

## First Progress Report for a "Monitoring — Early Warning Project" for *Amorbia* and the O. Looper, Insect Pests of California Avocado and Citrus

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### Abstract

*Amorbia*, *Amorbia cuneana* (Walsingham), and the Omnivorous Looper, *Sabulodes aegrotata* (Guenee), are sporadic pests of avocados in California. Recently both of these pests have also been found on citrus in the San Joaquin Valley in large enough numbers to warrant treatments. Two pheromones have been developed for *Amorbia* because our research has shown that two populations of this pest exist which use different pheromones. A Monitoring-Early Warning Project for these pests has been established in major avocado and citrus growing areas of California. There are 33 trapping (monitoring) sites covering San Diego, Riverside, Orange, Ventura, Santa Barbara, San Luis Obispo, Kern, Tulare, and Fresno counties. This project has been successfully operated since early 1987 and will continue for an additional two years, until the three pheromones are commercially available. One Looper trap and one or both *Amorbia* traps are being operated at each site. Cooperators check the traps and report the counts at weekly intervals to local farm advisors who make this information available by telephone or newsletter to assist growers and pest management professionals in timing releases of *Trichogramma platneri* wasps for control of these pests. In general, Looper catches were highest in January to late March, late April through early June, during July, and again from September through October. *Amorbia* activity tended to be highest from January through April, late May through June, and in September through October. Highest *Amorbia* moth catches were obtained in the San Joaquin Valley.

For years, two moth pests of concern to avocado growers have been the Western Avocado Leafroller, *Amorbia cuneana* (Walsingham), better known as *Amorbia*, and the Omnivorous Looper, *Sabulodes aegrotata* (Guenee), henceforth referred to as O. Looper (Ebeling 1959). Even though both pests are usually kept under adequate control by a complex of naturally occurring parasites, predators, and pathogens, occasional outbreaks occur which can cause considerable economic losses. Recently, populations of *Amorbia* large enough to warrant treatments have been found on citrus in the San Joaquin Valley. Both pests feed on fruit and foliage of these crops. The O. Looper in

particular can completely defoliate avocado trees which results in severe sunburning of fruit and tender twigs. This often leaves fruit unsalable and kills twigs, rendering them unable to produce fruit or leaves.

Since 1979, the California Avocado Commission has intermittently funded integrated pest management (IPM) research on avocado insect and mite pests. Various control measures for these pests have been investigated, including the use of the egg parasite, *Trichogramma platneri* (Nagakatti), against *Amorbia* and *O. Looper* (Oatman and Plainer 1985). This tiny wasp stings and kills the eggs of both moth pests; thus, larvae are prevented from hatching to damage crops. Dr. Oatman, University of California, Riverside, has *experimentally* shown these wasps to be effective against both pests if they are released at precisely the time when the pests are flying, mating, and laying eggs. If released at any other time, the wasps will most likely be wasted.

To gain knowledge of when moths are flying, a monitoring device or tool, such as a blacklight trap or pheromone trap, must be used. *T. platneri* should be released when one of these traps indicate moth flight activity is at or approaching a peak. Blacklight traps are inconvenient to operate because they require a source of electricity in or near the grove in which monitoring is being done. They also capture insects other than the targeted species. Sorting through blacklight catches for the desired species is difficult, time consuming, and expensive.

Pheromone traps, on the other hand, eliminate these difficulties because they are baited with a synthetic sex pheromone. Sex pheromones are chemicals which one organism emits to attract others of the same species for the purpose of mating. In insects, females usually emit pheromones to attract males.

These chemicals are very species specific, so that when used in traps as lures, the great majority of insects caught will be only of the desired species.

Development of a pheromone for *Amorbia* was initiated in 1978. We collected *Amorbia* females from avocado groves in Orange County and shipped them to the USDA-ARS Laboratory, Yakima, Washington, where pheromone chemist, Dr. Les McDonough, identified the pheromone from excised sex pheromone glands of female moths. This pheromone was found to consist of two components [(E,Z) and (E, E) tetradecadien -1-ol acetates] in a 1:1 ratio (McDonough *et al.* 1982).

Dr. McDonough synthesized the pheromone and provided us with samples to field test in avocado and citrus growing areas of California. First, we demonstrated its effectiveness as a lure under field conditions. Subsequently, we conducted tests which provided information concerning optimal pheromone effectiveness. These included tests for the most effective pheromone dosage, the most effective dispenser, most effective trap design, optimal trap height above the ground, among others (Hoffmann *et d.* 1983).

While these tests were in progress, we continued to operate blacklight traps in southern California avocado groves to determine the times of year when *Amorbia* and *O. Looper* moths are most likely to fly. We found that two to three flights of *Amorbia* and three to four flights of *O. Looper* occurred per year at most locations in the period from 1980 through 1982. Further development of the *Amorbia* pheromone allowed us to augment the blacklight traps with traps baited with the *Amorbia* pheromone. These traps proved

effective in all areas tested except in Santa Barbara and San Diego Counties, even though nearby blacklight traps were attracting large numbers of *Amorbia* moths.

To determine the cause of this disparity, we collected *Amorbia* females from Santa Barbara and San Diego Counties and sent them to Dr. McDonough for analysis of their pheromones. Analysis showed them to contain the same two components, but in a 9:1 ratio instead of the 1:1 ratio of the Orange County females.

We later compared several different component ratios of synthesized pheromones as lures in traps in Santa Barbara and San Diego Counties. In both locations, we found the 9:1 ratio to be most attractive. Thus, two different pheromones now exist for *Amorbia*, the 1:1 or "low ratio" pheromone and the 9:1 or "high ratio" pheromone (Bailey *et al.* 1986).

Subsequently, the *O. Looper* pheromone was identified as 6, 9 nonadecadiene by Dr. McDonough, synthesized, and partially field tested in California (McDonough *et al.* 1986). Although we still have a half dozen field studies to complete before the *O. Looper* and *Amorbia* pheromones can be manufactured commercially, we felt enough data had been collected to set up an experimental monitoring program in areas of California where avocados and citrus are grown.

We decided to set this up as a three year project and call it the Monitoring-Early Warning Project. This program involved the establishment of 33 monitoring sites in nine avocado and citrus growing counties. At each site, cooperators operate an *O. Looper* trap and one or both kinds of *Amorbia* traps. In a particular area where only one kind of *Amorbia* trap is being operated, we had evidence from earlier studies that the other type is ineffective in that area. Cooperators check the traps on a weekly basis and mail or phone the trap counts to a local farm advisor's office. The farm advisor can then provide moth catch numbers by phone or newsletter to anyone requesting them.

### **Purpose of This Project**

The purpose of this project is several fold:

1. To determine which *Amorbia* population is predominant at each site monitored.
2. To determine the number of generations of both *Amorbia* species and the *O. Looper* at each site monitored and when they occur.
3. To detect differences or similarities between populations of moths occupying avocado and citrus groves.
4. To demonstrate how an effective monitoring system for these moths is operated.
5. To provide moth catch numbers to growers and pest management professionals, thus providing an early warning to growers as to whether or not it is time to order and release *T. platneri* wasps.
- 6.

### **Materials and Methods**

We divided the areas to be monitored as follows:

**Region 1    County    Total 15 Trapping Sites**

1. Orange\* Blair Bailey & Kirk Olsen
2. Riverside
3. San Diego

**Region 2 County Total 10 Trapping Sites**

1. Ventura\* Phil Phillips & Steve Griffin
2. Santa Barbara
3. San Luis Obispo

**Region 3 County Total 8 Trapping Sites**

1. Tulare\* Neil O'Connell
2. Kern
3. Fresno

*\*Indicates Regional Headquarters for monitoring & dissemination of moth flight data.*

At present, monitoring sites in Regions 1 & 2 are in avocado groves, while in Region 3 they are in both avocado and citrus groves.

**Cooperating Personnel on this Project During 1987 Included:**

1. Nine U.C. people, including 6 farm advisors, 2 area IPM advisors, and 1 specialist.
2. Ten licensed pest control advisors.
3. Seven avocado & citrus grove managers.
4. Five avocado growers.
5. Two indispensable assistants: Steve Griffin, Ventura County office, and Kirk Olsen, Field & Lab. Assistant to Blair Bailey at U.C. South Coast Field Station, for a grand total of 33 individuals.

At each of the 33 monitoring sites, one or both kinds of Amorbia traps and an O. Looper trap are being operated. The Amorbia traps are Pherocon 1C traps (wing style traps) consisting of a cardboard top and bottom held together by a wire frame. The bottoms of these traps are covered with a sticky material for capturing incoming moths.

In this project, cooperators apply an *extra* coating of Stickem Special to augment that provided by the manufacturer. The pheromone lures consist of rubber dispensers (septa) impregnated with 0.2 mg of pheromone. Septa are impaled on straight pins hanging from the top inside center of the traps.

The O. Looper trap consists of a 32 oz. plastic cup filled with a clear NR-415 spray oil to the level of 3 rectangular slots cut to allow entry of moths, and a plastic lid. The pheromone dispenser (rubber septum) is impaled on a straight pin hung from the top inside of the lid. It has been impregnated with 3 mg of O. Looper pheromone.

All traps are checked and serviced at weekly intervals. Weekly catch figures are phoned or mailed to the appropriate U.C. Cooperative Extension office.

## **Results**

### **Region 1 [15 Sites in Avocado Groves]**

San Diego County 10 sites

Riverside County 3 sites

Orange County 2 sites

### **Comments on Moth Populations: Omnivorous Looper**

Four peak flight periods were detected in Region 1. They occurred in January-early March, late April-early June, in July, and in September through October. One or more of these peaks were detected at each of the monitoring sites in this Region. Based on observations and trapping studies in this region during previous years, moth populations were light to moderate.

Table 1  
Region 1 Statistics

Trapping Dates	Ranch Name	Total Loopers	Total LR Amorbia	%**	Total HR Amorbia	%
<u>Avocado</u>						
1/9-12/4	Irvine 301 Orange Co.	176	1142	—	53*	—
1/9-12/4	SCFS #4 Orange Co.	205	505	—	4*	—
1/1-12/2	Curwen Fallbrook	643	12*	—	73	86
1/1-11/30	Robinson Couser Cyn.	1212	6	—	7	—
1/1-11/23	Fisher Morro Hills	699	14*	—	80	—
1/12-12/1	Scudder Pauma Valley	1067	484	89	60	11
1/1-12/1	Ranch 966 Temecula	1042	483	84	89	16
1/1-11/16	Humphrey Rainbow	729	25	81	6	19
1/1-12/1	Stika Pala Mesa	932	2*	1	141	99
1/1-11/23	Strong Highland Val.	1209	3	—	6	—
1/1-11/23	Froelich N. Escondido	247	No trap	—	No trap	—
1/7-9/7	Hunt Lake Mathews	938	280	74	96	26

\* Traps not operated entire period.

Where the — appears in data column, we elected not to calculate percentages of either population because the high ratio or the low ratio traps were removed early from the site or numbers of moths in both populations were so low as to be meaningless.

\*\*% or total moths caught.

**Disclaimer:** These data provide only an approximate indication of Amorbia populations, HR or LR, trapped at each monitoring site. We did not have replicated traps at each site.

## Amorbia

In San Diego County, trap catches were extremely low at all sites except the Scudder Ranch in Pauma Valley. The Scudder site and the Humphrey site, located just south of the Riverside-San Diego County line, were the only two predominantly LR sites in San Diego County (Table 1). Despite the relatively high numbers of Amorbia caught at the

Scudder site, we could detect no distinct flight peaks.

In Riverside and Orange Counties, catches appear to conform to trends of past years. Mostly low ratio *Amorbia* were captured at all sites in these counties (Table 1). Three flights were detected: the first was a long drawn out flight from January through April, the second occurred from late May through June, and a third and final one occurred during September and October.

## **Region 2 [10 Sites in Avocado Groves]**

1. Ventura County = 5 sites
2. Santa Barbara County = 3 sites
3. San Luis Obispo County = 2 sites
- 4.

### **Comments on Moth Populations: Omnivorous Looper**

Peak flights at both sites in San Luis Obispo County occurred in February and June. At the Morro Creek Ranch, a third peak occurred in September. At Irwin Farms, near Nipomo, a third peak occurred in late September-early October.

Moderate levels of activity were detected throughout the year in Santa Barbara County. The highest peak occurred in February-early March.

In Ventura County, high trap counts were obtained only from the Mesa School site near Saticoy and the Rummonds site near Moorpark. At Mesa School, four peaks were detected. These occurred during January-February, May, late July-early August, and in October. At the Rummonds site, three peaks were detected, the first in January-early March, the second in May-early June, and the third in August.

### **Amorbia**

At all sites in this region, most of the activity occurred in either March-May, or during September-October. Of the San Luis Obispo and Santa Barbara County sites, only traps in the Bailard grove, Carpinteria, captured mostly high ratio moths (Table 2). The other sites were either predominantly low ratio or of mixed populations.

Generally, the highest catches were obtained from Ventura County sites, even though only low ratio traps were operated in this county. Previous studies had shown that Ventura County is predominantly a low ratio area.

**Table 2  
Region 2 Statistics**

<b>Trapping Dates</b>	<b>Ranch Name</b>	<b>Total Loopers</b>	<b>Total LR Amorbia</b>	<b>%</b>	<b>Total HR Amorbia</b>	<b>%</b>
	<b><u>Avocado</u></b>					
1/1-11/16	Morro Creek Morro Bay	853*	1029*	95	58*	5
1/5-11/2	Irwin Farms W. Nipomo	802	28	56	22	44
2/4-10/28	Parks Ranch W. Goleta	608	343	95	18	5
1/7-11/4	Bailard Carpinteria	1301	30	7	380	93
1/26-9/8	Brown -C. Rincon Creek	507	125	59	87	41
1/8-11/18	Ladera Ranch Ojai	58	887	—	—	—
1/5-11/2	Rummonds Moorpark	670	2004	—	—	—
1/8-11/18	San Ysidro Fillmore	67	749	—	—	—
1/5-11/4	TMK No. 3 Santa Paula	50	1205	—	—	—
1/20-11/10	Mesa School S. Saticoy	651	1632	—	—	—

\* Traps not operated entire period.

**Region 3 [8 Sites; 5 in Citrus, plus 3 in Avocado Groves]**

Kern County = 1 site

Tulare County = 5 sites

Fresno County = 2 sites

**Comments on Moth Populations:**

**Omnivorous Looper**

Generally moth catches were greater in avocado groves than in citrus groves (Table 3).



The only exception were those from the Cove Ranch site, a citrus grove near Woodlake. Most moths were caught in the period from January through April. At sites where catches were highest; i.e., the three avocado groves and the Cove Ranch, this period extended into May. Light activity was detected at most sites in late September and October.

### Amorbia

Populations of Amorbia were higher in this region than in either of the other two regions. Moth populations were overwhelmingly of the low ratio type (Table 3). Catches ranged from 75% low ratio at the Bailey citrus grove in southern Fresno County, to 97% low ratio at the Rocky Hill avocado grove near Exeter. Catches were light during January and February and increased in March. Subsequently, catches were consistently high at most sites with the highest peak in September and October.

Table 3  
Region 3 Statistics

Trapping Dates	Ranch Name	Total Loopers	Total LR Amorbia	%	Total HR Amorbia	%
<u>Avocado</u>						
1/19-11/2	Rocky Hill N. Exeter	273	2247	97	77	3
1/27-11/2	Harrison Sunland	691	776	84	140	16
1/27-11/10	Colvert Orange Cove	603	724	86	120	14
<u>Citrus</u>						
1/23-10/28	Cameo E. McFarland	195	2557	92	226	8
1/13-10/30	Mulholland Orange Cove	86	1897	96	75	4
2/17-11/13	Cove E. Woodlake	589	1076	96	45	4
2/24-11/6	Steele Richgrove	74	2614	91	246	9
1/13-11/10	Bailey Orange Cove	128	742	75	247	25

## Conclusions

Generally, most O. Looper moths were caught in the four periods of January-early March, late April-early June, July, and September-October. Highest populations appear to have occurred in San Diego, Riverside, Santa Barbara, and San Luis Obispo Counties. The largest Amorbia catches were obtained from sites in Region 3 and Ventura County of Region 2. We could discern no pattern of seasonal abundance for Amorbia which could apply to all three regions. Trap catch data reported in this paper cover only the first 10 or 11 months of 1987. Flight activity of both O. Looper and Amorbia has been known to occur in late November and early December. Most Amorbia populations appear to be comprised primarily of low ratio moths. Only certain sites in San Diego County and one site near Carpinteria in Santa Barbara County have predominantly high ratio populations. However, small numbers of high ratio moths were captured at every site where traps for these moths were in operation. This could be due to low levels of high ratio moths occurring in these areas or to low ratio moths investigating the high ratio traps and getting caught, even though they prefer the low ratio pheromone.

Data collection has proceeded most smoothly in Regions 2 and 3. Information has been more difficult to obtain from Region 1, primarily because of the large number of monitoring sites in this region.

The Ventura county office, which serves as headquarters for Region 2, has set up a very efficient system for retrieving trap catch data and disseminating the information to the public. Each cooperator has been provided with stamped, self addressed post cards which have spaces for entering weekly trap catches of each type of moth monitored, the date, and location. Each cooperator fills out one of these cards each week and sends it to Steve Griffin in the Ventura County Cooperative Extension office, where he enters the data on his computer. These data are made available to the public by the Area IPM Advisor in his "IPM Newsletter." or by the Avocado Farm Advisor in his "Avo-Mist" newsletter. In addition, recorded messages containing updated moth flight information for Region 2 can be obtained without charge by phoning (805) 654-5006. Flight information from the other two regions can be obtained by calling the U.C. Cooperative Extension Offices in San Diego County for Region 1, or in Tulare County for Region 3.

Through our Monitoring-Early Warning program, we hope to provide the first practical benefits to the avocado and citrus industries from the development of the O. Looper and Amorbia pheromones. This system should assist growers and pest management professionals in determining when there are potential problems with these pests and to help them in determining if and when they should release *T. platneri* wasps or apply selective insecticides. Thus, guesswork is greatly reduced in making pest management decisions. Counts obtained from cooperators in this system, however, provide only an indication of what might be happening in a nearby grove without traps. Growers would best be served by operating traps in their own groves. This will become possible when the pheromones are commercially available.

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