

California Pepper Commission
Research Report 2019-2020

I. IDENTIFICATION

A. California Pepper Commission.

B. Insect Pest Management on Peppers

C. Proposal for period beginning March 2019, ending February 2020.

D. Principal Investigator:

Dr. Thomas Perring
Department of Entomology
University of California, Riverside

E. Cooperating Personnel:

Greg Kund
Department of Entomology
Univ. of California, Riverside

F. Locations of Work:

U.C. Riverside Agricultural Operations
Riverside, CA
Riverside County, CA

G. Insects

Tomato/Potato Psyllid: *Bactericera cockerelli* (Sulc)
Beet armyworm (BAW): *Spodoptera exigua* (Hübner)
Tomato Fruitworm(TFW): *Helicoverpa zea* (Boddie)
Leafminer: *Liriomyza sativae* (Blanchard)
Leafminer: *Liriomyza trifolii* (Burgess)
Lygus bugs: *Miridoa* spp.
Stink bugs (SB): *Pentatomidae* spp.
Bagrada bug (BB): *Bagrada hilaris*
Pepper weevil (PW): *Anthonomus eugenii* (Cano)
Green peach aphid (GPA): *Myzus persicae* (Sulzer)
Twospotted spider mite (SM): *Tetranychus urticae* (Koch)

II. Field Screening Trials for Effective Pesticides

Seedlings were transplanted in a sandy loam type soil on 23 May, 2019 at the University of California Riverside's Agricultural Operations field #10G. Experimental plots were 3 rows wide (5-ft centers) by 40 ft long and separated by a 3-ft buffer (Figure 1). The pepper transplants were drip irrigated (water pH 7.2 - 7.5). Treatments were replicated 4 times in a RCB block design. Application dates and a treatment list are shown in Table 1. All applications were made during working hours when wind conditions were mild. A tractor-mounted boom sprayer with 6 nozzles per row incorporated D-3 orifice disks, #25 cores, and 50 mesh screens. Operating pressure was 100 psi delivering 100 gpa. All treatments included an adjuvant as specified except treatment number seven, which consisted of Pyganic, Trilogy, and Entrust.

Table 1: Pepper Chemical Trial List of Treatments 2019

Treatment #	Compound	Rate-Product	Application Dates	Company Sponsor
1	Untreated	-	-	-
2	Radiant SC + Sequoia 2 SC Dyne-amic	7.0 Fl oz 4.5 Fl oz 0.25%	7/10, 7/18, 7/25, 8/1, 8/8, 8/22	Dow
3	VST-00634 LC Bioprotec Latron B-1956	16.0 fl oz 16.0 fl oz 0.125 %v/v	7/10, 7/18, 7/25, 8/1, 8/8, 8/22	Vestaron
4	VST-00634 LC Bioprotec Latron B-1956	32.0 fl oz 16.0 fl oz 0.125 %v/v	7/10, 7/18, 7/25, 8/1, 8/8, 8/22	Vestaron
5	Venerate XC Bond Max	3 qt 18 Fl oz	8/1, 8/22	Marrone Bio
6	IPM a-Intrepid + Sequoia 2 SC b-Radiant SC c-Vydate L Dyne-amic	10.0 oz 4.5 oz 7.0 oz 32 oz 0.25%	7/10, 8/8 7/18, 8/22 7/25, 8/1	Dow
7	Organic IPM a-Pyganic 1.4EC b-Trilogy EC c-Entrust SC	32.0 oz 64.0 oz 8.0 oz	7/10, 7/18, 8/8 7/18, 8/1 7/25, 8/1, 8/22	
8	Chem Standard: Asana XL Dyne-amic	9 oz 0.25 %	7/10, 7/18, 7/25, 8/1, 8/8, 8/22	

Early and late season field counts of insect populations were taken by counting a single branch from four plants per plot (plots were replicated four times per treatment) to determine what impact the treatments had on insect populations. On 4 Sep, 100 mature-green to ripe fruit were harvested from the center row of each replicate (400 per treatment) and examined for internal worm damage (TFW), external worm damage (BAW), potato psyllid (PP), spider mite (SM), aphids (GPA), and hemipterous pests (SB). Hemipterous pests include stink bugs and a more recent pest, bagrada bug (BB). Fifty fruit also were opened and inspected for damage from pepper weevil larvae (PW) (Figure 2). Results are shown in Table 2.

Results

Combined early and late season field counts of psyllids revealed significant differences between the treatments for the number of nymphs and the total number of psyllids. The untreated control had the highest number of total psyllids followed by treatment eight, which was the Asana XL treatment (Figure 3). The Asana XL treatment also showed high numbers of aphids in the late season field counts as well as in the harvest assessment. Early season insect populations such as whiteflies, leafminers, and mites were seen in the field but there were no significant numbers to report.

Damage to the calyx by TFW, BAW, and PW feeding showed no differences from the harvest assessment between treatments. Lepidopteran pressure was low to moderate in the category of 'external damage by BAW'. Harvest assessment of aphid infestation levels showed a difference for treatment 8, which was the Asana product (Figure 4). Weekly applications of the pyrethroid dramatically increased aphid populations. Internal damage by the pepper weevil was very low this year and could be a result of hot weather conditions. Some pepper weevils were seen in the field, but no internal damage by larvae was found. Potato psyllids were present in the field and there were significantly more psyllids in the Asana treated plots (Trt. 8), (Figure 5). The hot dry weather provided ideal conditions for mites this year. However, we did not see significant differences between mite numbers on the fruit at harvest (Figure 6). For the first time in our harvest assessment, we found bagrada bug damage on the pepper fruit (Figure 7). Bagrada bug typically feeds on cole crops and mustard plants but they are capable of doing damage to pepper plants when given the opportunity. Classic symptoms of Bagrada bug damage are star shaped lesions on the pepper fruit (Figure 8)



Figure 1. The field trial was composed of eight treatments with 4 replicates each for a total of 32 plots. The field was located at UCR Agricultural Operations.



Figure 2. Fifty harvested pepper fruit were picked for each tray and were subsequently evaluated for insect damage.

Mean Number of Fruit Damaged/Replicate ^a

Table 2.

Treatment/ Formulation	Rate Amt/acre	Internal	External	All Leps	Pepper Weevil Internal	Calyx Damage	Aphids
1 Control	-	0.25	2.25	2.50	0.00	4.50	2.25 c
2 Radiant SC + Sequoia 2 SC	7.0 Fl oz 4.5 Fl oz	0.25	2.00	2.25	0.00	2.75	0.75 c
3 Dyne-amic VST-00634 LC	0.25% 16.0 fl oz	0.25	2.50	2.75	0.00	3.75	0.25 c
4 Bioprotec Latron B-1956 VST-00634 LC	16.0 fl oz 0.125 %v/v 32.0 fl oz	0.25	1.00	1.25	0.00	4.75	0.75 c
5 Bioprotec Latron B-1956 Venerate XC	16.0 fl oz 0.125 %v/v 3 qt	0.25	4.75	5.00	0.00	3.00	9.50 b
6 Bond Max IPM	18 Fl oz	0.50	1.50	2.00	0.00	3.75	0.50 c
7 a-Intrepid + Sequoia 2 SC	10.0 oz 4.5 oz	0.25	1.75	2.00	0.00	2.50	2.50 c
7 b-Radiant SC	7.0 oz						
7 c-Vydate L	32 oz						
7 Dyne-amic	0.25%						
8 Organic IPM		0.25	1.75	2.00	0.00	2.50	2.50 c
8 a-Pyganic 1.4EC	32.0 oz						
8 b-Trilogy EC	64.0 oz						
8 c-Entrust SC	8.0 oz						
8 Chem Standard: Asana XL	9 oz	0.00	2.50	2.50	0.00	2.75	100.0 a
8 Dyne-amic	0.25 %						
ANOVA F value (by column)		0.229	1.605	1.441	--	0.656	285.37
ANOVA P value (by column)		0.974	0.182	0.236	--	0.707	0.001

^a Means in columns followed by the same letter are not significantly different (P<0.05 level, Fisher's LSD Test). Internal damage due primarily to (TFW); external damage due primarily to (BAW). Calyx damage can be attributed to (TFW), (BAW), and (PW) feeding.

Figure 3. Pepper field early and late season combined Potato Psyllid counts.

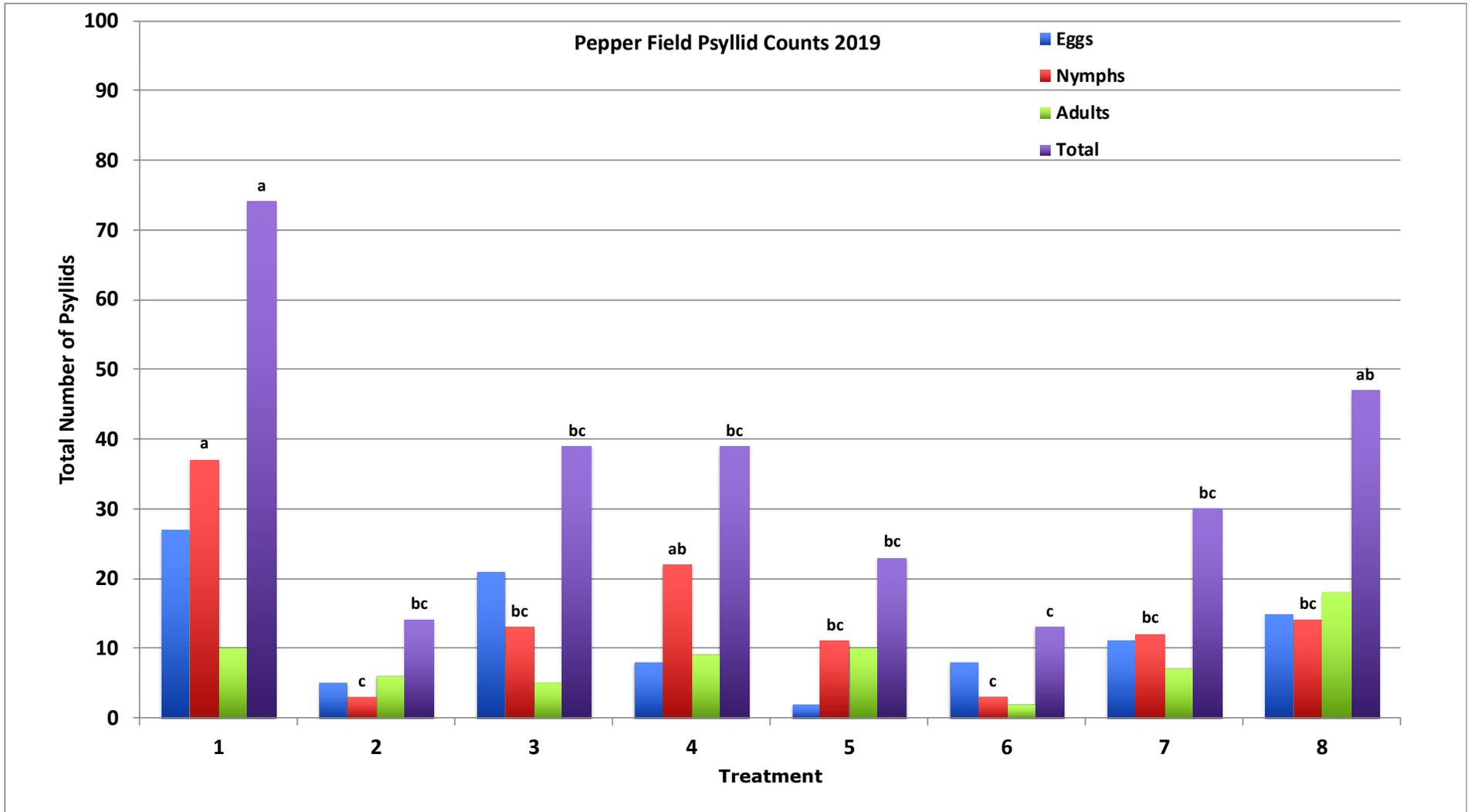


Figure 4. Pepper harvest assessment aphid infestation levels.

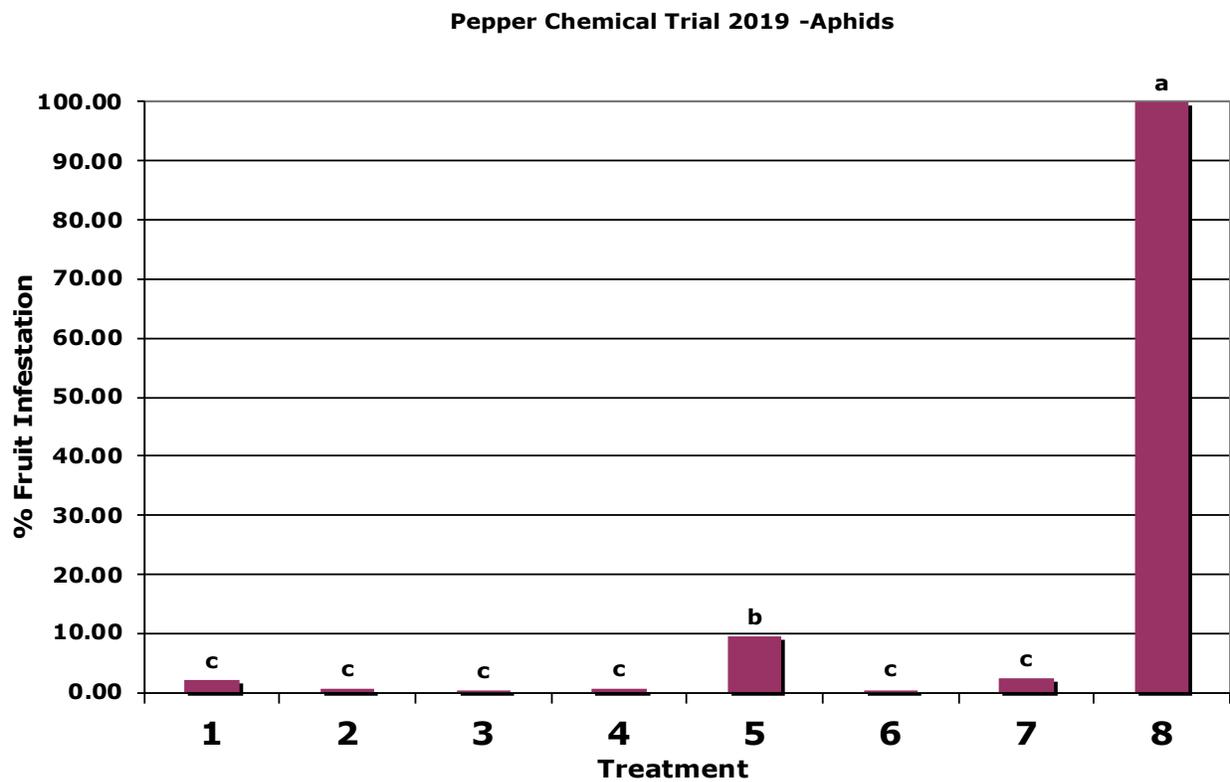


Figure 5. Pepper harvest assessment psyllid infestation levels.

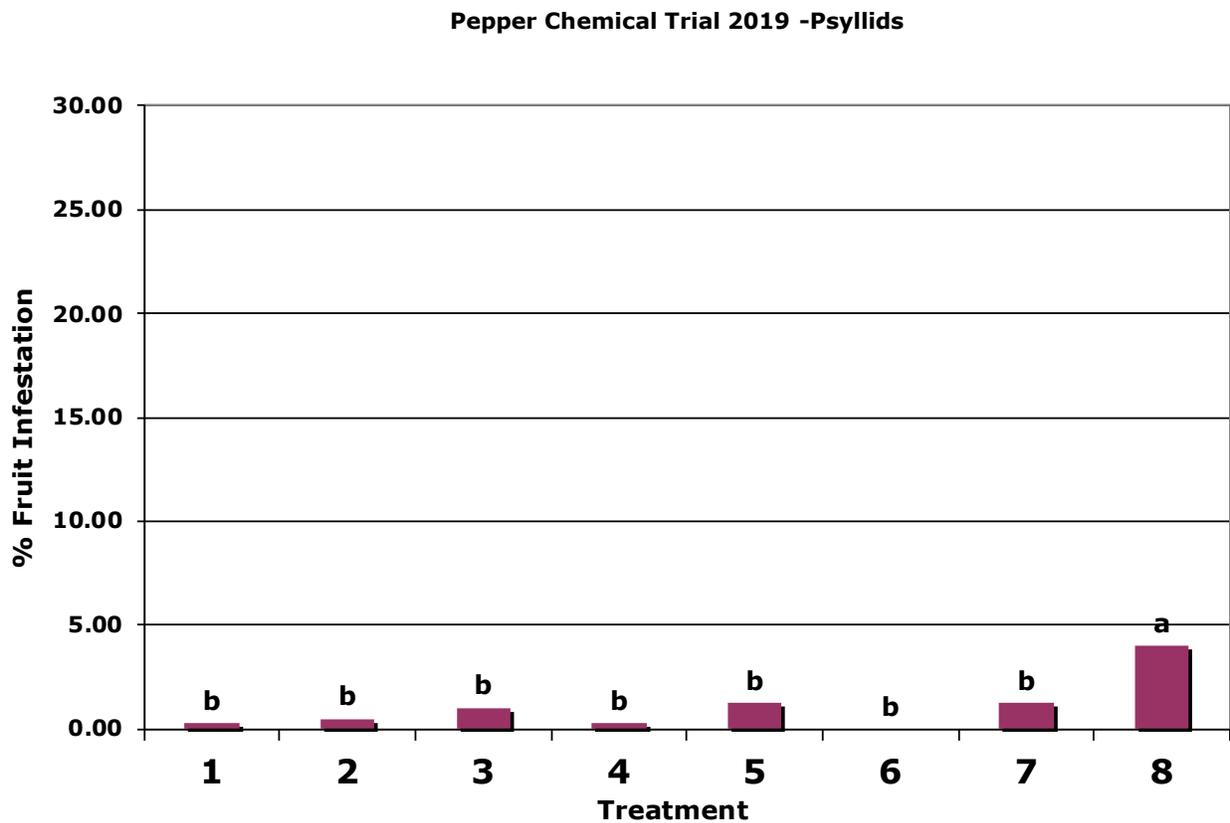


Figure 6. Pepper harvest assessment mite infestation levels.

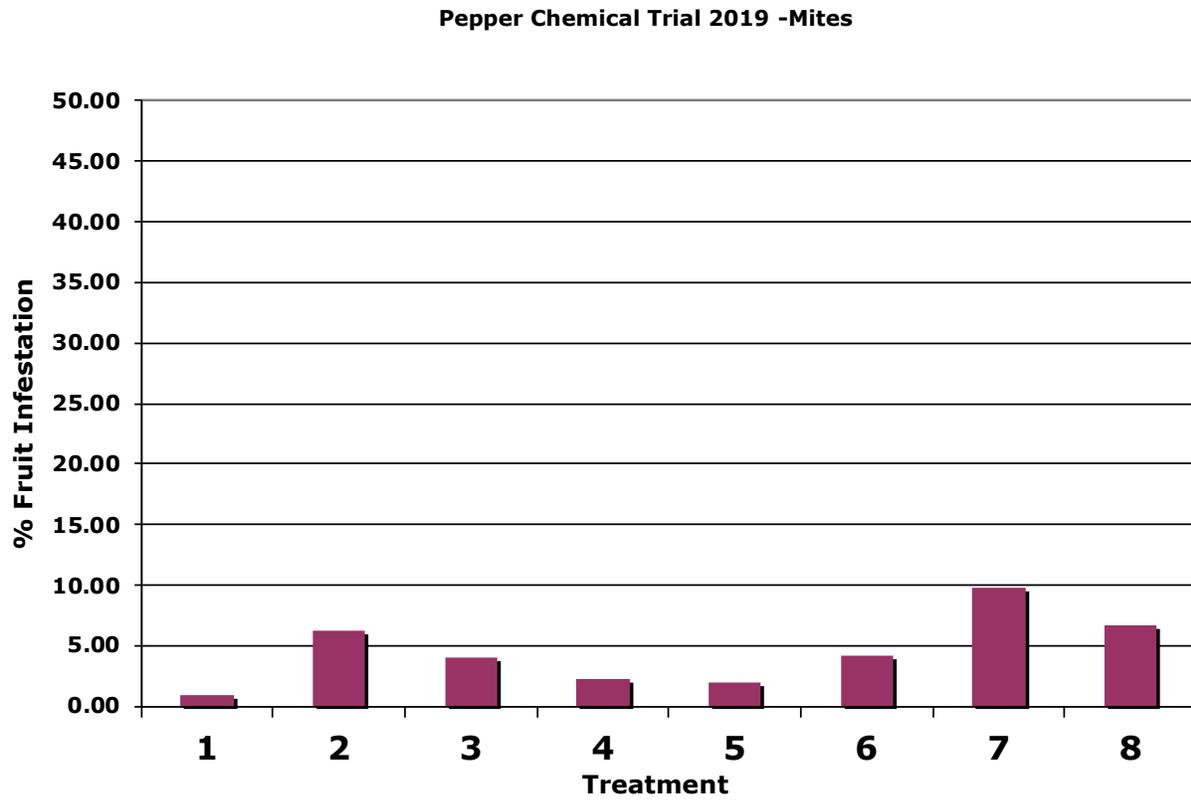


Figure 7. Pepper harvest assessment Bagrada bug infestation.

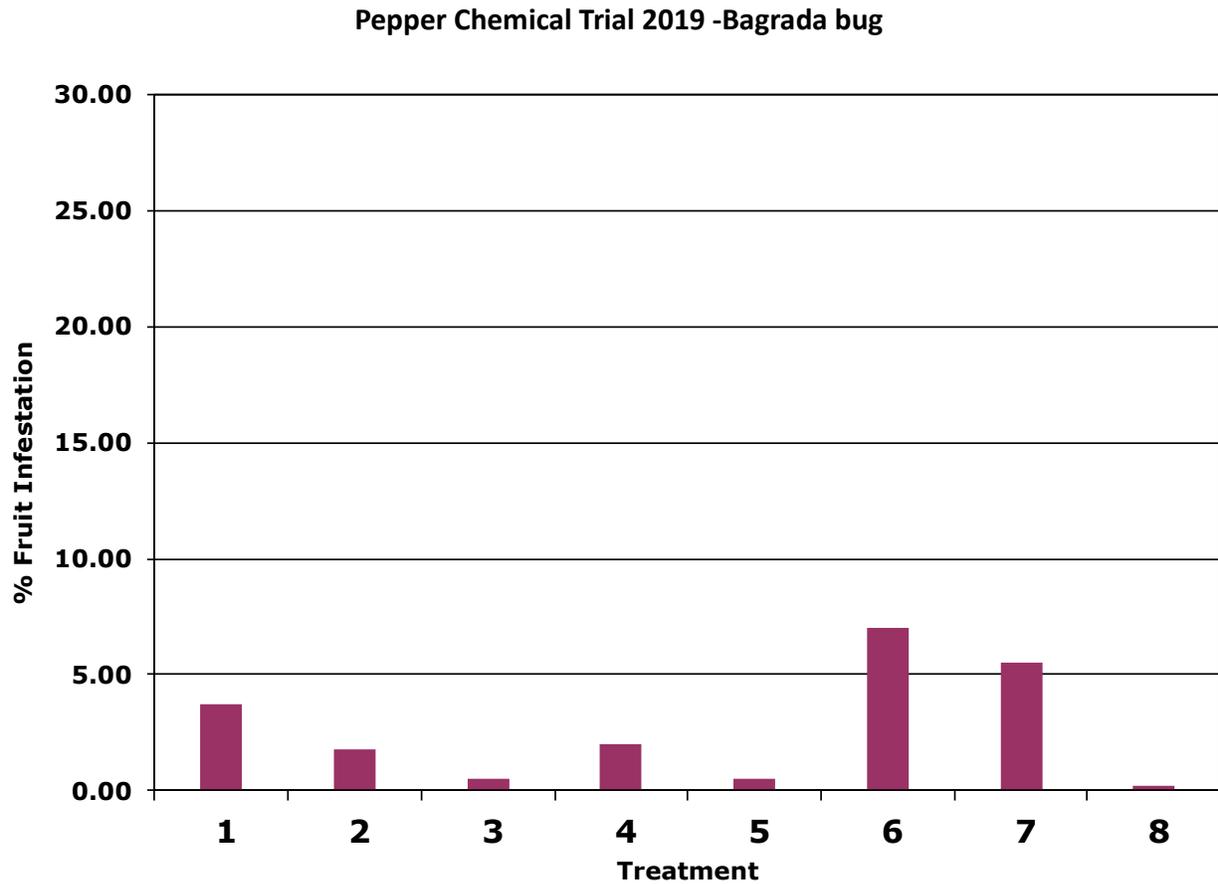


Figure 8. Bagrada bugs cause damage by feeding with their needle-like mouthparts. Multiple insertions of their mouthparts at each feeding site causes cell wall damage to the pepper fruit resulting in the visible star shaped patterns.



Photo by Greg Kund

III. Laboratory Research on potato psyllids

Objectives:

For the second year, we tested the susceptibility of the potato psyllid *Bactericera cockerelli* to Exirel™ using a field collected population of pepper psyllids found on *Capsicum annuum* CV. “California Wonder” peppers, which were collected from Irvine, CA.

Key Conclusions:

- Exirel™ provided good control of all psyllid populations at rates that were well below recommended field application amounts.

Methods

A colony of *Bactericera cockerelli* psyllids was initiated on August 14, 2014 from insects collected at the South Coast Research and Extension Center, Irvine, CA. The susceptibility of the population to Exirel™ was tested by placing 10 2nd-3rd instar psyllid nymphs on a leaf with a camel-hair brush. The host plants used were *Capsicum annuum* CV. “California Wonder” peppers. The nymphs were allowed to acclimate to the new leaf for an hour prior to being sprayed with a hand-held sprayer. The entire plant was sprayed until runoff and both sides of the leaves were sprayed for maximum coverage. Each treatment was replicated 5 times. All treatments included “Dyne-amic” as an adjuvant at 0.25%. The range of rates tested were determined from several preliminary assays. We started with the highest field rate and did multiple dilutions until we were able to find rates in the LC₉₅, LC₉₀, LC₅₀, and LC₂₅ range. The following rates of Exirel™ were tested:

- 1) Non-treated
- 2) 1.6 ppm (0.2 oz/Ac)
- 3) 0.8 ppm (0.1 oz/Ac)
- 4) 0.6 ppm (0.075 oz/Ac)
- 5) 0.4 ppm (0.05 oz/Ac)
- 6) 0.2 ppm (0.025 oz/Ac)

The nymphs were counted for mortality every 24 hours for a total of 6 days and the data for each day were analyzed independently. The JMP Pro 12.2 statistical program was used to conduct probit analyses.

Results

The results indicate that this population of psyllids was very susceptible to Exirel™ (Figure 1), indicating that resistance to Exirel is very low. The highest rate of Exirel™ tested is well below recommended commercial label rates and yet 100% control was achieved in 24 hours.

Figure 1. Irvine, CA South Coast Research and Extension Center Population

