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1979 Annual Report

California Almond Board Project 79-H3

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Project: I. Identification of navel orangeworm oviposition attractants

II. Control of navel orangeworm and peach twig borer

I. Oviposition attractant research

A. Objectives: 1) to extract, isolate and identify the chemicals in almonds and wheat bran that induce oviposition by NOW females; 2) to simplify the egg trap and monitoring techniques for NOW using a synthetic chemical as the attractant source; and 3) to attempt using the oviposition attractants as a control technique for NOW.

B. Methods and Procedures: This portion of the project was again coordinated closely with Dr. W. E. Jennings and his research group at U.C. Davis. As in previous work in this cooperative project, the chemical extracts, identifications, etc. were done at Davis, and greenhouse and laboratory bioassays were conducted at Parlier.

Bioassays of candidate attractants were carried out primarily in the greenhouse cage, using free-flying moths and the revolving wheel olfactometer described in previous reports.

C. Results and Discussion: A total of 233 materials were screened in 175 separate bioassays during 1979. Numbers of eggs collected on traps were consistently highest using ether extracts of almonds, bran, or NOW frass and lowest on blank or check traps. However, numbers of eggs collected on traps containing the various isolated extracts were often quite variable and erratic, leading to considerable difficulty in interpreting the bioassay data. In general, the results were considered only moderately successful, due in large part to the short-comings of the bioassay techniques. The conclusions drawn from these bioassays will be considered in detail in the report from Dr. Jennings.

Observations were also made of moths responding to attractants in the greenhouse bioassay. Female moths became active in late November at approximately 1700 hrs. (sunset at 1644) with heavy activity occurring from 1730 on. All of the moths observed approached the traps from the bottom. Their flight was a weaving horizontal movement in conjunction with occasional short vertical rises which became less pronounced as the moth approached the trap. Some moths would hover close to the trap before landing while others would land immediately. Moths attracted to a specific trap could be identified approximately 16 inches away from the trap. Beyond that point it was difficult to separate them from females in random flight. Many female NOW, though not attracted to a trap, appeared to be flying in a slow random "search" type pattern. Occasionally moths would return to a trap several times, ovipositing each time while others would remain on the traps for as long as 20 minutes.

Moths would often follow a trap as it rotated on the olfactometer. At times a female NOW would be attracted to a trap, fly off and then return directly to that trap even though it had rotated some distance. Once the moths landed on the trap oviposition began immediately. The females were stimulated to oviposit on preferred sites by tactile senses located on the ovipositor.

Attraction to the traps is related to the strength of the attractant. In one test, the standard NOW bran bait was most attractive followed by an ether extract of infested almonds, almond oil, and the blank trap. As many as five moths were observed on the standard bait trap at one time during this test. Occasionally a moth appeared to be attracted to the blank trap, but after hovering near the trap, it would fly off. In general, it appears that the weaker the attractant, the less time the female moth spends ovipositing on the trap.

II. Control of navel orangeworm and peach twig borer.

A. Objectives: To re-evaluate several approaches to control of navel orangeworm, and to determine the correllation between optimum timing for control of NOW and for peach twig borer.

B. Methods and Procedures: Chemical controls were applied for NOW and PTB at several different timings in a mature almond orchard near Caruthers, Fresno County. The orchard is ca. 15 yrs. old and is irrigated by solid set sprinklers at ca. 10 day intervals. Chemicals were applied by the grower as concentrate sprays at 80 gpa. Each plot was a rectangular 16 acre block and was monitored with 10 NOW egg traps and 2 PTB pheromone traps. Traps were counted and serviced twice weekly. Nut samples were taken at harvest (Sept. 6) at 10 sites from the center of each block and were hand-cracked to determine percent infestation from NOW and PTB. Each nut sample was comprised of 250 sound nuts randomly selected from ca. 1000 field collected nuts.

All blocks received a thorough post-harvest (hand-poling) sanitation program during the winter to remove and destroy mummy nuts and overwintering NOW larvae. The chemical treatments superimposed on the sanitation program, and evaluated in this trial were:

1. Standard copper, and oil (6 gpa), applied 12/20/78.
2. Copper, oil, and diazinon (2.0 lbs. a.i./ac.), applied 12/21/78.
3. Copper, oil, and diazinon (Trtmnt. 2) 12/21/78, plus Guthion 50W (2.0 lbs. a.i./ac.) applied 5/14/79.
4. Copper plus oil only 12/20/78; plus Guthion 5/18/79.
5. Trtmnt. 4, plus Imidan 50W (2.0 lbs. a.i./ac.) applied 7/17/79 (hullsplit).

Navel orangeworm eggs laid on egg traps in these plots began hatching on April 29, 1979; the first PTB strikes were observed May 6-7, 1979. European red mites were not a problem in the orchard due to the dormant oil application; other tetranychid mites did not develop to economic levels during the year. Harvest in these plots (Sept. 6 start) was ca. 3 weeks earlier than in 1978.

C. Results and Discussion: In the plot treated with only copper and oil on December 20, combined NOW and PTB damage reached 9.1 percent (Table 1). Without the prior removal of the mummy nuts from the trees, this damage level would have been much greater; at least 15 percent and possibly higher.

The standard dormant spray comprised of copper, oil, and phosphate insecticide applied on Dec. 21, significantly reduced both NOW and PTB infestations, to a combined total of only 3.0 percent. The reduction in PTB damage is attributed to the addition of diazinon in the dormant spray. Since it is known that NOW females prefer to oviposit on infested nuts, the associated reduction in NOW damage in this treatment is believed due to fewer nuts infested by PTB, thus tending to concentrate total NOW oviposition and egg distribution on those (fewer) nuts attacked earlier by PTB. There is no evidence to suggest or imply that standard dormant sprays alone cause appreciable direct mortality to NOW larvae in mummy nuts.

The third plot received the standard dormant spray on December 21, plus an additional spray of azinphosmethyl on May 14. This date was ca. 2 weeks after first NOW egg hatch and 1 week after first PTB egg hatch and strikes were observed. The combined effect of both the dormant and May sprays reduced the NOW and PTB infestation even more, to a total of only 0.6 percent.

The fourth and fifth plots (Trtmnts. 4 and 5, Table 1) showed NOW and PTB control at excellent levels due to the combined effect of sanitation and the optimally timed May spray. As in previous tests, the addition of a hullsplit spray (Trtmnt. 5) did not improve the level of NOW control over the single May treatment.

These data confirm the benefits realized from a standard dormant spray program and from properly timed May sprays for NOW and PTB control when used in conjunction with orchard sanitation and early harvest. Although the single insecticide application in May provided good control of both NOW and PTB, this technique for control of the lepidopterous pests should be approached with caution. The success of this method does not imply that dormant oil sprays could also be deleted, particularly if an orchard has a history of brown almond mites, European red mites, and San Jose scale.

The effects of the dormant and May sprays on NOW oviposition and PTB moth flights are shown in Figs. 1 and 2. Surprisingly, neither the check plot (Trtmnt. 1) nor the dormant spray plot (Trtmnt. 2) had as many eggs as did Trtmnt. 4 (May Guthion) during the early season.

However, egg deposition in plot 4 dropped sharply following the May 18 spray to levels approximating those in the other two plots. The effects of different sprays on PTB moth populations were somewhat easier to identify. The moth flight in plot 1, with no dormant insecticide spray, was of much longer duration and greater magnitude than plot 2 with Diazinon in the dormant spray. This suppressant effect of the dormant insecticide on PTB in plot 2 was evident throughout the season, particularly in terms of peak numbers of moths in each flight. The effect of the May spray of Guthion was even more evident, with virtually no PTB adult collections through the major infestation period of green nuts in late June-early July, and much lower collections into hullsplit during August. However, it should be noted that PTB populations were beginning a strong recovery during September and October, and demonstrates the need for an annual control program (normally a dormant <u>or</u> a May spray) for PTB.

Table 1. Control of NOW and PTB in almonds, 1979 1/

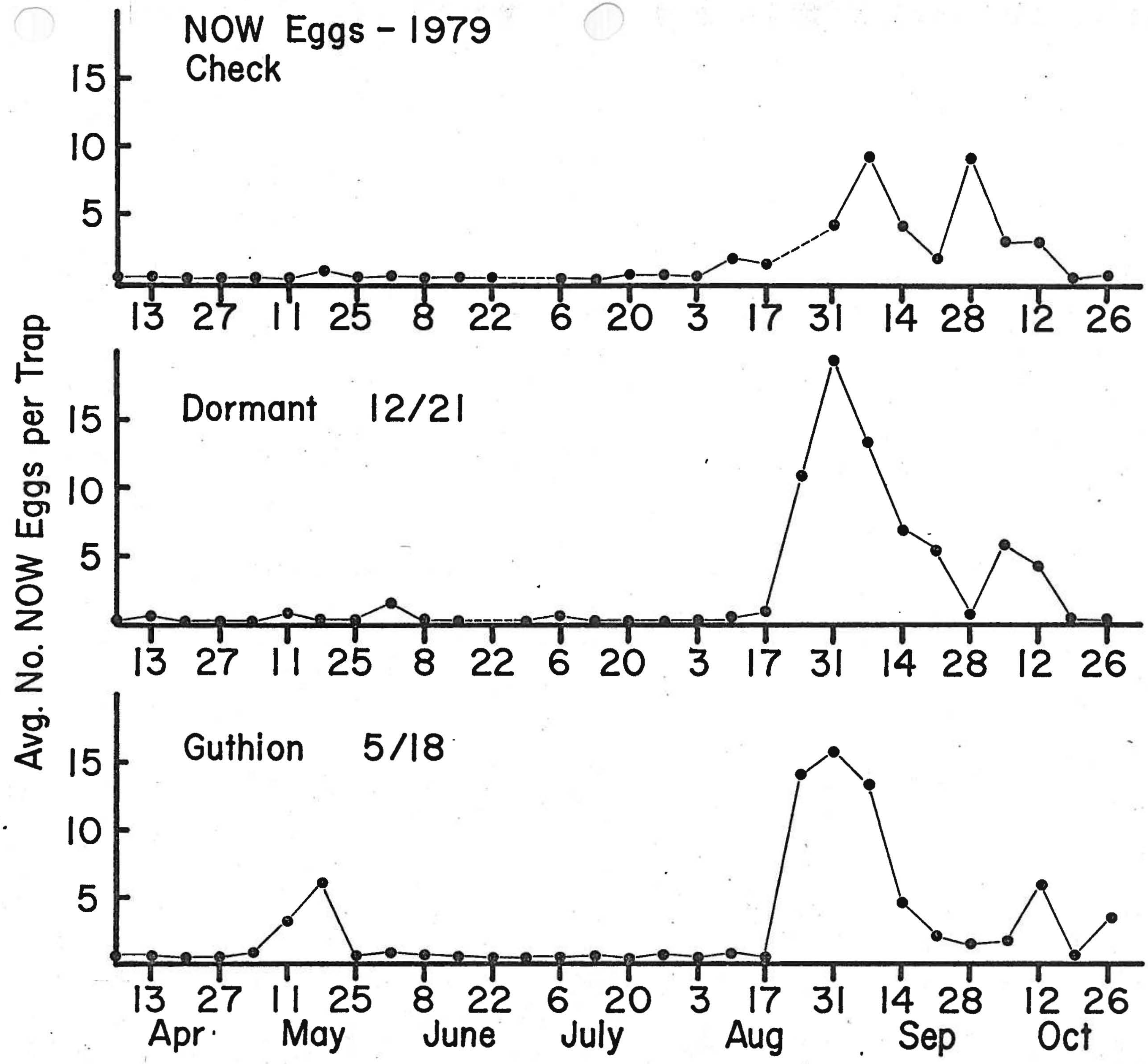
Treatment	Percent damaged meats 3/ NOW	PTB 2/	Total
Cu + oil 12/20	5.6 a	3.5 a	9.1 a
Cu, oil + Diazinon 12/21	2.3 b	0.7 b	3.0 b
Dormant 12/21 + Guthion 5/14	0.5 c	0.1 c	0.6 c
Cu, oil + Guthion 5/17	0.3 c	0 c	0.3 c
Cu, oil + Guthion 5/17 + Imidan 7/17	0.3 c	0 c	0.3 c

1/ Caruthers, Calif.

2/ First PTB eggs hatching May 6-7.

3/ Average from ten 250-nut samples per treatment Sept. 6.

P = .05.



NOW Eggs - 1979
Check
Dormant 12/21
Guthion 5/18
Avg. No. NOW Eggs per Trap
5
10
15
13 27 11 25 8 22 6 20 3 17 31 14 28 12 26
Apr
May
June
July
Aug
Sep
Oct

FIG. 1

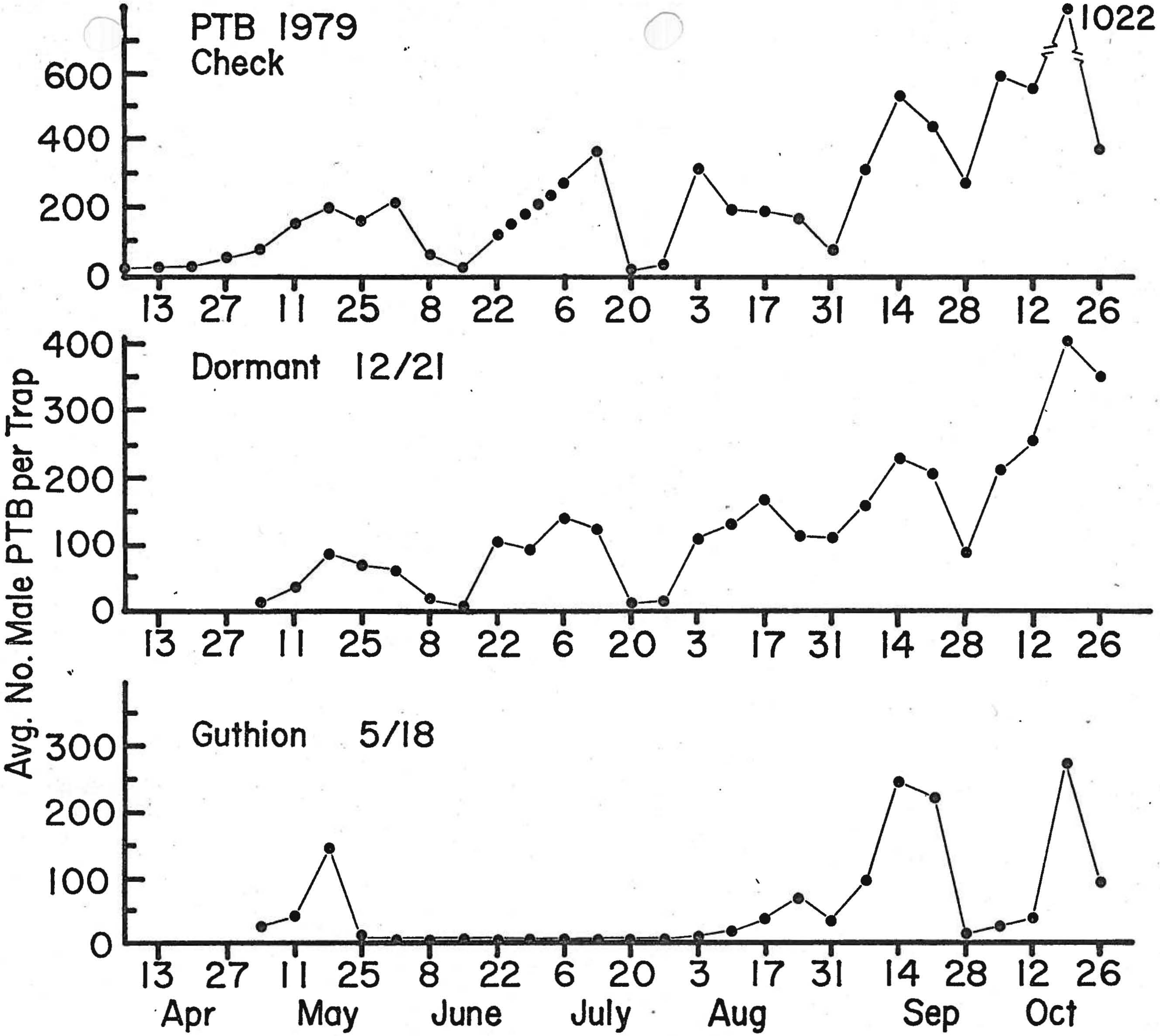

PTB 1979
Check
1022
600
400
200
0
Dormant 12/21
400
300
200
100
0
Guthion 5/18
300
200
100
0
Avg. No. Male PTB per Trap
13 27 11 25 8 22 6 20 3 17 31 14 28 12 26
Apr
May
June
July
Aug
Sep
Oct

FIG. 2

Addendum

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Dormant or May sprays of Imidan or Diazinon at 0.5 lb. a.i./100 gals. and Ambush at 0.05 and 0.10 lb. a.i./100 gals. applied to young almonds provided good to excellent control of peach twig borer in terminals (Table 2). The addition of 1.0 or 2.0 pts. of Buffer-X/100 gals. appeared to improve the performance of Imidan. Mite samples at 27 and 41 days post-treatment (Tables 3 and 4) showed no differences in European red mite counts between treatments; mite populations increased dramatically in the Ambush treatments after 63 days, but not in the other treatments.

Table 2. Control of peach twig borer with dormant and May sprays in almonds.

Treatment	A.I./ 100 gals.	No. PTB strikes per treatment	
		Dormant 1/	May 2/
Ambush 2E	.05 lb.	2	0
Ambush 2E	.10 lb.	0	0
Diazinon 50W	.5 lb.	4	1
Imidan 50W	.5 lb.	16	5
Imidan + 1 pt. Bu-X	.5 lb.	5	0
Imidan + 2 pts. Bu-X	.5 lb.	-	0
Check	-	87	139

1/ Sprayed 2/5/79; four 9-tree reps; all treatments w/ 1.5% oil. Counted 4/12/79.

2/ Sprayed 5/10/79; four 4-tree reps. Counted 5/31/79.

Table 3. Effect of PTB May sprays on European red mite (motiles) in almonds.

Treatment	A.I./ 100 gals.	ERM/100 leaves - post-treatment 1/ 27 days	41 days	63 days
Check	0	10	27	26
Ambush 2E	.05 lb.	6	22	86
Ambush 2E	.10 lb.	10	26	185
Diazinon 50W	.5 lb.	4	17	8
Imidan 50W	.5 lb.	6	13	19
Imidan + 1 pt. Bu-X	.5 lb.	10	17	45
Imidan + 2 pt. Bu-X	.5 lb.	0	27	10

1/ Sprayed 5/10/79, handgun @ 400 gpa; four 4-tree reps/treatment.

Table 4. Effect of PTB May sprays on European red mite (eggs) in almonds.

Treatment	A.I./ 100 gals.	ERM/100 leaves - post-treatment 1/ 27 days	41 days	63 days
Check	0	120	121	135
Ambush 2E	.05 lb.	62	218	846
Ambush 2E	.10 lb.	102	334	584
Diazinon 50W	.5 lb.	122	104	204
Imidan 50W	.5 lb.	92	133	160
Imidan + 1 pt. Bu-X	.5 lb.	202	113	158
Imidan + 2 pt. Bu-X	.5 lb.	34	83	134

1/ Sprayed 5/10/79, handgun @ 400 gpa; four 4-tree reps/treatment.