Project Number: 92-ZB3

Annual Report to the Almond Board of California, 1992.

Project Title: Synthesis and field study of new mating disruption blend for the peach twig borer, *Anarsia lineatella*

Project Leader: J. G. Millar, Department of Entomology, University of California, Riverside, CA 92521.

Collaborators: R.E. Rice, Department of Entomology, University of California, Davis, CA.

Objectives:

1) Synthesis and Field testing of a new compound as a peach twig borer (PTB) mating disruptant.

2) Survey the response of PTB host and geographic populations to different blends of the two major compounds of the pheromone, to determine whether the optimum formulation differs between regions or crops.

Materials and Methods

The test compound was synthesized in my laboratory at UC Riverside. Two different mating disruption dispensers were used. First, BASF white plastic double ampoule dispensers, containing standard pheromone blends for peach twig borer and oriental fruit moth, were kindly obtained for us by Pacific Biocontrol of Davis, CA. Each dispenser contained about 350 mg of PTB standard pheromone blend. Each dispenser was injected by hand with 35 microliters of test compound, and the needle hole was sealed with a hot-melt glue gun. Adulterated dispensers were then repackaged and shipped to Kearney Field Station for deployment. In total, 2,050 dispensers were loaded this way.

Second, test compound was sent to Consep Membranes (Bend, Oregon), who custom loaded 2,000 of their controlled release membrane dispensers with an 83:17 blend of their standard PTB pheromone:our test compound.

All dispensers were applied at a rate of 200 dispensers/acre, with the first set being applied at biofix (end of March, beginning of April). The plots were retreated approximately 3 months later.

Treatments consisted of an untreated check block, a block treated with the standard blend (BASF or Consep, respectively), and a block treated with the adulterated blend. The BASF dispensers were deployed in one 5-acre block, in Nonpareil almonds (S & J Farms, Pinedale, Madera Co., Fig. 1), while the Consep dispensers were deployed in 2-2.5 acre blocks, one block in Nonpareil, and the other in Butte hardshell almonds (Tom Dighiera, Carruthers, Fresno Co., Fig. 2).

Moth populations were monitored season-long in all blocks with pheromone-baited sticky traps (2 traps/block). Traps were counted twice weekly, with lures replaced every second week. Trap bottoms were renewed as required.

Dosage was assessed at harvest by random sampling of 1,000 nuts from the bins. Each nut was cracked out, and insect damage was recorded as hull damage or nut meat damage, and damage was categorized by insect species. In addition, in the block treated

with BASF dispensers, a midseason sample of green nuts was taken on June 24, and evaluated as above.

For the survey of the attractiveness of different pheromone blends for different PTB populations, six sites were used, one at Yakima, Washington (plums), three at Parlier, CA (plums, almonds, and nectarines) and two at Banning, CA (peaches). Rubber septa were loaded with a total load of 1 mg, at the following ratios of E5-decenyl acetate (E5-10:Ac) to E5-decenol (E5-10:OH): 100:0, 95:5, 80:20, 50:50, 20:80, 5:95, 0:100. Blank septa were included with each set as negative controls. Traps (replicated 4 times) were hung 6-7 feet high, in the north-east quadrant of trees, within the canopy. Traps were counted every 2-3 days, with a minimum of 4 count periods. Results were normalized and plotted as the percentage of the total of male moths caught per site, so that the results from different sites could be directly compared.

Results

Mating disruption trials

1) BASF dispensers, Nonpareil almonds, S & J Farms. (Table 1). In these blocks, midseason samples of 250 green nuts were taken. Total insect damage was 1.2, 3.6 and 8.0%, respectively, in the test treatment, the standard treatment, and the check blocks. Peach twig borer was responsible for all the damage in all blocks.

At harvest (1,000 nut samples, Table 2), damage in all blocks had increased to 10.9, 15.3, and 20.8% in the test treatment, standard treatment, and control blocks. Most of the damage in all blocks was from peach twig borer, with a small percentage due to navel orangeworm.

2) Consep dispensers, Nonpareil almonds, Carruthers. (Table 3). These blocks were sampled only at harvest (1,000 nuts). PTB damage was less overall than in the S & J Farms block, with 2.9, 7.0, and 11.8% damage in the test treatment, standard treatment, and control blocks, respectively. However, navel orangeworm damage was also considerable, at 13.8, 14.4, and 5.5% in test, standard, and check blocks. This data is interesting, as it has been suggested that navel orangeworm is a secondary pest which primarily infests nuts damaged by other species such as peach twig borer. However, our data indicate no correlation between the two insects, with the lowest amounts of orangeworm damage being found in the block with the highest amounts of PTB damage (the check block).

3) Consep dispensers, Butte hardshell almonds, Carruthers. (Table 4). Twig borer damage in the test treatment, standard treatment, and check block was limited entirely to hull damage, with 4.7, 5.1, and 6.4% hull damage in the test, standard and check blocks. More damage was caused by navel orangeworm, which accounted for 2.0, 2.7, and 1.0% nut meat damage, and considerably higher levels of hull damage.

Season-long monitoring of mating disrupted blocks

Pheromone-bated monitoring traps were maintained in all blocks from biofix at the end of March or early April, through to the end of October. In the untreated check blocks, trap captures reached as high as 500 moths per week per pair of traps during the peak of the flights. The blocks treated with either the standard blends or the test blends of pheromone had much decreased trap captures in the period up until harvest, but trap captures were not completely shut down (Figs. 3-5). In particular, traps in the standard and test treatment blocks at the S & J Ranch site (BASF dispensers, Fig. 3) and one of

the Carruthers sites (Consep dispensers, Fig. 4) caught some moths during the first flight, with lesser catches during the second and third flights. After harvest, when the pheromones had run out, moth trap captures in all blocks increased rapidly, with the moth catches in at least one of the Carruthers blocks equalling those of the check block by mid-September.

Attractiveness of different pheromone blends to different moth populations

Six different sites were used, five in California and one in Washington. The Washington site was considered crucial, as it had been previously reported that Washington populations of peach twig borer used a different blend of pheromones than California populations. However, this experiment was compromised by an error in labelling some of the different blend lures as they were being shipped to collaborators, and the error was not detected until after most of the field data had been collected. Fortunately, we were able to recover and analyze some of the lures which had been used. Analyses determined that two lures appeared to have been mislabelled (i.e., their labels had been exchanged). Furthermore, analysis determined that the same mistakes had been made with one of two spare sets of lures which had been kept in reserve. However, because we were able to recover and analyze only one of the six sets of lures used in the field tests, we cannot be absolutely sure of the veracity of the two potentially suspect blends in the remaining five data sets. Thus, the data shown in Fig. 6 is incomplete, and while it does indicate that the standard commercial blend of 80:20 E5-10:Ac : E5-10:OH is probably correct, the key data points for the Washington populations (the 100:0 and 0:100 blends) are missing. This experiment will be repeated correctly next year.

Summary

The test pheromone blend for peach twig borer again performed consistently, better than the standard commercial pheromone blend from two companies. This test material has now performed well in two years of testing. A third and final year of testing will be carried out next year, if possible, in 20 acres.

Secondary monitoring of treated and check blocks with pheromone traps revealed that during the first flight in April, trap catches were not completely shut down in the treated blocks. Trap shutdown appeared to improve over the season until harvest. After harvest, when the pheromone had run out, moth populations built to sizeable numbers in both treated and control blocks.

The survey of the attractiveness of various pheromone blends was inconclusive due to an error made in labelling the lures used. The experiment will be repeated in 1992.

Table 1

1992 FRUIT DAMAGE SUMMARY

	BASF Standard	BASF E-X	CHECK
Variety	Nonpareil/Carmel	Nonpareil/Carmel	Nonpareil/Carmel
Location	Madera County	Madera County	Madera County
Field	S &J Farms Ave. 10	S & J Farms Ave. 10	S & J Farms Ave. 10
Acres	5.0	5.0	5.0
Disruption Type	BASF PTB/OFM Std.	BASF PTB/OFM E-X	None
Treatment Date	4/2 & 6/30	4/2 & 6/30	
Green Nut Sample Date	6/24/92	6/24/92	6/24/92
Total Fruit Observed	250	250	250
Total Infested Fruit	9	3	20
% Total Insect Damage	3.60	1.20	8.00

DAMAGE BY INSECT		TREATMENT	CHECK	CHECK
OFM	**#Fruit**	0	0	0
	% Damage	0.00	0.00	0.00
OLR	**#Fruit**	0	0	0
	% Damage	0.00	0.00	0.00
PTB	**#Fruit**	9	3	20
	% Damage	3.60	1.20	8.00
CM	**#Fruit**	0	0	0
	% Damage	0.00	0.00	0.00
Katydid	**#Fruit**	0	0	0
	% Damage	0.00	0.00	0.00

Table 2

1992 FRUIT DAMAGE SUMMARY

	BASF Standard	BASF E-X	CHECK
Variety	Nonpareil	Nonpareil	Nonpareil
Location	Madera County	Madera County	Madera County
Field	S &J Farms Ave. 10	S & J Farms Ave. 10	S & J Farms Ave. 10
Acres	5.0	5.0	5.0
Disruption Type	BASF PTB/OFM Std.	BASF PTB/OFM E-X	None
PTB Treatment Date	4/2 & 6/30	4/2 & 6/30	
Harvest Date	7/29/92	7/29/92	7/29/92
Total Nuts Observed	1000	1000	1000
Total Infested Nuts	153	109	208
% Total Insect Damage	15.30	10.90	20.80

DAMAGE BY INSECT		Hulls/Meats/Total	Hulls/Meats/Total	Hulls/Meats/Total
PTB	#Nuts	105/29/134	76/22/98	163/35/198
	% Damage	10.5/2.9/13.4	7.6/2.2/9.8	16.3/3.5/19.8
NOW	#Nuts	1/16/17	0/10/10	0/8/8
	% Damage	0.1/1.6/1.7	0/1.0/1.0	0/0.8/0.8
Raisin Moth	#Nuts	2/0/2	0/0/0	2/0/2
	% Damage	0.2/0/0.2	0/0/0	0.2/0/0.2
Ants	#Nuts	0/0/0	0/1/1	0/0/0
	% Damage	0/0/0	0/0.1/0.1	0/0/0

Table 3

1992 FRUIT DAMAGE SUMMARY

	Consep Standard	Consep E-X	CHECK
Variety	Nonpareil	Nonpareil	Nonpareil
Location	Caruthers, Fresno Co.	Caruthers, Fresno Co.	Caruthers, Fresno Co.
Field	Block I West	Block I West	Block I West
Acres	2.5	2.5	2.5
Disruption Type	Consep Standard	Consep E-X	None
Treatment Date	4/1 & 6/2	4/1 & 6/2	
Harvest Sample Date	8/5/92	8/5/92	8/5/92
Total Nuts Observed	1000	1000	1000

DAMAGE BY INSECT		Consep Standard	Consep E-X	CHECK
PTB	Hull Damage	65	28	103
	Meat Damage	5	1	15
	Total Damage	70	29	118
	% Meat Damage	0.50	0.10	1.50
NOW	Hull Damage	82	102	27
	Meat Damage	62	36	28
	Total Damage	144	138	55
	% Meat Damage	6.20	3.60	2.80
Raisin M.	Hull Damage	2	4	8
	Meat Damage	0	0	0
	Total Damage	2	4	8
	% Meat Damage Damage	0.00	0.00	0.00

Table 4

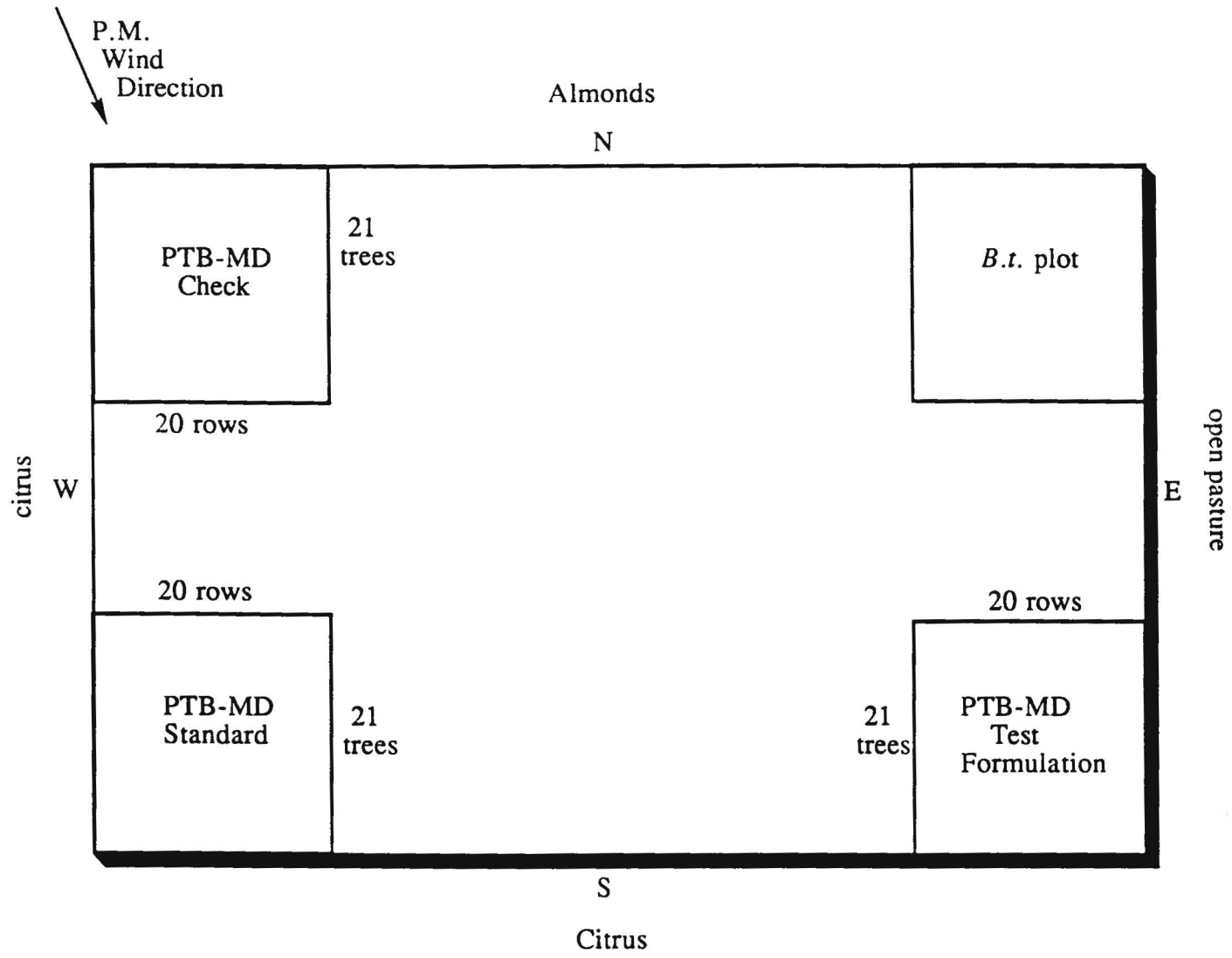
1992 FRUIT DAMAGE SUMMARY

	Consep Standard	Consep E-X	CHECK
Almond Variety	Butte(hard shell)	Butte(hard shell)	Butte(hard shell)
Location	Caruthers, Fresno Co.	Caruthers, Fresno Co.	Caruthers, Fresno Co.
Field	Block 2 East	Block 2 East	Block 2 East
Acres	2.5	2.5	2.5
Disruption Type	Consep Standard	Consep E-X	None
Treatment Date	4/1 & 6/2	4/1 & 6/2	
Harvest Sample Date	8/27/92	8/27/92	8/27/92
Total Nuts Observed	1000	1000	1000

DAMAGE BY INSECT		Consep Standard	Consep E-X	CHECK
PTB	Hull Damage	51	47	64
	Meat Damage	0	0	0
	Total Damage	51	47	64
	% Meat Damage	0.00	0.00	0.00
NOW	Hull Damage	92	49	60
	Meat Damage	27	20	10
	Total Damage	119	69	70
	% Meat Damage	2.70	2.00	1.00
Raisin Moth	Hull Damage	0	0	0
	Meat Damage	0	0	0
	Total Damage	0	0	0
	% Meat Damage Damage	0.00	0.00	0.00

Figure 1

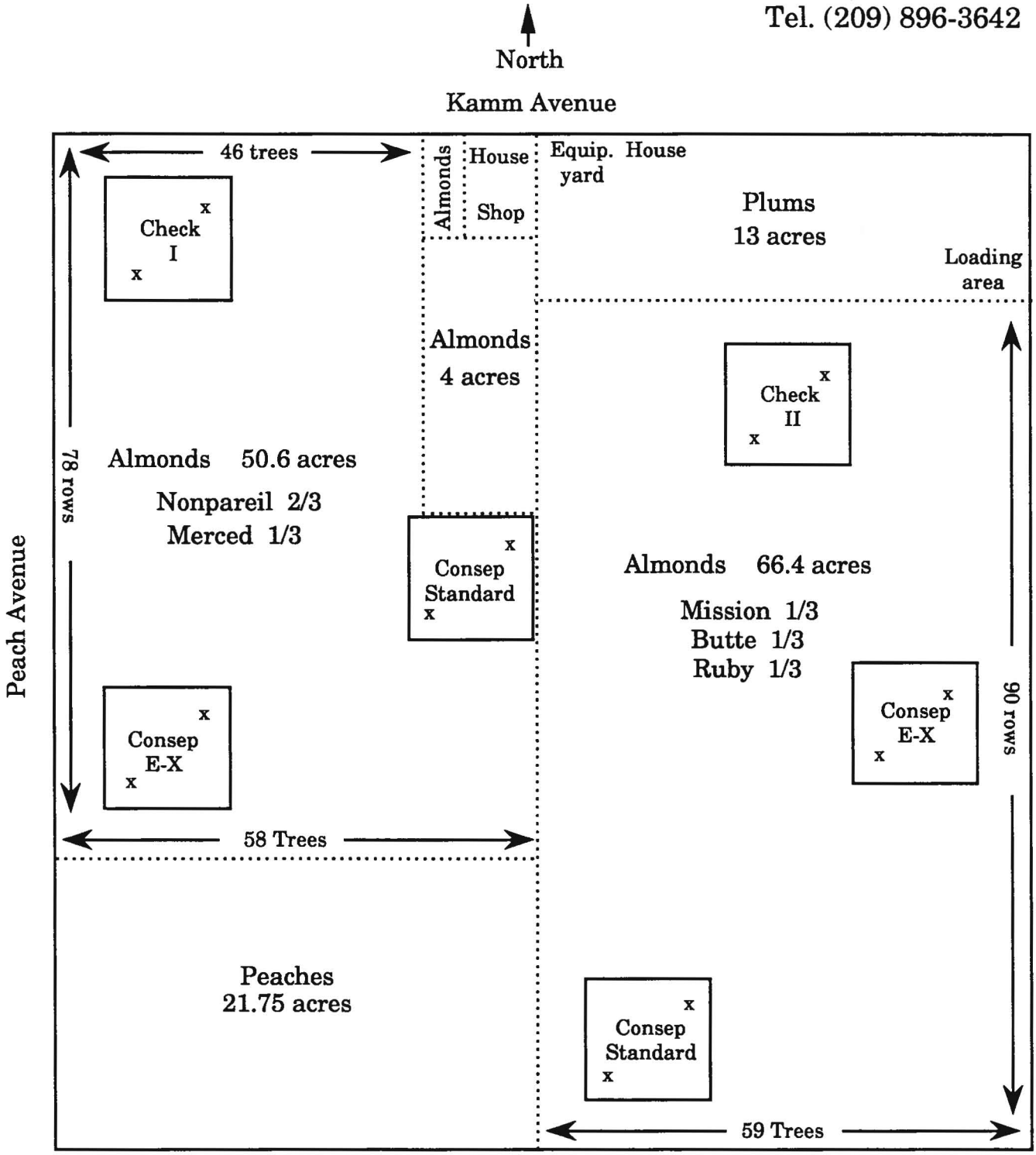
S & J Ranch Inc.
Pinedale (Avenue 10)



Spacing: 24' X 22'

Figure 2

Tom Dighiera
4225 E. Kamm Ave.
Selma, CA
Tel. (209) 896-3642



Tree Spacing = 22' x 25' (25' between rows)
Trees per Acre = 80
Scale = 1/4" = 100'

2.5 ac. = 200 trees @ 200 dispensers per acre.

15T x 13R = 2.46 ac. = 1.0 ha.

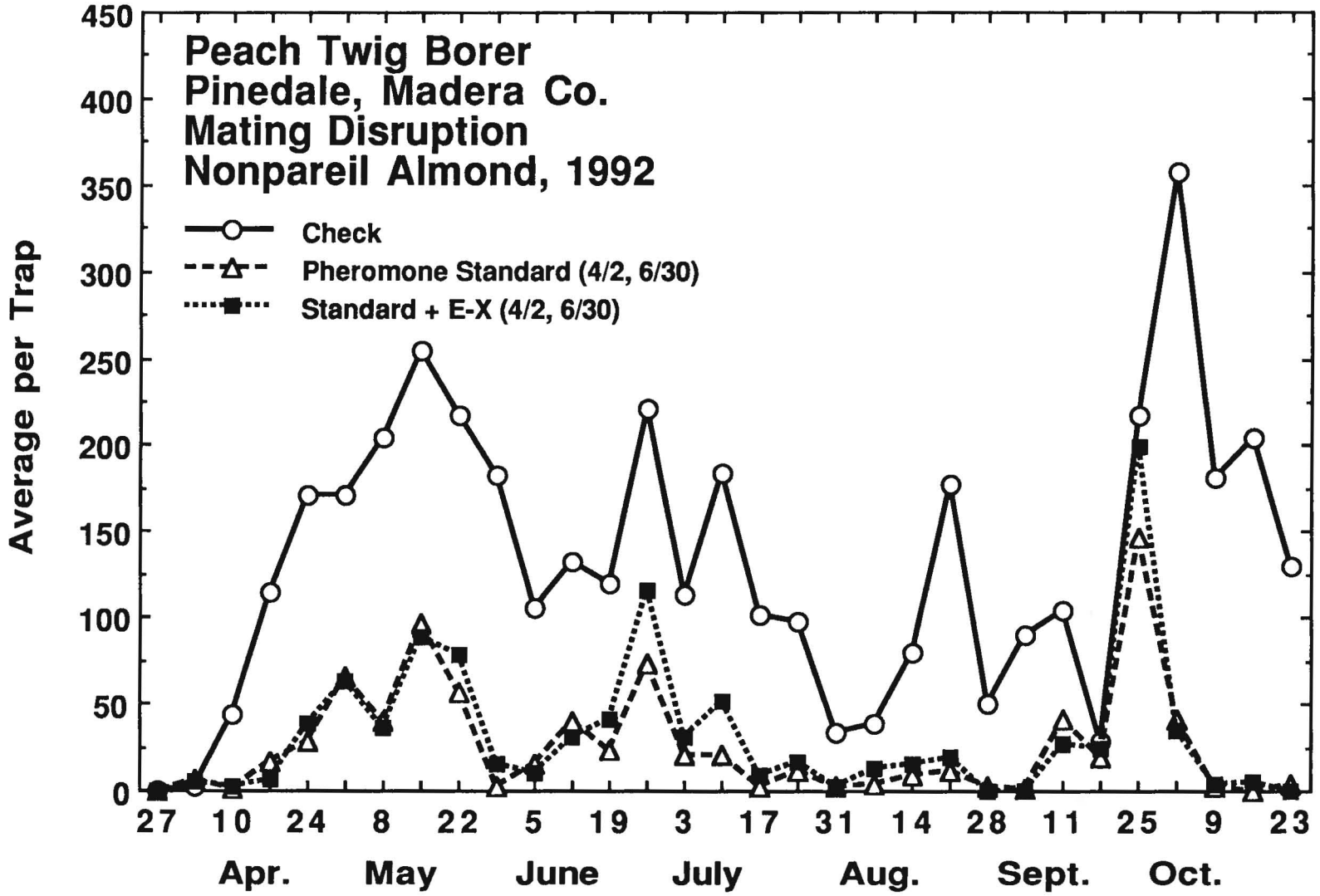

Peach Twig Borer
Pinedale, Madera Co.
Mating Disruption
Nonpareil Almond, 1992
Check
Pheromone Standard (4/2, 6/30)
Standard + E-X (4/2, 6/30)
Average per Trap
450
400
350
300
250
200
150
100
50
0
27
10
24
8
22
5
19
3
17
31
14
28
11
25
9
23
Apr.
May
June
July
Aug.
Sept.
Oct.

Figure 3

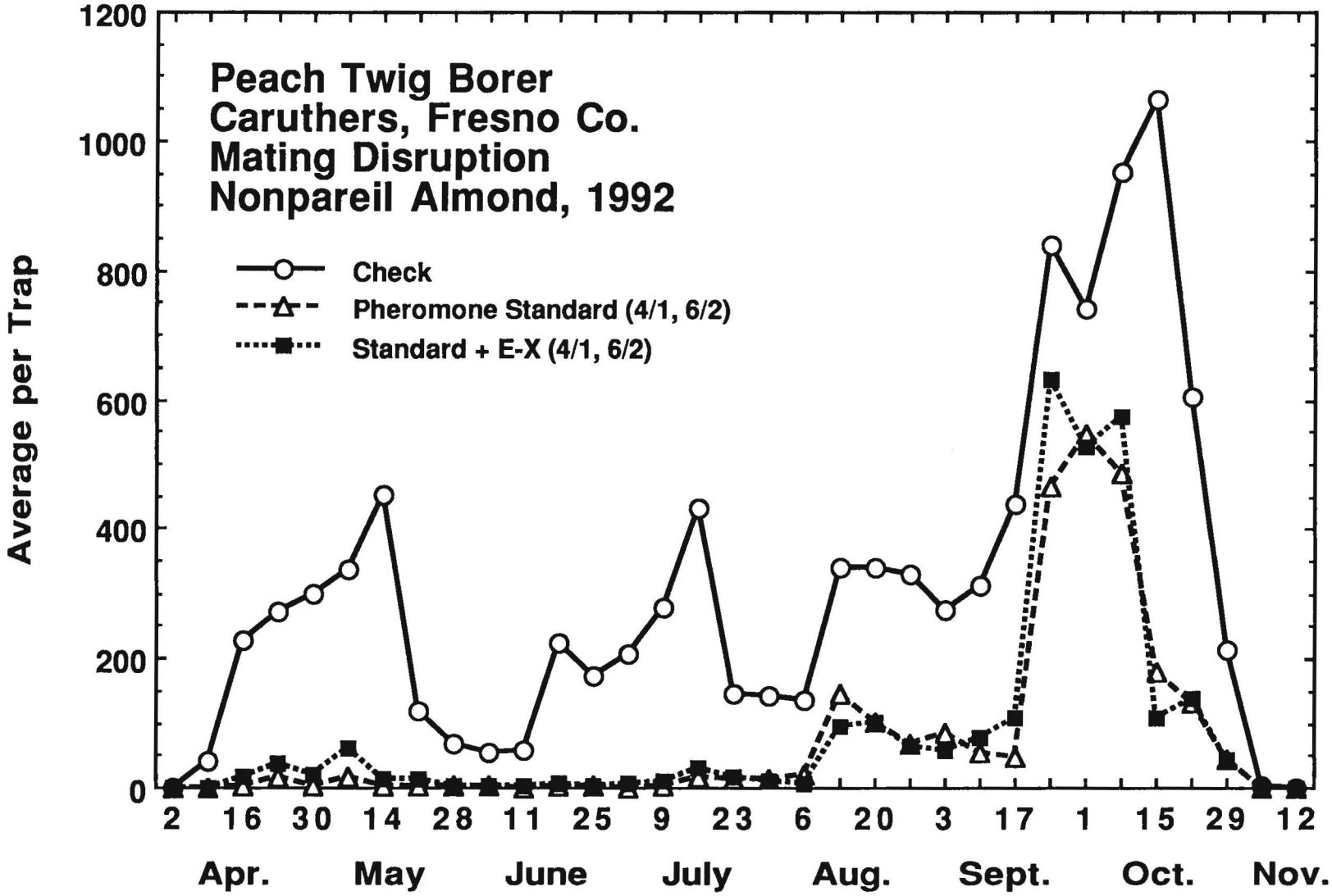

Peach Twig Borer
Caruthers, Fresno Co.
Mating Disruption
Nonpareil Almond, 1992
Check
Pheromone Standard (4/1, 6/2)
Standard + E-X (4/1, 6/2)
Average per Trap
1200
1000
800
600
400
200
0
2 16 30 14 28 11 25 9 23 6 20 3 17 1 15 29 12
Apr. May June July Aug. Sept. Oct. Nov.

Figure 4

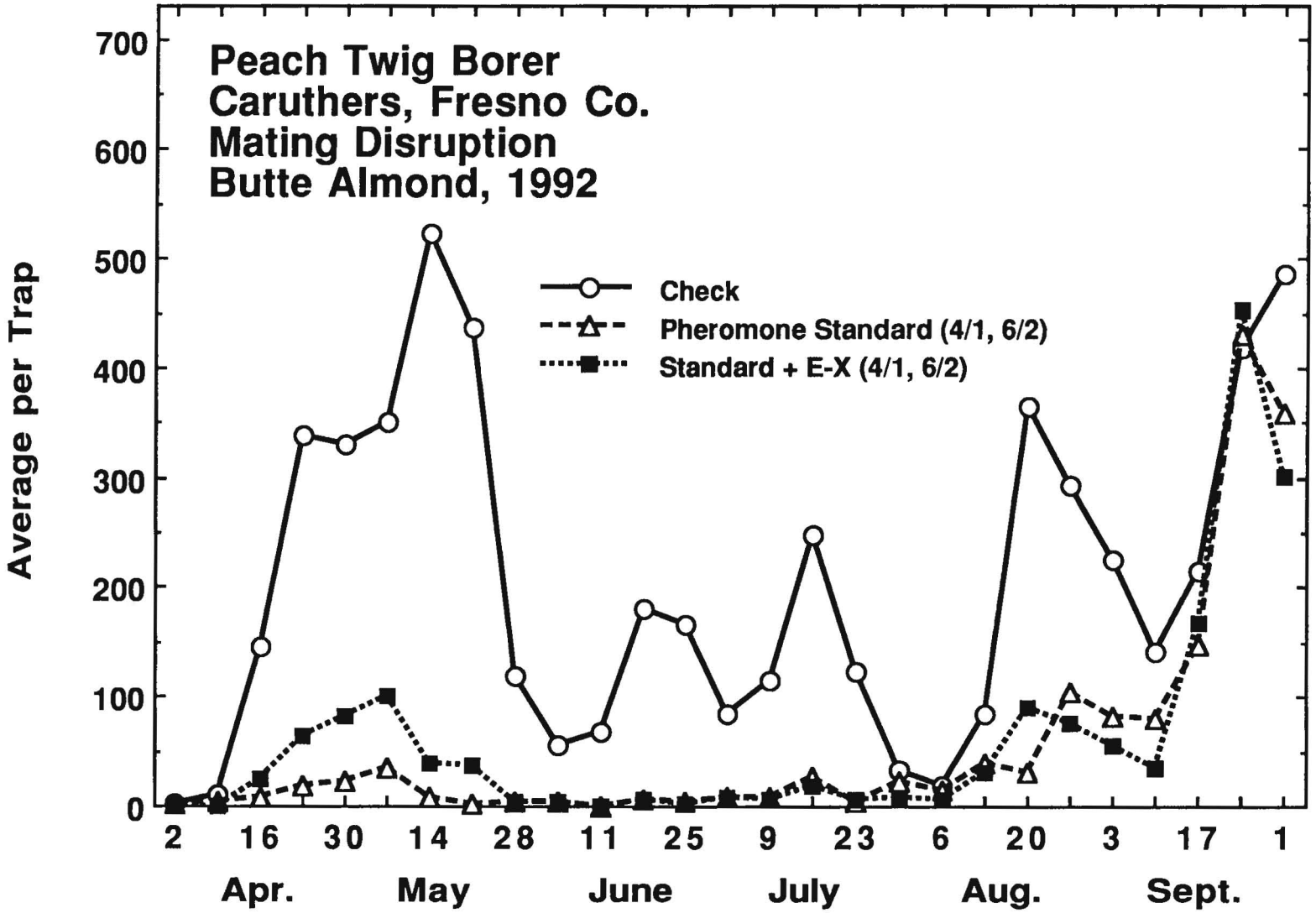

Peach Twig Borer
Caruthers, Fresno Co.
Mating Disruption
Butte Almond, 1992
Average per Trap
700
600
500
400
300
200
100
0
Check
Pheromone Standard (4/1, 6/2)
Standard + E-X (4/1, 6/2)
2
16
30
14
28
11
25
9
23
6
20
3
17
1
Apr.
May
June
July
Aug.
Sept.

Figure 5