DESCRIPTION:	**Control of Codling Moth and True Bugs by Reducing Risk Insecticides - Upper Sacramento Valley**
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Monitoring and Control of Consperse Stink Bug (*Euschistus conspersus* Uhler) in Pear Orchards

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ABSTRACT

True bugs, e.g. stink bugs, boxelder bogs, and lygus bugs can be particularly problematic in pear orchards using codling moth mating disruption due to the reduced use of broad-spectrum insecticides. A one-year replicated trial was undertaken in 2002 to test 1) several methods of monitoring Consperse stink bug (CSB) both outside and inside the orchard, and 2) several registered alternative insecticides to dimethoate. Treatments were all applied at 250 gpa on May 25 (prior to CSB biofix) and June 18 (228 or 514 CSB °D) by the grower cooperator using an engine driven air blast sprayer. Treatments included: 1) fenpropathrin (Danitol® 2.4 EC), 20 oz. per acre; 2) imidacloprid (Provado® 1.6F), 8 oz. per acre; 3) formetanate hydrochloride (Carzol® SP), 1.25 lbs. per acre, and 4) untreated. 2 lbs. azinphosmethyl was also applied for CM control with all treatments except Danitol®. Physical monitoring methods used were visual searches, sweep net samples and beating tray samples. Double-cone traps with CSB pheromone lures were placed in the orchard and catch data correlated with the UC Davis degree-day-based phenology model developed for processing tomatoes. Species of levee, riparian, and orchard floor vegetation was evaluated once on April 3. Fruit damage was evaluated on July 8 prior to scheduled harvest on July 15. Results showed that the double-cone traps combined with the degree-day model and confirmed by visual search evidence was a good indicator of the presence of stink bugs in the orchard. Data in the pear trial correlated with data from tomato trials in the lower Sacramento Valley. Using the trap catches and model, the better treatment timing appeared to be on June 25. Treatment differences were statistically insignificant although damage was numerically greater closer to the level. The CSB degree-day model, combined with the double-cone traps, has potential in pears and should be more widely tested.

INTRODUCTION

True bugs, e.g. stink bugs, boxelder bugs, and lygus bugs, while historically a pest in some pear orchards, can be even more problematic in mating disrupted orchards due to the reduced use of broad spectrum insecticides which (at least moderately) control them. The most effective material traditionally used to control them, dimethoate (e.g. Cygon®), is quite disruptive to natural enemies, and also is now an unallowable material in orchards with fruit destined for certain processing uses (i.e. baby food).

The need for data on available materials prompted a trial to test several in an orchard with chronic Consperse stink bug (CSB) problems. In addition to testing insecticide efficacy, the trial provided an opportunity to monitor consperse stink bug through the season using several methods in order to determine when and how populations could be most easily seen and a treatment decision made.

CSB is only one of several stink bugs found in pear orchards. Another one somewhat less commonly found is Conshuela (*Chlorochroa ligate*). Complete details on the identification and life cycle of stink bugs, as well as other true bugs in pear orchards can be found in *Integrated Pest Management for Apples and Pears, 2nd edition* (UCANR Publ. #3340) and the UC IPM Pest Management Guidelines: Pear, revised September 2002 (available on the website *www.ipm.ucdavis.edu*). Briefly, there are three stages of CSB: eggs, nymphs, and adults. They overwinter as adults in or near orchards. Favorite host crops include wild mustard, wild rose, common mullen, and dock, but also many others. In late March through early April they mate and lay eggs; some may move into the orchard at bloom if it is warm. First generation nymphs mature in June and move into the orchard as weed hosts dry. They then feed on the developing crop as well as orchard weeds, mate and lay eggs. Second generation nymphs mature from late June through October, and leave the orchard to start the cycle again.

Insecticide treatments have targeted 1) overwintering sites prior to movement into the orchard, and 2) orchard populations from late spring to pre-harvest. Timing is often difficult due to the need for time-consuming searches and unpredictable, spotty distribution. There is also increasing resistance to spraying riparian vegetation with disruptive insecticdes such as dimethoate and formetanate hydrochloride (Carzol®).

Pheromone-base monitoring is being researched on the West Coast by Dr. Jocelyn Millar (UC Riverside), Dr. Jay Brunner (WSU Wenatchee) and Dr. Frank Zalom (UC Davis). Dr. Zalom has developed a degree-day-based phenology model for use in processing tomatoes, which combined with commercially available CSB lures in double cone traps, enables one to more exactly track the population dynamics and time treatments. This is important because newer selective materials must be timed more accurately to achieve good results. The degree-day model/trap system is also potentially more efficient than relying solely on visual search, beating tray, and sweep net sampling.

The Zalom phenology model (developed with his graduate student Eileen Cullen), sets biofix when the first adult CSBS are caught in a double cone trap in the orchard. The minimum temperature threshold is 53.6° F (12° C) with no established maximum. Most first generation summer nymphs should emerge at about 558° F (310° C). Nymphs can also be caught in the traps, but this is less likely as they tend to disperse and are more attracted to the crop. A second emergence occurs in late August to early September but will be less pronounced as adults leave the orchard. The model and traps are supplemented by beating tray samples (and shaking in tomatoes) and visual searches. A complete description of the phenology model and double-cone traps can be found in the UC IPM Pest Management Guidelines: Tomato (available at *www.ipm.ucdavis.edu*).

While the degree-day model was developed for processing tomatoes, it was deemed worthwhile to test it in pears. Data from several lower Sacramento Valley tomato fields could be compared to the pear test site in Marysville; similar trap catch occurrence to tomatoes would indicate that the system could be transferred to pears. If the 2002 trial was successful, the effort could be expanded to more orchards and districts.

PROCEDURES

Trial Location: Naumes New England Ranch, Marysville
24' x 24' spacing, 76 trees per acre (24' x 12' interplanted)

Trial Design: RCBD (blocked parallel to the adjacent levee), 4 replications per treatment; each plot 5-6 rows wide, 8 mature trees long = 0.53 – 0.63 acres

All timings were applied at 250 gpa by commercial engine-driven air blast sprayer. The first treatments were applied on May 25 (prior to CSB biofix but coinciding with codling moth 1B timing). Treatments were: 1) fenpropathrin (Danitol® 2.4 EC), 20 oz. per acre; 2) imidacloprid (Provado® 1.6 F), 8 oz. per acre; 3) formetanate hydrochloride (Carzol® SP), 1.25 lbs. per acre; and 4) untreated. 2 lbs. per acre azinphosmethyl 50W (generic) was simultaneously applied for CM control, thus the untreated control actually consisted of 2 lbs. azinphosmethyl alone. All treatments were reapplied on June 18 (228 or 514 CSB °D, depending on selected biofix; see trapping section), to coincide with the final pre-harvest CM treatment. Danitol® was applied alone whereas the Provado®, Carzol®, and untreated plots also received 2 lbs. azinphosmethyl. No CM MD was utilized in the orchard.

Evaluation

Degree days and trap catches:

CSB degree-day data was collected using the UC IPM (NCDC #5385) Campbell Scientific weather station in Marysville. One double-cone trap was placed in the crotch of a tree in the second row of each plot in the replication closest to the levee (4 traps total). Traps were checked once per week from April 11 – September 26 for male and female adults. Traps and CSB pheromone lures were provided by Dr. Frank Zalom's laboratory. Lures were changed once per month. CM traps were placed and monitored by the grower.

CSB habitat preference and presence:

1) Levee vegetation was identified on April 3 to determine the presence of desirable hosts.
2) Sweep net samples were performed weekly March 26 through late May on the levee and in the orchard.
3) 50 beating tray samples per plot (3 traps per beat) were taken weekly through post-harvest.
4) Visual searches of 30-60 minutes each were performed once per month on the levee, along the riparian corridor, and in the orchard. Emphasis in the orchard was placed on the replication closest to the levee.

CSB infestation:

200 fruit per plot (800 per treatment) were sampled for damage on July 8 (609 or 927 CSB °D, depending on chosen biofix). CM, leafroller, and lygus bug damage was also noted.

RESULTS

Degree-day model and traps: One adult stink bug was caught in one double-cone trap on April 18. None were caught again until May 16 (2 males). Sustained catch occurred June 7 (3 females, 1 male), June 13 (2 of unknown sex), and June 17 (3 males). All were caught in the same trap located at the south end of the orchard. No adults were caught in any trap after June 17. Using this data, the CSB model was run using two biofix dates, May 16 and June 7 (Figures 1 and 2).

Vegetation sample (April 3):

Levee and riparian (along Feather River): * vetch, annual bluegrass, wild oats, brome grass, clover, bur and crimson, lupine, California poppy, red-stem filaree, pineapple weed, and * wild blackberry.

Orchard floor: chickweed, red-stem filaree, Carolina geranium, scarlet pimpenel, * broadleaf plaintain, common groundsel, clovers, * common sowthistle, * common mallow, wild oats, panicled willow herb, speedwell, and Miners lettuce.

* indicates major CSB host plants

Sweep net and beating tray samples: no CSB were caught during any sampling event.

Searches: the only CSB find occurred on June 7 in the weeds and lower canopy of the tree containing the double-cone trap in which 4 adults were also found on the same date.

Damage evaluation (July 8): Damage averaged 0.85% and there were no significant treatment or block differences in either CSB or CM damage, although numerical damage was highest (1.3%) in the block parallel to, and decreased linearly away from, the levee (Table 1 and Figure 3).

CONCLUSIONS

Despite the history of chronic CSB damage in the trial orchard, it was very difficult to find CSB individuals using sweep net and beating tray samples, despite spending 30-60 minutes per sampling event. The double-cone traps placed parallel to the levee were very effective, and catches correlated well with visual search finds. Treatments were timed, by necessity, to coincide with CM control, rather than according to the phenology model. Timing of the June 25 treatment, however, correlated relatively well with predicted nymphal emergence, allowing for residual efficacy. The May 25 timing, on the other hand, was likely too early to effect control, as it preceded when the majority of adults appeared to move into the orchard to feed, mate and lay eggs.

The Zalom/Cullen CSB degree-day model instructs to begin biofix when the first CSB is caught in the double-cone trap. In this case, the May 16 catch of one adult, followed by no catch until June 7, might be considered a “false” biofix. The longer, second wave of catches closely matched data from tomato fields showing the first adult peak catch occurring from June 11 (Woodland) to June 25 (Dixon). The second expected peak, seen from July 29-August 21 in the tomato trials, was not observed in the pear trial, perhaps due to successful treatment. Using a June 7 biofix, about 429 °D had accumulated on June 25, the day of the second treatment. This was about 6 days before the 590 °D found by Zalom to be the optimal sampling time for 1st and 3rd instar nymphs. Treatments applied on June 25 therefore would have enough residual, 10-14 days, to affect the most vulnerable CSB life stage (Cullen and Zalom 2000).

It appears then that the combination of double-cone trap catches, the CSB degree-day phenology model, confirmed by visual search near the traps, was an excellent indication of CSB nymphal emergence and consequent treatment timing. The correspondence with the pre-harvest CM treatment should be seen as coincidental as the two treatments may fail to coincide in any given year or location (i.e. one should utilize two separate models for these pests, rather than assuming treatment timing).

The other methods utilized in the trial failed to provide any additional information. It can be stated, however, that the lack of CSB presence in traps before June 7 showed that 1) CSB is difficult and time consuming to monitor for relative to “payback”, especially in the spring; 2) growers may resort to premature prophylactic, and hence, less effective treatment in chronically-damaged orchards; and 3) the availability of a trap/degree-day system can potentially greatly enhance confidence in timing treatments to the most vulnerable CSB lifestage. Although the traps and model were only tested in one site in 2002, the traps were utilized by one pest control adviser with great success in Kelseyville, Lake County. Trap catch timing also correlated well with the degree-day model run from the Kelseyville UCIPM PestCast weather station. This positive experience, followed by one or two years of validation in several orchards, should confirm the usefulness and cost effectiveness of the system in pear orchards.

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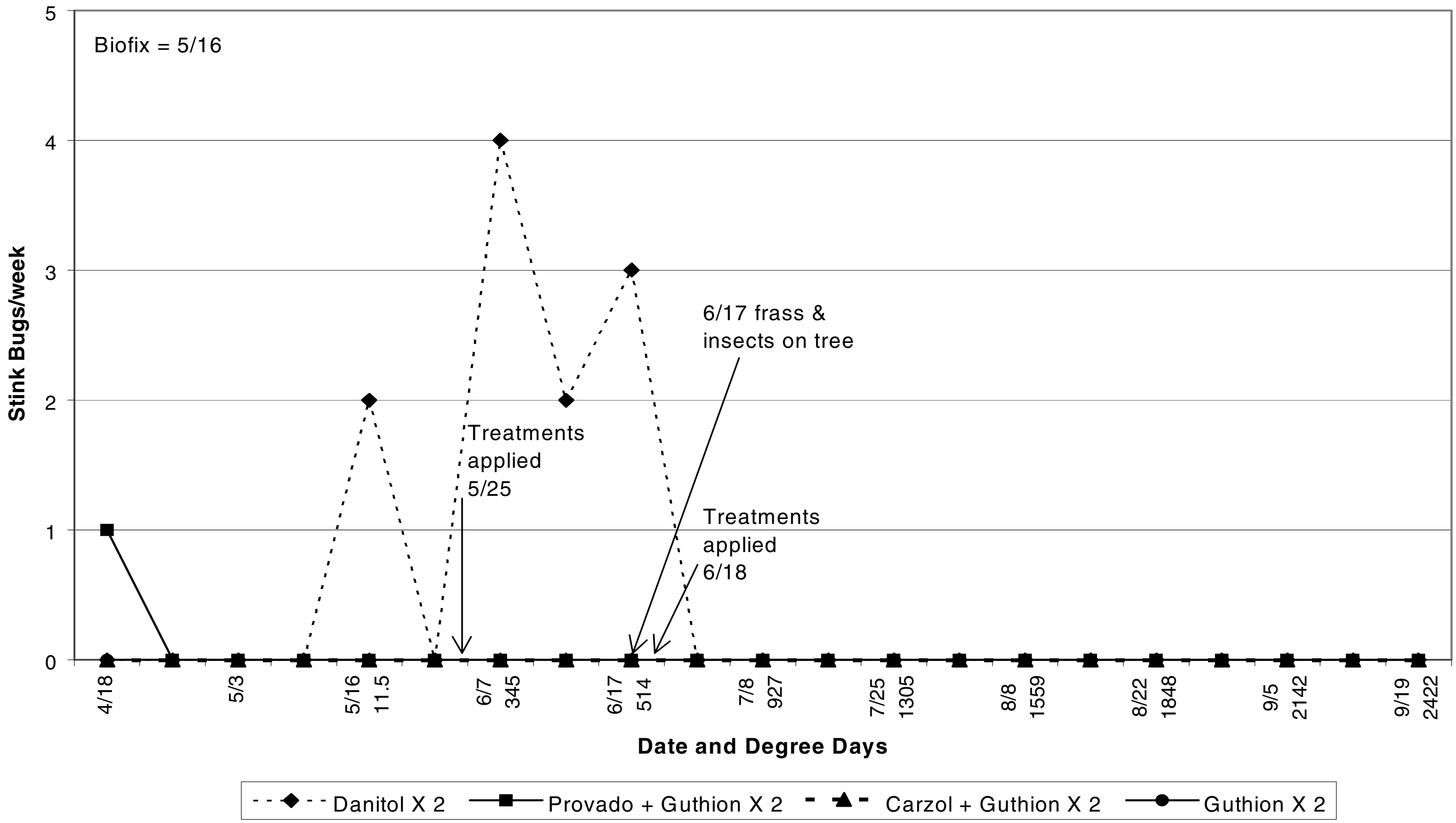

Figure 1: Consperse stink bug trap catch and degree-days using a May 16 biofix, Naumes New England Orchard, Marysville, Yuba County, 2002.

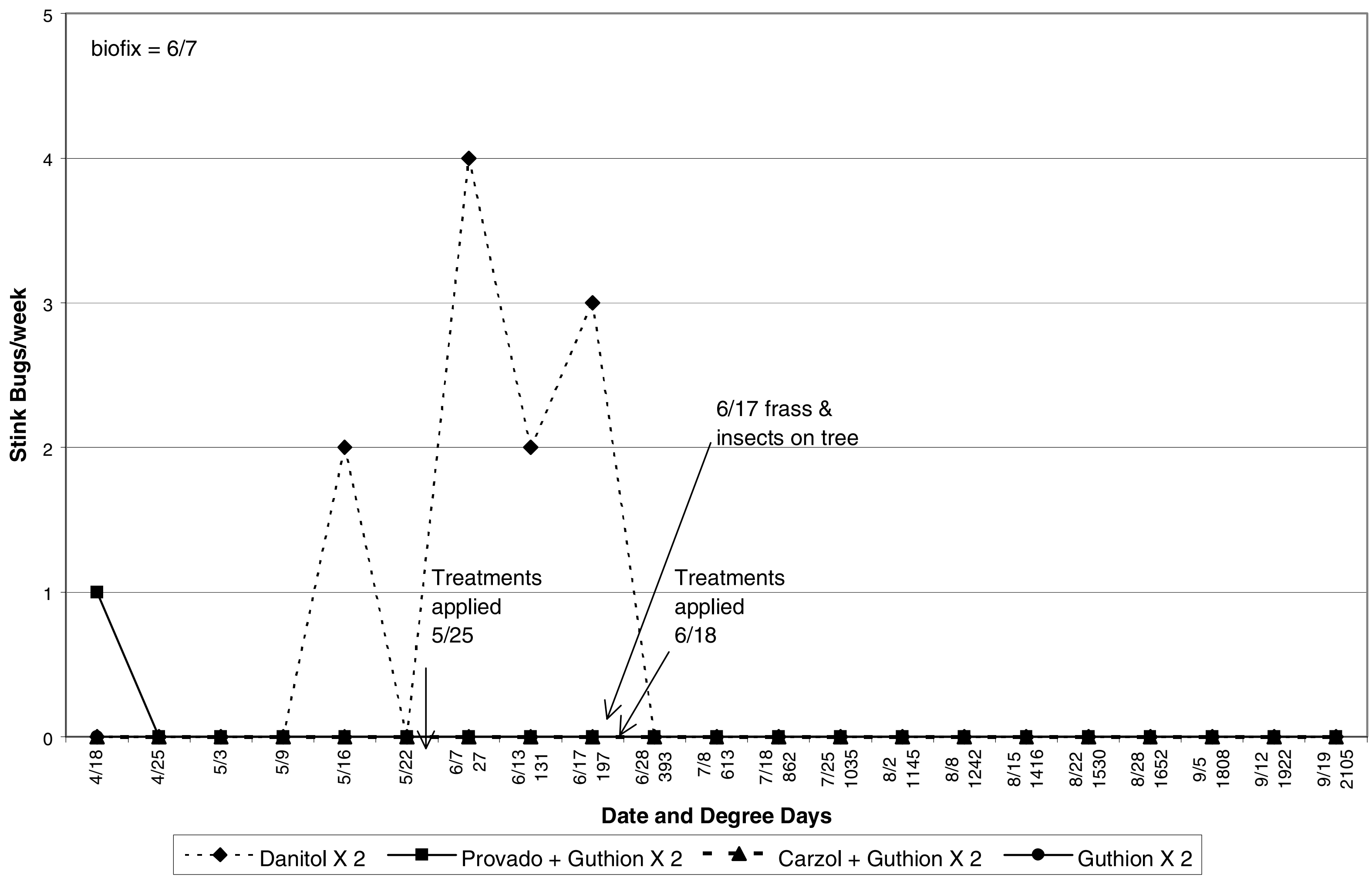

Figure 2: Consperse stink bug trap catch and degree-days using a June 7 biofix, Naumes New England Orchard, Marysville, Yuba County

Treatment	Mean [1] Stinkbug Damage	Mean [1] CM Worms
Danitol	1.1 a	0.6 c
Provado	0.6 b	1.0 b
Carzol	1.1 a	0.3 d
Control	0.6 b	1.1 a
Block		
I	1.3 a	0.9 a
II	1.1 b	0.8 b
III	0.9 c	0.5 c
IV	0.3 d	0.9 a
ANOVA [2]		
Treatment	NS (P=0.865)	NS (P=0.478)
Block	NS (P=0.645)	NS (P=0.907)

[1] Within columns, treatment and block means significantly different (Tukey-Kramer multiple range test, $P \leq 0.05$).

[2] NS indicates not significant, $P>0.05$.

Table 1: Average percent Consperse stink bug and codling moth damage per 200 fruit per block, Naumes New England Orchard, Marysville, Yuba County, July 8, 2002

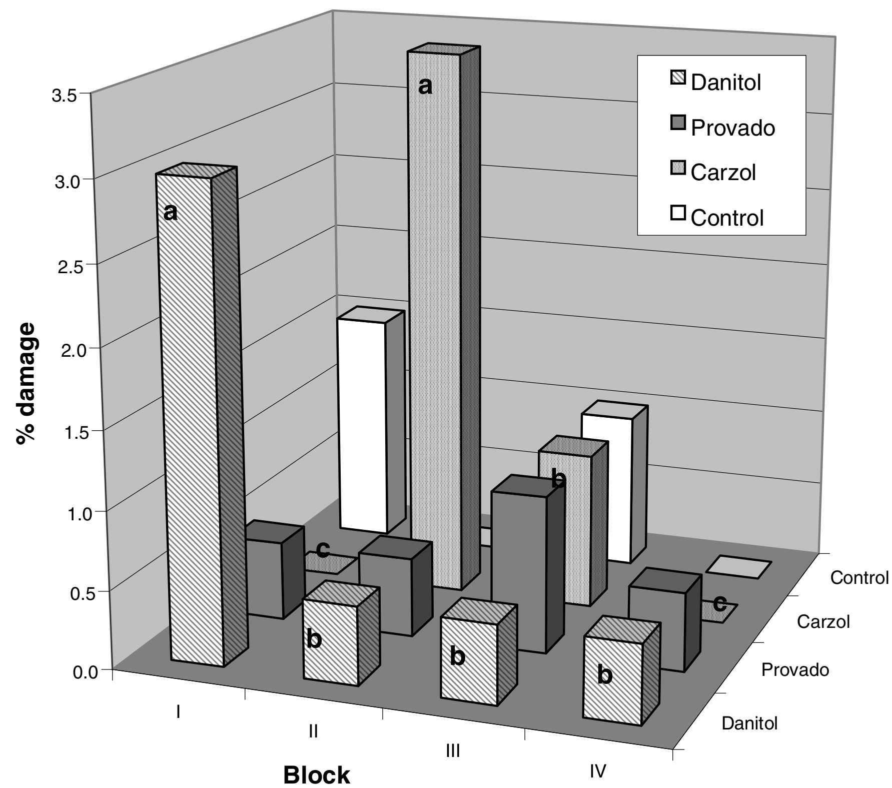

Figure 3: Percent Consperse stink bug damage per 200 fruit per block, Naumes New England Orchard, Marysvile, Yuba County, July 8, 2002