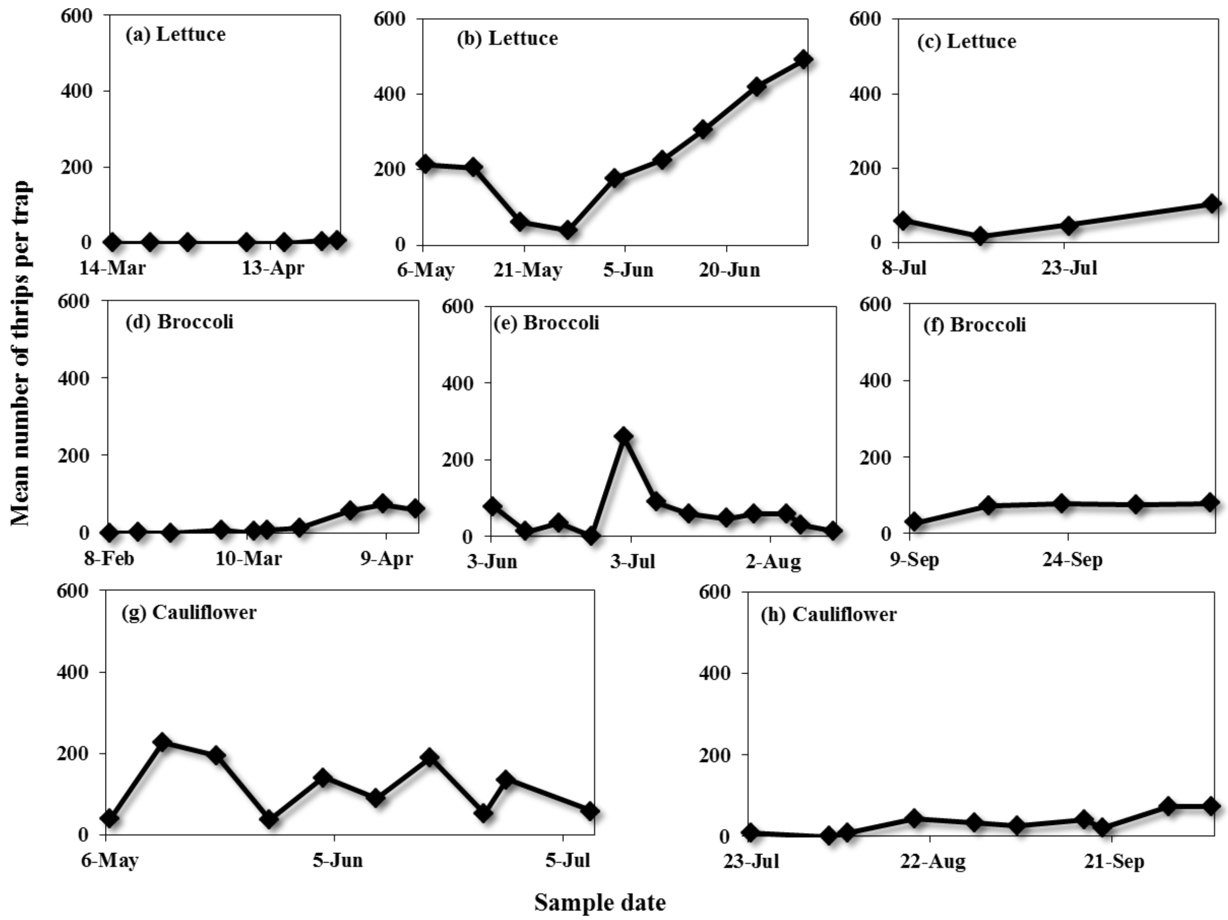

Figure 2. Mean number of thrips collected from various fields (a-c) leafy lettuce, (d-f) broccoli, and (g-h) in Gonzales/ Soledad areas.

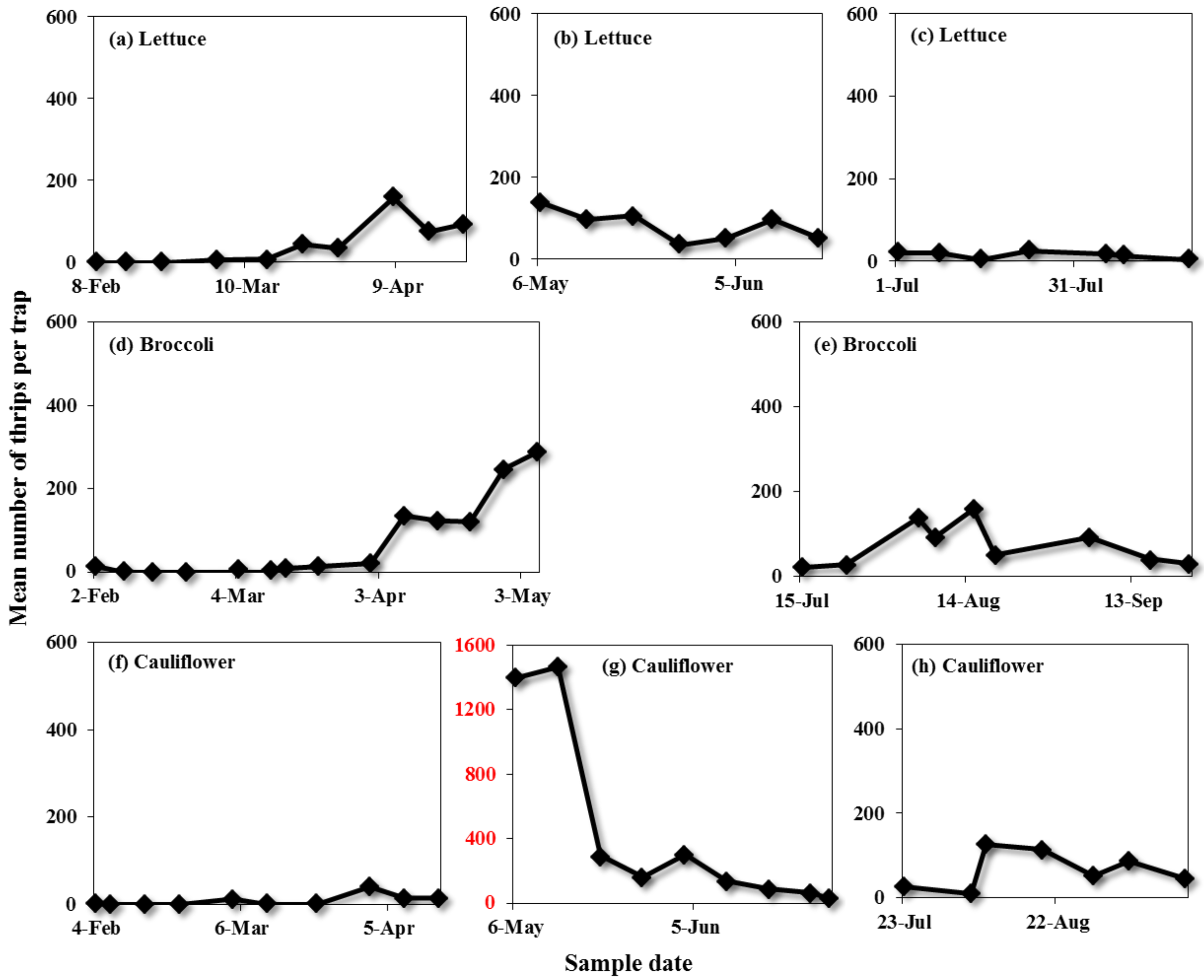

Figure 3. Mean number of thrips collected from various fields (a-c) leafy lettuce, (d-e) broccoli, and (f-h) cauliflower in Greenfield / King City areas.