MONITORING OF CONSPERSE STINK BUG (*EUSCHISTUS CONSPERSUS* UHLER) IN PEAR ORCHARDS

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ABSTRACT

Abstract: Consperse stink bug (*Euschistus conspersus*) (CSB) is the most commonly noted stink bug pest of pears in California. Though considered a localized pest, it can cause great damage to fruit if unmanaged, and is of major concern in fruit destined for canning. Like other true bug pests, its presence has increased since the advent of mating disruption for codling moth control due to reduced organophosphate use. Management is generally accomplished by visually monitoring the presence of CSB in vegetation outside the orchard in the spring, and then CSB presence and damage within the orchard during the summer, followed by treatment with broad-spectrum materials is necessary. Timing applications can be problematic due to the uncertainty of determining the timing of nymphal hatch and development and insect movement from external weed hosts into the orchard. In 2003, research was initiated in one orchard in the northern Sacramento Valley to test a degree day model developed for tomatoes. The Zalom-Cullen model appeared to accurately predict the hatch of the first summer generation in the orchard. In 2005 research continued in four orchards in Lake County. In addition to continued testing of the Zalom-Cullen model, four trap and lure combinations (two trap and two lure types) were compared to determine which best tracked seasonal CSB phenology. The two trap types were the double-cone trap used in tomato research in California and the Intercept® Pyramid cone trap developed by WSU and Applied Plant Technologies, Inc. (APT). The two lures are commercially available from Trece, Inc. and APT, respectively. Traps were place in late May within the orchard, and each trap and lure combination was replicated three times at each of the four sites. Biofix occurred on May 26 and degree days correlated with CSB adult catches. Peak adult trap catch occurred on July 20 (745°D), late according to the model. This may have been due to the prolonged rainy spring. The APT lure caught significantly more adult CSB than the Trece lure. There was no significant difference between the two trap types. Damage was highest in the proximity of the traps and decreased as the distance from the traps increased.

INTRODUCTION

True bugs, e.g. stink bugs, boxelder bugs, and lygus bugs, while historically pests 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).

Consperse stink bug (CSB) is only one of several stink bugs found in pear orchards. Another one somewhat less commonly found is Conchuela (*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 insecticides 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 (Trece, Inc., Adair, OK) 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-Cullen phenology model (developed with his graduate student Eileen Cullen), sets biofix when the first adult CSB are caught in a double cone trap in the orchard. The minimum temperature threshold is 53.6° F (12° C) with no established maximum. After peak adult emergence in June, 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 was compared to a pear test site in Marysville in 2002; similar trap catch occurrence to tomatoes indicated that the system could be transferred to pears.

In addition to the double-cone trap system used in California, the yellow Intercept® Pyramid trap baited with an aggregate pheromone lure (Advanced Pheromone Technologies, Marylhurst, OR) was successfully tested in North Central Washington in 2001.

In 2005, four trap and lure combinations were tested in four Lake County orchards to compare efficacy, ease of use, and cost. The Zalom-Cullen °D model was run in conjunction with trapping to determine if it accurately predicted CSB phenology.

PROCEDURES

Trap/lure combinations and degree days:

Three replicates of four trap plus lure combinations (12 traps total) were placed in a randomized complete block design in four orchards (three pear, one apple) with known CSB populations.

Treatments included:

1) Intercept® Pyramid + Trece Pherocon lure
2) Intercept® Pyramid + APT IPM lure
3) Double-cone + Trece Pherocon lure
4) Double-cone + APT IPM lure

In three orchards, traps were placed 25 feet apart down the second row in from the edge closest to potential CSB habitat. In one orchard, traps were placed down an inside row in the vicinity of historical damage (in this case, the CSB were known to be living year round inside the orchard, versus the other three, where they were coming in from external habitat). Pyramid traps were anchored to the ground using rebar and double-cone traps placed in the tree crotch and tied to a scaffold. They were checked weekly from May 31 - October 27 for male and female adults and lures changed every 45 days.

CSB presence and damage:

Each week, 50 beating tray samples in a transect from the edge into the middle of each orchard (3 traps per beat) were taken. Visual searches of 30 minutes were performed concurrently with beating tray sampling. Bin damage (5 bins, 200 fruit/bin) was evaluated in one orchard in relation to trap row location.

RESULTS AND DISCUSSION

CSB phenology and degree days (Figures 1-7) - Biofix was set on May 26, as CSB adults were caught immediately after trap deployment. Placement was relatively late due to the prolonged rainy season; traps are normally placed in April. Average peak adult catch was July 20 (745 °D).

Only one orchard (#1, Kelseyville) was treated specifically for CSB, on July 18 (702 °D). Orchard #4 (Scotts Valley) was treated for box elder bug on June 7 (125 °D) and had very low CSB trap catches after that (though the low catches may also be due to an inherently lower population). Catches trended lower after July 20, with several smaller peaks in September.

Using the May 26 biofix, theoretical peak 1-3 instar nymphal presence was July 11-12

(543-564 °D), 9-10 days **prior** to peak adult emergence as reflected in trap catches. This indicates CSB moved into the orchards late due to a prolonged developmental period and/or a prolonged spring weed growth. Although July 18 treatment date coincided well with peak catch, some percentage of the more vulnerable nymphal stages likely escaped treatment due to the prolonged spring emergence.

Trap plus lure combinations - the APT IPM lure attracted significantly more CSB adults than the Trece Pherocon lure, regardless of trap type. There was no significant difference between trap types. Since the pyramid traps cost more than the double-cone ($14.00 versus about $5.00) the double-cone/APT lure combination the more economical alternative.

Bin damage in relation to trap location (Figure 8, Table 7) - Damage was worst in the trap trees and generally decreased with distance. The attraction of the aggregate pheromone should thus be considered if utilizing this monitoring system. In most cases, it is probably safer to place the traps just outside the orchard in order to reduce likelihood of fruit damage that may otherwise be avoided. One possibility being explored is to exploit this attractiveness in an attract-and-kill strategy.

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Table 1. Total seasonal Consperse stink bug trap catches, Orchard #1, Kelseyville, Lake County 2005

Trap + Lure	Total CSB/Season [1] (avg./3 reps)
Pyramid + APT	56.3 A
Double-Cone + APT	42.7 A
Double-Cone + Trece	9.7 B
Pyramid + Trece	2.3 B

[1] Means separated by LSD, p = .05 (actual p = .0006)

Table 2: Total seasonal Consperse stink bug trap catches, Orchard #2, Kelseyville, Lake County 2005

Trap + Lure	Total CSB/Season [1] (avg./3 reps)
Pyramid + APT	84.7 A
Double-Cone + APT	27.0 A
Double-Cone + Trece	14.3 B
Double-Cone + APT	9.0 B

[1] Means separated by LSD, p = .05 (actual p = .0010)

Table 3: Total seasonal Consperse stink bug trap catches, Orchard #3, Kelseyville, Lake County 2005

Trap + Lure	Total CSB/Season [1] (avg./3 reps)
Double-Cone + APT	62.0 A
Pyramid + APT	20.0 A
Pyramid + Trece	2.6 B
Double-Cone + Trece	3.3 B

[1] Means separated by LSD, p = .05 (actual p = .0007)

Table 4: Total seasonal Consperse stink bug trap catches (apples), Orchard #4, Lakeport, Lake County 2005

Trap + Lure	Total CSB/Season [1] (avg./3 reps)
Double-Cone + APT	5.7
Pyramid + APT	1.7
Pyramid + Trece	0.7
Double-Cone + Trece	0.3
	NS

[1] Danitol applied for boxelder bug 6/7/05

Table 5: Total seasonal Consperse stink bug trap catches, all orchards combined, Kelseyville, Lake County 2005

Trap + Lure	Total CSB/Season [1] (N=12)	
Pyramid + APT	41	A
Double-Cone + APT	34	A
Double-Cone + Trece	5	B
Pyramid + Trece	5	B

[1] Means separated by LSD, p = .05 (actual p = .0001)

Table 6: Separation of trap versus lure type, all orchards combined, Kelseyville, Lake County 2005

	F-Ratio	P-Value	LS mean	
Pyramid	.01	0.94	22.8	A
Double-Cone	----	----	19.7	A
APT	28.62	0.0000	37.4	A
Trece	----	----	5.2	B
Block	NS	>>.05	----	---

Means separated by LSD, p = .05

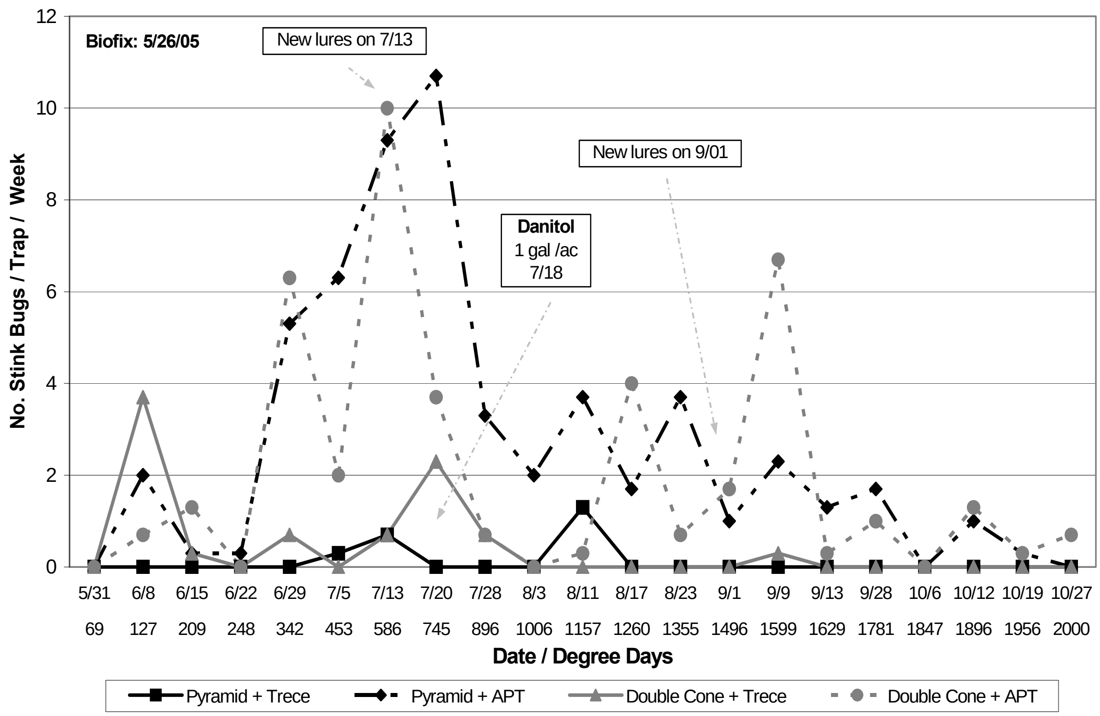

Figure 1: Consperse stink bug trap catch and degree-days using a May 26 biofix, weekly average of 3 traps, Orchard # 1, Kelseyville, Lake County, 2005.

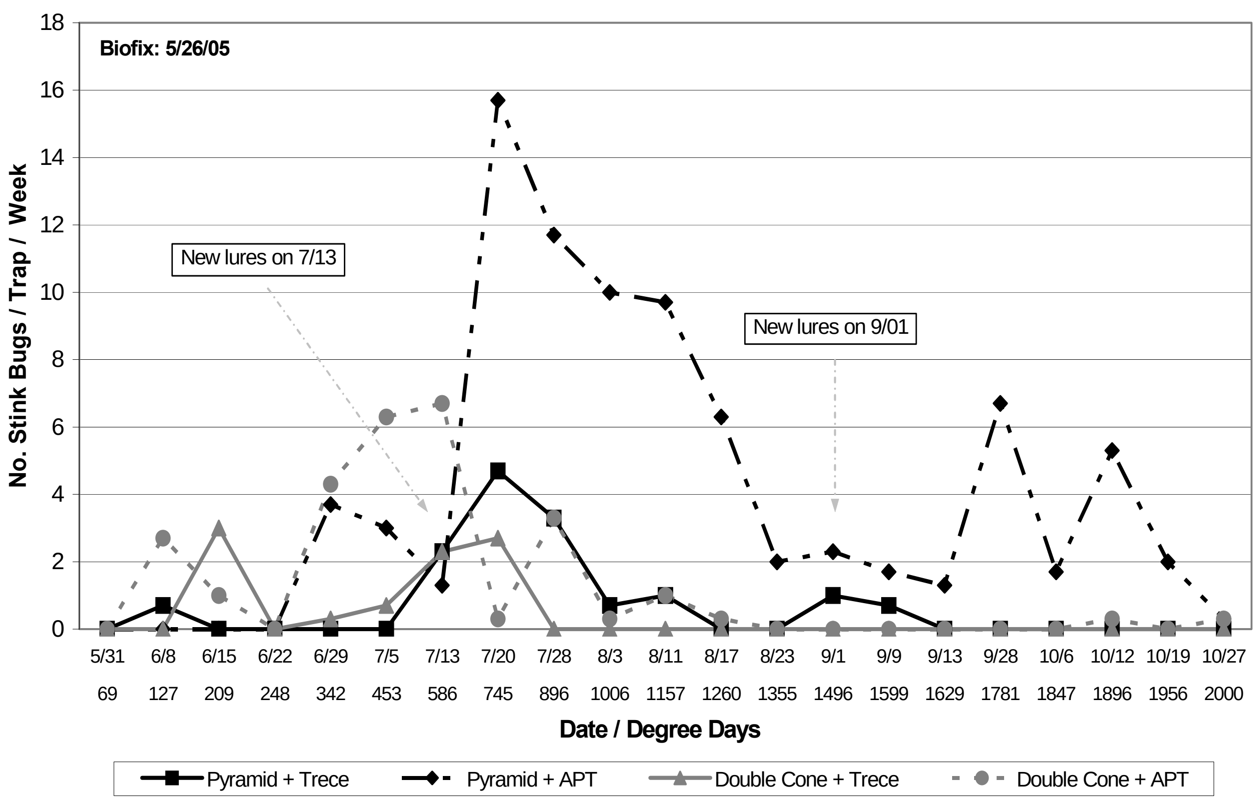

Figure 2: Consperse stink bug trap catch and degree-days using a May 26 biofix, weekly average of 3 traps, Orchard # 2, Kelseyville, Lake County, 2005.

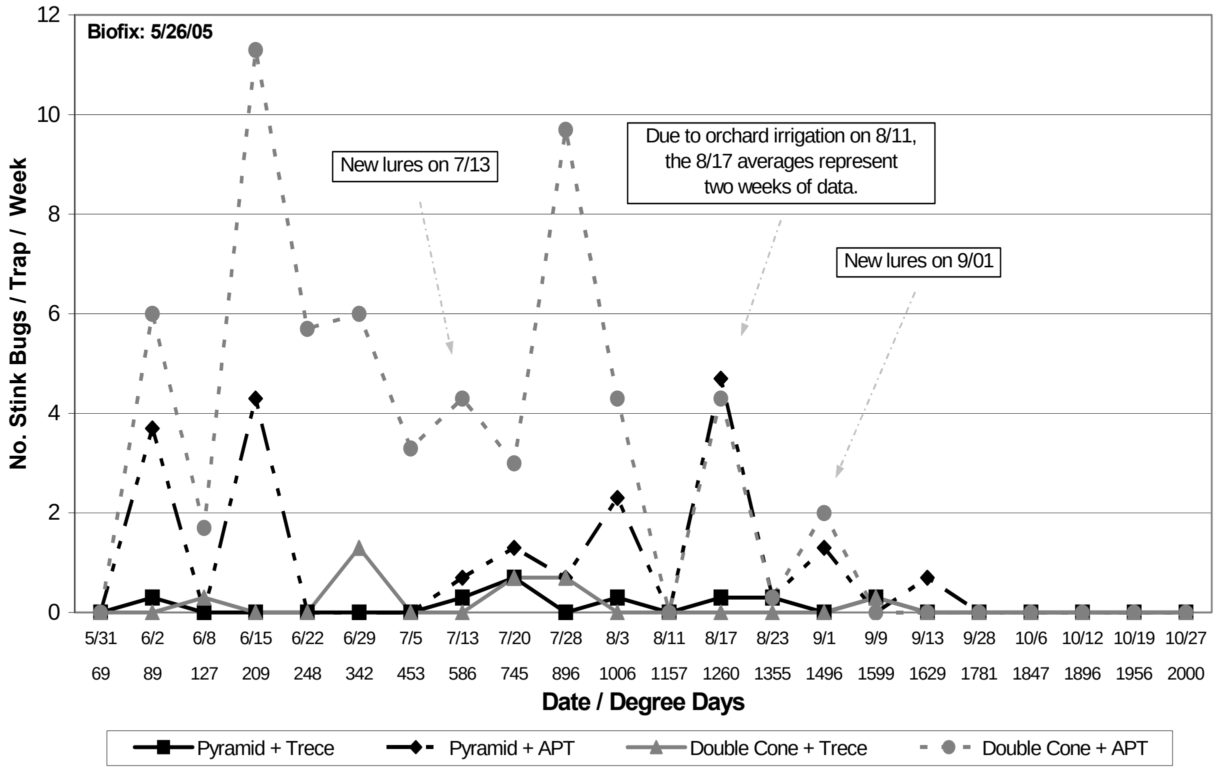

Figure 3: Consperse stink bug trap catch and degree-days using a May 26 biofix, weekly average of 3 traps, Orchard # 3, Kelseyville, Lake County, 2005.

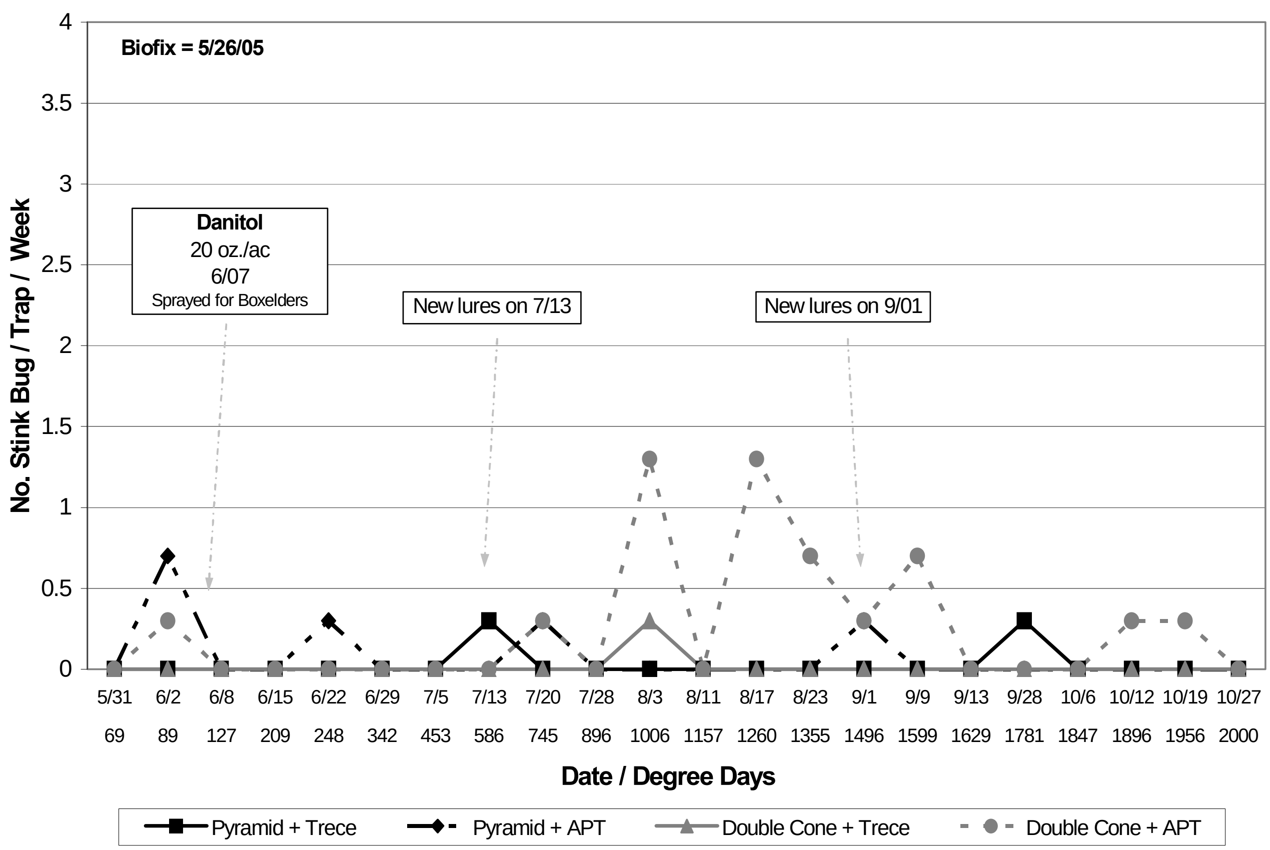

Figure 4: Consperse stink bug trap catch and degree-days using a May 26 biofix, weekly average of 3 traps, Orchard # 4, Scotts Valley, Lake County, 2005.

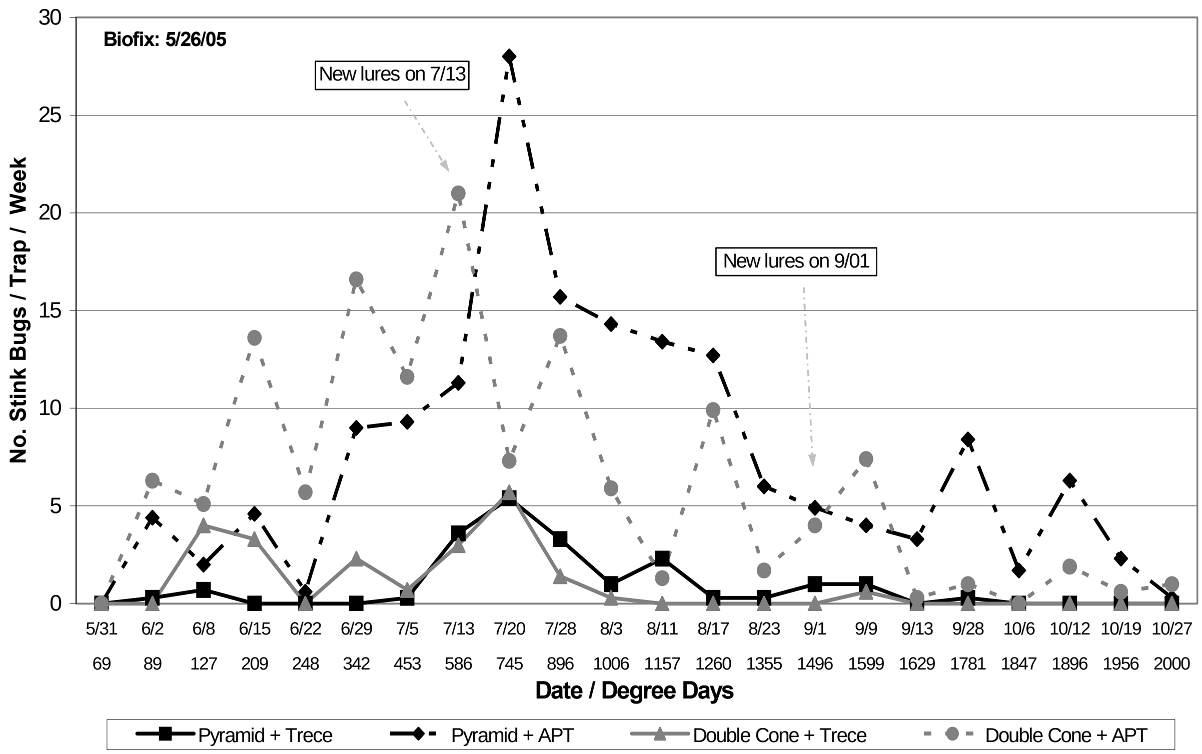

Figure 5: Consperse stink bug trap catch and degree-days using a May 26 biofix, weekly average of 3 traps, average of 4 orchards, Kelseyville & Scotts Valley, Lake County, 2005.

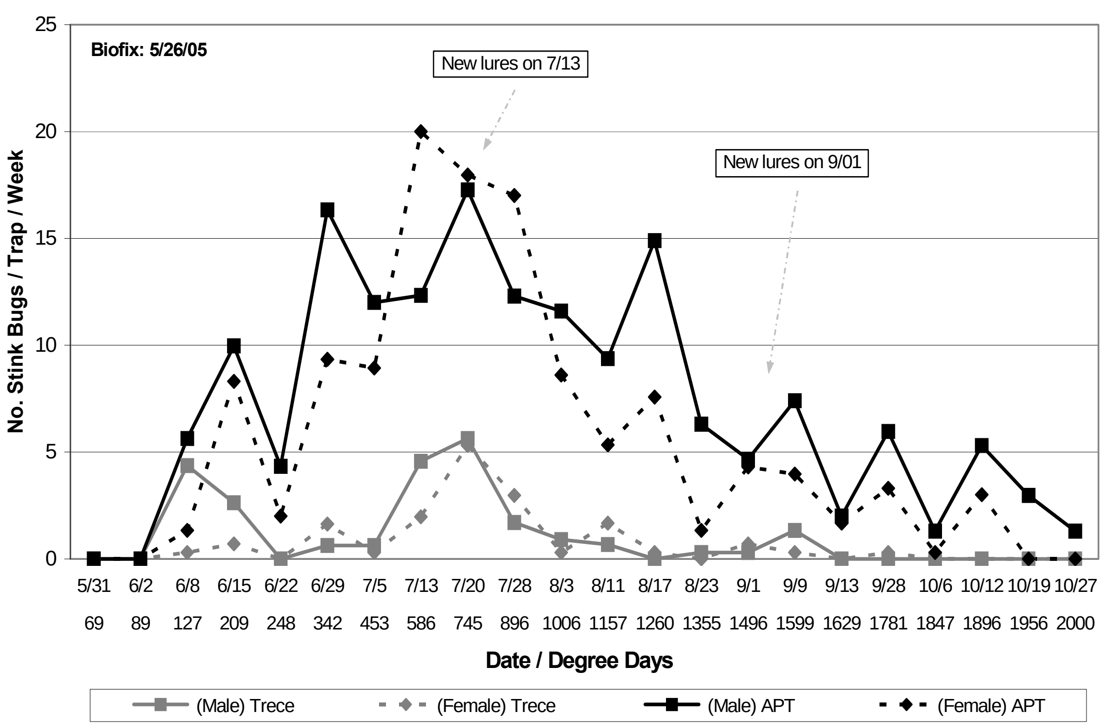

Figure 6: Consperse stink bug male and female trap catch and degree-days using a May 26 biofix, weekly average of 3 traps, lure comparison average of 4 orchards, Kelseyville & Scotts Valley, Lake County, 2005.

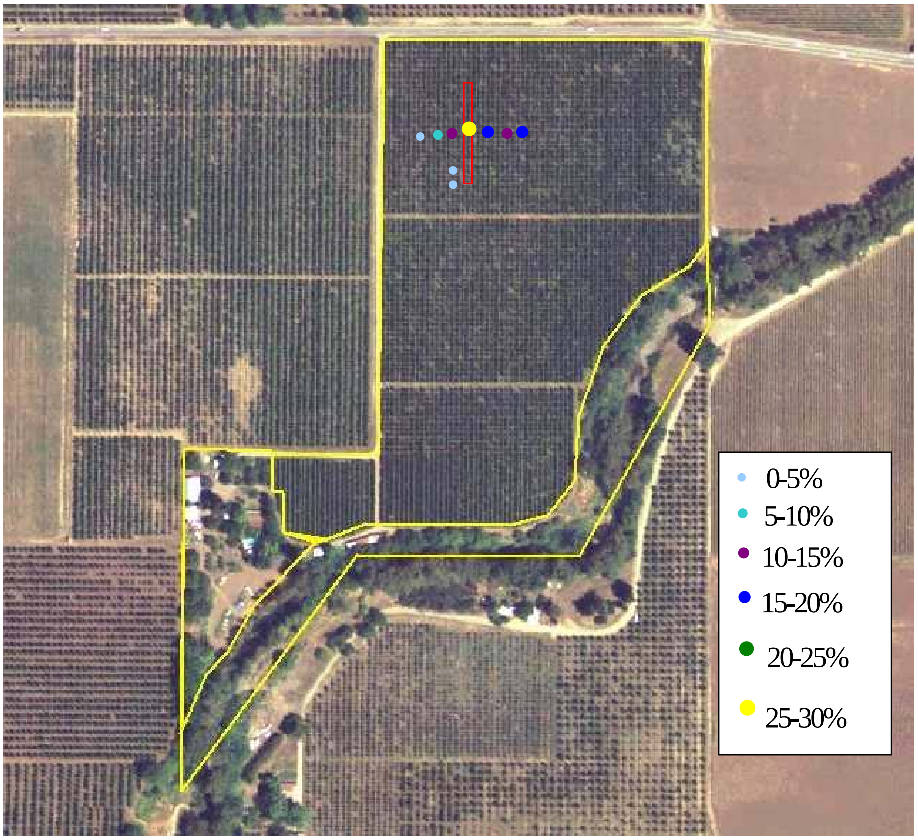

Figure 7: Damage gradient away from Consperse stink bug traps, Orchard #1, Kelseyville, Lake County 2005

Table 7: Amount of damage in relationship to distance from Consperse stink bug traps, Orchard #1, Kelseyville, Lake County 2005

No. Rows from Trap	Damage (%/200 fruit)
Trap Row	23, 25, 28.5
1-2	
East	20,23,7.5*,2.5*,15
West	14
*>8 trees south of traps	
3-4	
East	-----
West	8,7
4-5	
East	13
West	-----
6-7	
East	19.5
West	3.5
≥8	
East	-----
West	2.0 (edge row)