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Second Progress Report for a Monitoring Early Warning Project for Amorbia and the Omnivorous Looper, Insect Pests of California Avocados 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 in citrus in the San Joaquin Valley. Synthetic sex pheromones have been developed for use in monitoring flight activity of these pests. Two sex pheromones have been developed for Amorbia because our research has shown that two geographically separated populations of this pest exist which use different pheromones. A Monitoring Early Warning Project for these pests, using traps baited with these pheromones, has been established in major avocado and citrus growing areas of California. This paper is a progress report of the second year of this project. This project will continue through 1989 when all three pheromones should become commercially available. Currently, there are 36 trapping sites covering San Diego, Riverside, Orange, Ventura, Santa Barbara, San Luis Obispo, Kern, Tulare, and Fresno Counties. At each site, cooperators operate one O. Looper trap, and most operate one or both Amorbia traps. Cooperators check the traps on a weekly basis and report the counts to a designated University of California Farm Advisor who makes the information available to growers or pest control professionals by telephone or newsletter. This information assists them in timing releases of *Trichogramma platneri* wasps or in timing the application of selective pesticides for control of these pests. In general, O. Looper catches were highest in February through early April; mid May to early June; mid July to early August; and in September to late October. Amorbia activity tended to be highest in early February through April; early June through late July; and in September through October. The highest O. Looper catches were obtained in San Diego County while the highest Amorbia catches were obtained from the San Joaquin Valley.

Introduction

Amorbia cuneana (Walsingham), better known as Amorbia, and the Omnivorous Looper, *Sabulodes aegrotata* (Guenee), henceforth known as the O. Looper, are sporadic pests of avocados in California (Ebeling, 1959). 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.

Amorbia is also a pest of citrus, especially in the San Joaquin Valley. Some licensed pest control advisers (PCAs) currently consider Amorbia the number one "worm" pest of citrus in this region of the state, and are ordering treatments for its control. The O. Looper has been detected on citrus, but in such low numbers as not to be considered much of a pest at this time on this crop.

We have developed synthetic sex pheromones for both of these pests (McDonough *et al,* 1982; McDonough *et al.,* 1986). 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 so species specific that when used as lures in insect traps, the great majority of insects caught in the traps will be only of the desired species.

Pheromone baited traps are useful in monitoring adult insect populations for accurate timing of control measures such as parasite releases or pesticide applications. For control of Amorbia and the O. Looper, a tiny parasitic wasp called *Trichogramma platneri,* which stings and kills the eggs of these pests, is commercially available (Oatman and Platner, 1985). *T. platneri* wasps are most effective if released when pheromone baited traps indicate Amorbia or O. Looper moth flight activity is at a peak, because eggs are most abundant during these times. If for any reason wasps fail, growers can time the application of an insecticide which can kill newly hatched larvae before they grow to a larger size and cause severe crop damage.

During development of the Amorbia pheromone, we discovered regional differences in the composition of the pheromone used by Amorbia (Bailey *et al.,* 1986; Bailey *et al.,* 1987b; Bailey *et al.,* 1988d). The Amorbia pheromone was initially identified as composed of two components, (E,Z) and (E,E) tetradecadien-1-ol acetate isomers in a 1:1 ratio, based on analysis of pheromone extracted from females collected in Orange County. We call this the "low ratio" Amorbia pheromone, and the Amorbia moths from which it came, "low ratio" Amorbia.

The pheromone was synthesized and field tested in five southern California counties; i.e., San Diego, Riverside, Orange, Ventura, and Santa Barbara (Hoffman *et al.,* 1983; Bailey *et al.,* 1988c). This pheromone was shown to be effective in attracting male Amorbia moths in all areas tested except at one of the eleven sites in San Diego County and one of the three sites in Santa Barbara County.

Subsequent analysis of the pheromone extracted from moths collected from these two areas showed females from these areas to produce a pheromone consisting of the same two components as found in the Orange County moths, but in a 9:1 EZ/EE component ratio rather than the 1:1 ratio. We now refer to this second pheromone as

our "high ratio" pheromone, and the moths from which it was taken as "high ratio" Amorbia. Dr. McDonough has also synthesized this high ratio Amorbia pheromone.

At present, the two Amorbia pheromones and the O. Looper pheromone are not commercially available. At the end of 1986, we still had several field studies to conduct before we wanted to go commercial with these three lures; therefore, we began a three year project we call the Monitoring Early Warning Project in January of 1987. This experimental monitoring project is operated in avocado and citrus growing areas of California. During 1987, we had 34 monitoring sites in nine avocado and citrus growing counties. Results of the first year of this study revealed flight patterns similar to those obtained from previous blacklight and pheromone trapping experiments (Bailey *et al.* 1987a; Bailey *et al.,* 1988a). One notable exception was the observation that high ratio Amorbia populations do not predominate in all areas of San Diego and Santa Barbara Counties. We found one of the 11 sites in San Diego County and two of the three sites in Santa Barbara County to be low ratio. In January of 1988, we increased the number of sites to 36 (Figure 1). At each site, cooperators operate one O. Looper trap and most also operate one or both Amorbia traps. Cooperators check each of the traps on a weekly basis and mail or phone the trap counts to a local University of California Farm Advisor's office. The farm advisor can then provide these moth catch numbers by phone or newsletter to anyone requesting them.

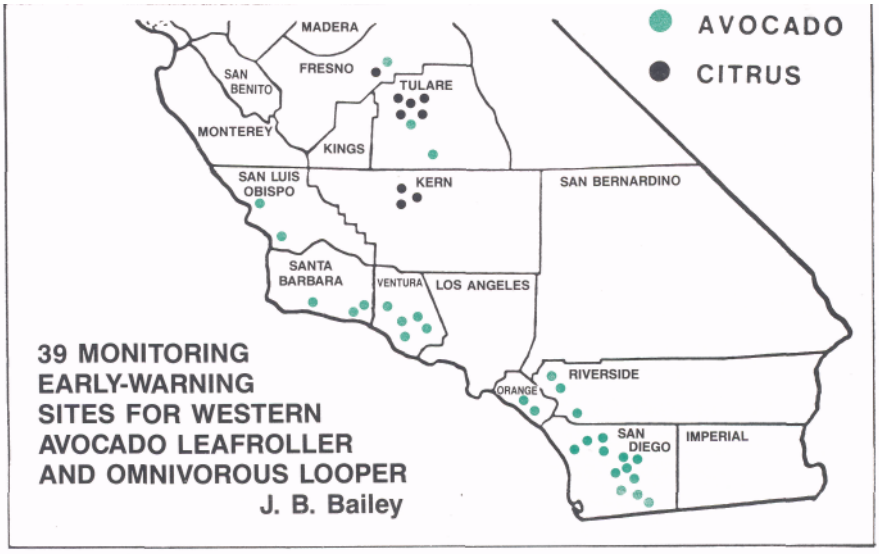

Figure 1.

Purpose of This Project

The purpose of this project is several-fold:

1. To determine *which* Amorbia population is predominant at each monitoring site.
2. To determine the *number of generations* of both Amorbia species and the O. Looper and *when they occur* at each of the monitoring sites.

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 the population warrants control measures, or if it is *time* to order and release *T. platneri* wasps.

Materials and Methods

We divided the areas to be monitored as follows:

Region 1 Counties Total of 15 Trapping sites

1. San Diego *Gary Bender & Hilda Hasler
2. Riverside
3. Orange

Region 2 Counties Total of 9 Trapping Sites

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

Region 3 Counties Total of 12 Trapping Sites

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

Cooperating Personnel on this Project During 1988

1. Eight University of California employees, including three Farm Advisors, two Area Advisors, one specialist, and two staff employees.
2. Ten licensed pest control advisers (PCAs).
3. Six avocado growers.
4. One citrus grower.
5. Four avocado and citrus grove managers.

Results

Region 1 (15 Sites in Avocado Groves)

San Diego County = 11 sites Riverside County = 2 sites Orange County = 2 Sites

Comments on Moth Populations: Omnivorous Looper

Four peak flights were detected during 1988. Generally, they occurred in February-early April, mid May-early June, mid July-early August, and in September-October. One or more of these peaks were detected at each of the monitoring sites in this region. The best example of a site with four distinct generations was the Strong grove in Highland Valley south of Escondido (Figure 2).

Populations of O. Looper were very heavy this year in San Diego County. During July, the larvae produced by the mid May-early June flight caused severe damage to many groves in the county, especially to those in the Couser Canyon, Valley Center, and North Escondido areas. Dipel or Lannate were used for control of larvae in some areas. Lannate provided moderate to good control and Dipel was relatively ineffective.

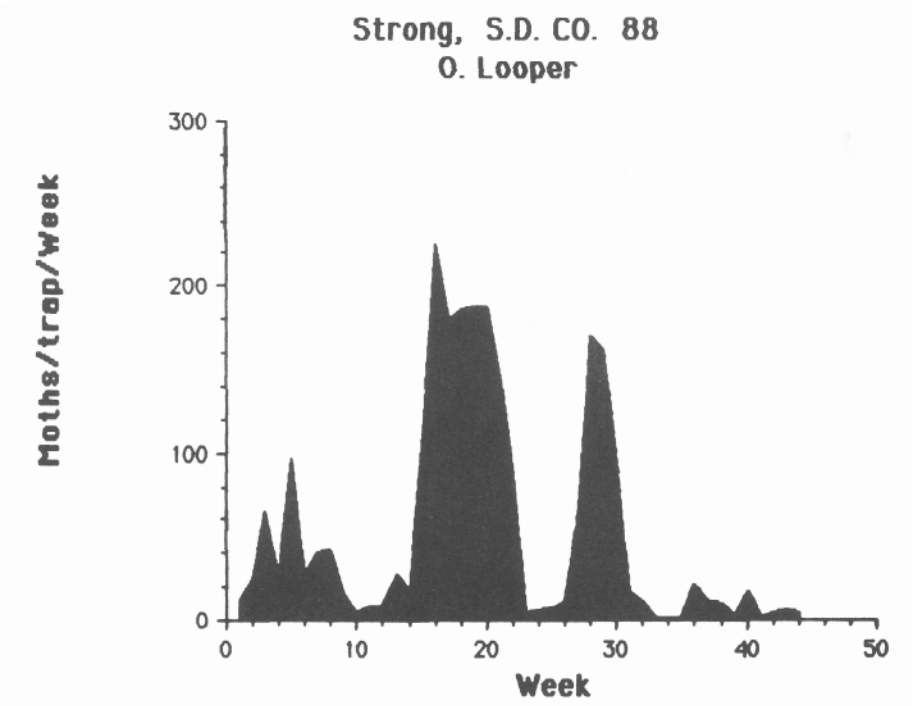

Figure 2.

The larvae resulting from the mid July-early August flight caused damage in some areas, but not as much as the previous generation because indigenous biological agents such as parasites and viral pathogens combined with severe heat drastically reduced the number of larvae. The fourth flight occurred in only a few areas and was of insufficient magnitude to warrant any concern. O. Looper populations in Orange and Riverside Counties were light to moderate and caused little damage.

Comments on Moth Populations: Amorbia

Three distinct flight peaks were detected at the two Orange County sites, the Temecula

site in southern Riverside County, and at the Scudder Ranch in Pauma Valley of San Diego County. These sites are predominantly low ratio Amorbia population areas. The first peak occurred during a long and drawn out flight which lasted from early February through April. The second flight occurred during June and July, with the final flight occurring during September and October. Data obtained from the University of California's South Coast Field Station in Orange County are depicted in Figure 3. Activity was very light in the high ratio areas of San Diego County. Moderate activity was detected at Drake Farms in northern Riverside county, but no distinct flight patterns could be established from the moth catch data.

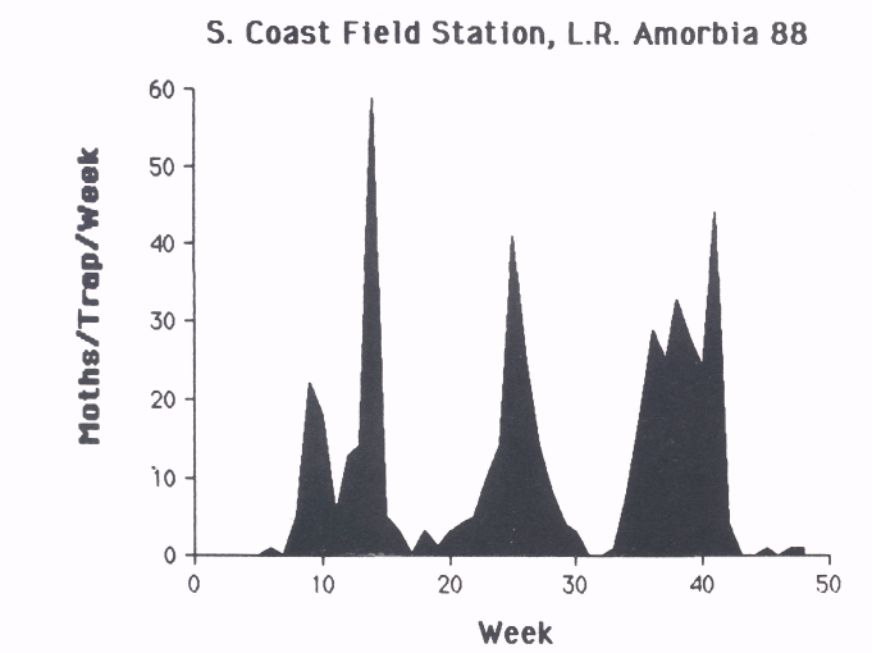

Figure 3.

Region 2 (9 Sites in Avocado Groves).

1. Ventura County = 5 Sites
2. Santa Barbara County = 2 Sites
3. San Luis Obispo County = 2 Sites

Comments on Moth Populations: Omnivorous Looper

Three peak flight occurred at both sites in San Luis Obispo County. The first occurred from February through April, the second from late May through mid July, and a third in September-October (Figures 4 and 5). Moderate levels of activity were detected throughout the year in Santa Barbara county with the highest peak occurring in October. In Ventura County, high moth counts were obtained only from the Mesa School site near Saticoy and the Rummonds site near Moorpark. At Mesa School, three peaks were

detected. These occurred in February-March, mid March-mid June, and July-August (Figure 6). The only major peak at the Rummonds Moorpark site occurred in June (Figure 7).

Comments on Moth populations: Amorbia

Three peak flights were detected at most sites in this region. They occurred at approximately the same times as those in Region 1. Generally, the highest catches were obtained from the Ventura 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. Of the San Luis Obispo and Santa Barbara sites, only the Bailard site near Carpinteria, southern Santa Barbara County, captured mostly high ratio moths (Figure 8). The other sites were either predominantly low ratio or of mixed Amorbia populations.

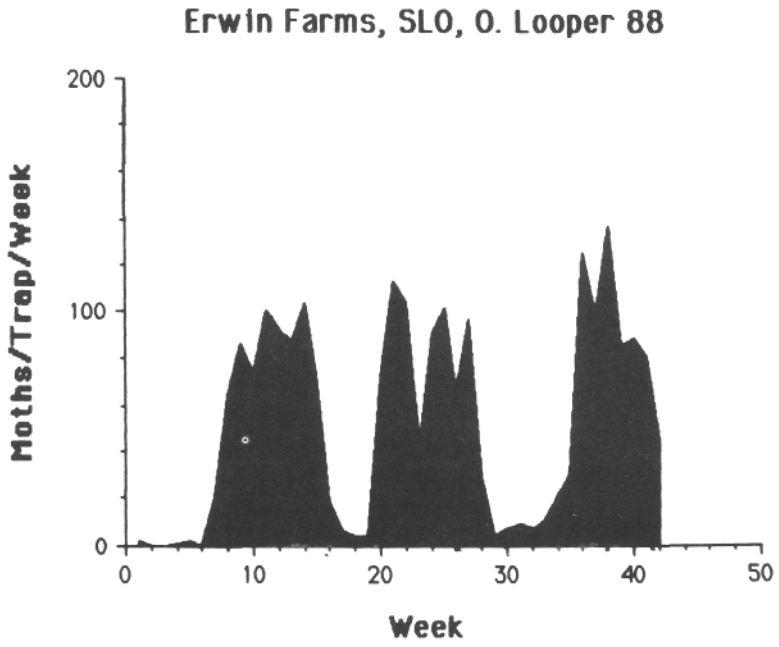

Figure 4.

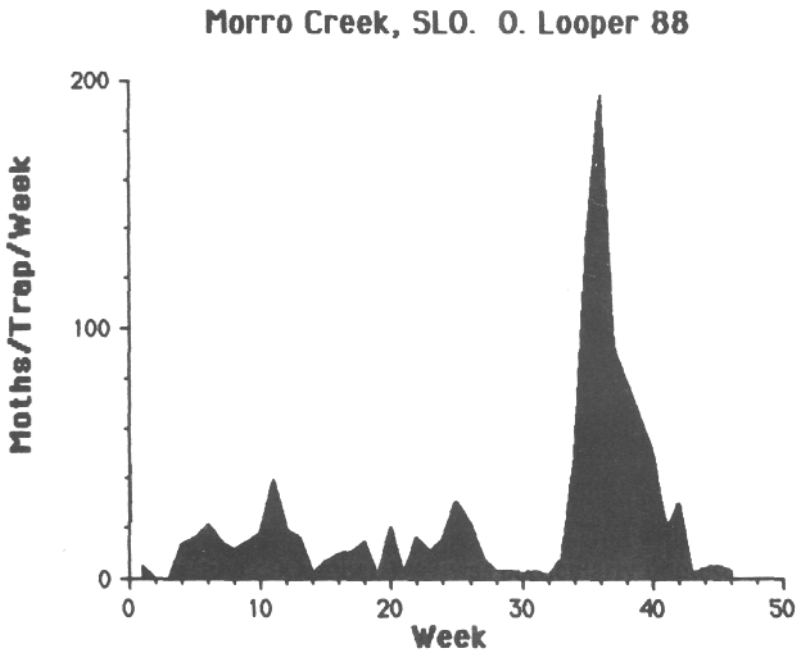

Figure 5.

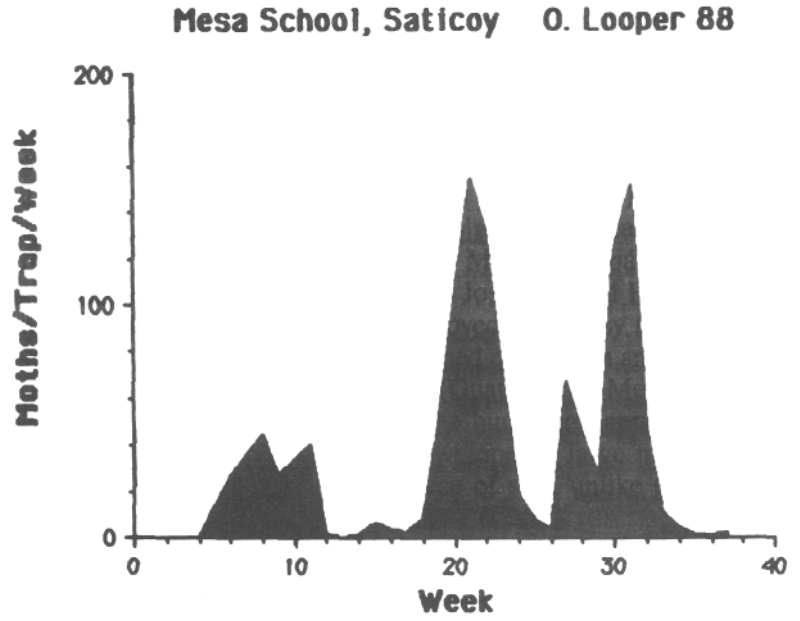

Figure 6.

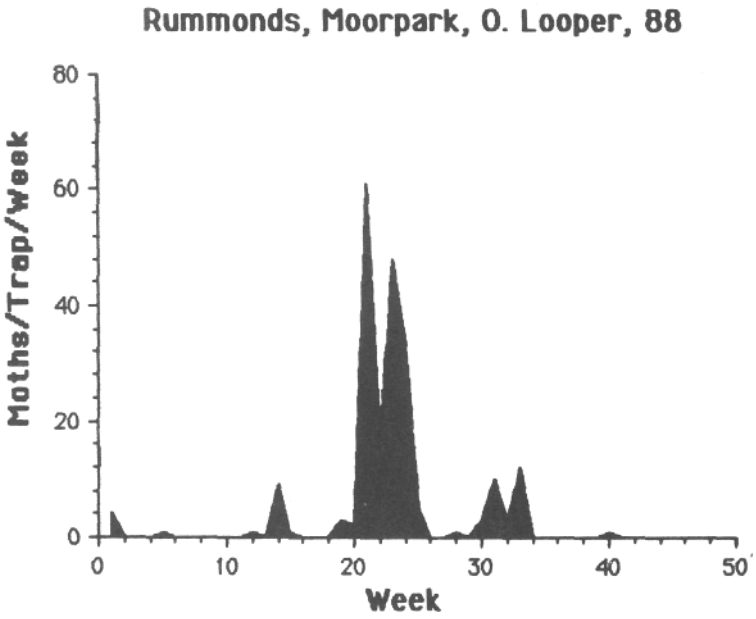

Figure 7.

Region 3 (12 Sites, 9 in Citrus, and 3 in Avocados).

1. Kern County = 3 Sites
2. Tulare County = 7 Sites
3. Fresno County = 2 Sites

Comments on moth Populations: Omnivorous Looper

Generally, O. Looper catches were greater in avocado groves than in citrus groves. The only exception was the Bailey citrus grove in southern Fresno County. Most moths were caught from February through May. There was some light activity during October. At most citrus sites, activity was too light for any trends to be discerned.

Comments on Moth Populations: Amorbia

Populations of Amorbia were higher in this region than in either of the other two regions and overwhelmingly of the low ratio type. Data for low ratio Amorbia from a typical site are depicted in Figure 9. At most sites, the first peak of both the high and low ratio Amorbia moths occurred in March. Most areas also experienced some activity in August and September. Peak flight activity at other times of the year varied from site to site.

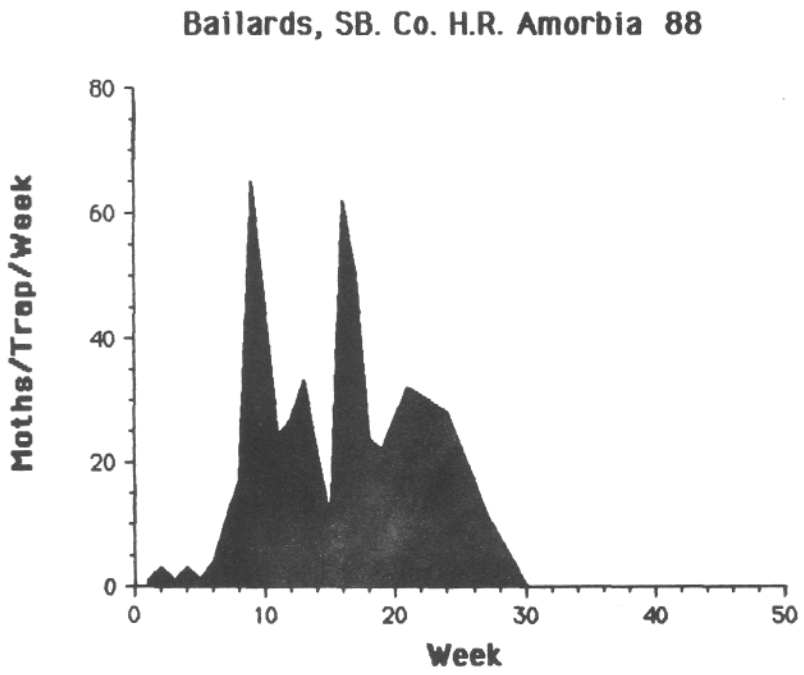

Figure 8.

Note: At each of the 36 monitoring sites cooperators operate one O. Looper trap and most also operate one or both Amorbia traps. 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 are covered with sticky material for capturing incoming moths.

In this project, cooperators apply an extra coating of Stikem Special to augment that provided by the manufacturer. The pheromone lures consist of rubber dispensers, often referred to as septa or caps, 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 vegetable oil to the level of three rectangular slots to allow entry of moths, and a plastic lid. The pheromone dispenser (rubber septum) is impaled on a straight pin hanging from the top inside of the lid. It is 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 Farm Advisors office.

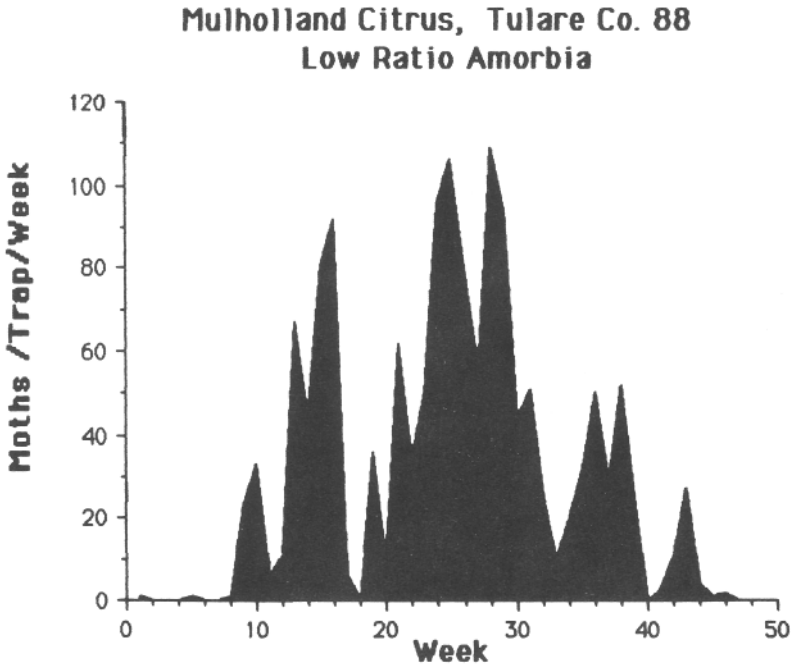

Figure 9.

Conclusions

In most instances, our conclusions are based on moth catches obtained during the first 11 months of the year because data for the last month had not yet reached us by the time we prepared this article during December of 1988. Some flight activity of both the O. Looper and Amorbia has been known to occur in late November and early December.

O. Looper

For the second consecutive year, most O. Looper flight activity was detected during four distinct periods as follows: 1. January-early March; 2. Late April-early June; 3. July; 4. September-October. The highest O. Looper populations and most damage occurred in San Diego County. Thus, growers in the county had great demand for *T. platneri* wasps, which the insectary rearing them was often unable to meet. Without improved communications with the insectary manager regarding approximate quantities and when needed, he may not be able to meet future avocado industry needs. One solution might be for growers to order wasps on a regular basis rather than to wait for peak flights to occur, thus assuring the insectary sufficient business to warrant continued high level production.

Amorbia

As in 1987, the largest Amorbia catches were obtained from Region 3 sites in the San

Joaquin Valley, followed by catches from Ventura County in Region 2. Again, most Amorbia populations appear to be comprised primarily of low ratio moths. Also, it appears that low ratio Amorbia larvae cause significantly more damage to both avocados and citrus than the high ratio Amorbia larvae.

Regarding the high ratio Amorbia, 10 of the 11 monitoring sites in San Diego County have significantly more high ratio Amorbia than low ratio Amorbia. Although we have not surveyed growers or packing houses regarding the percent of fruit damaged in high versus low ratio areas, we have observed that there has been significantly less damage caused by the high ratio populations. We believe this bears watching. In addition to San Diego County high ratio populations, we also noted one in the Bailard grove near Carpinteria, in southern Santa Barbara County. In Region 3, although we have several sites, especially in citrus groves, where we found significant high ratio Amorbia activity, the predominant population is low ratio.

Data Dissemination

The following is a summary of how data from this monitoring project can be obtained from each of the three regions.

In **Region 1,** the toll free phone number to call is (800) 336-3023 which is a taped message operated by the San Diego County Farm Bureau in cooperation with Dr. Gary Bender, our monitoring coordinator for Region 1. Mr. Warren Currier, of Escondido, in cooperation with the California Avocado Growers Association and Dr. Bender, also has a taped phone message, (619) 746-9813 on which he has moth counts only when they exceed 70 per week, as well as avocado marketing and production information.

Region 2 continues to operate its taped phone message containing moth counts. Call (805) 654-5006.

Region 3 provides moth counts from our Monitoring Project by newsletter to PCAs and through direct requests by telephone to Neil O'Connell, coordinator for that region, at (209) 733-6484.

Through our "Monitoring Early Warning Project" we hope to provide some of the first practical benefits to the avocado and citrus industries from the development of the O. Looper and two Amorbia pheromones and the biology studies for these pests. This system should assist growers and pest management professionals in determining if and when they should purchase and release the beneficial wasps known as *Trichogramma platneri,* or apply a selective insecticide if biological control fails. Thus, much of the guesswork in making pest management decisions is reduced or eliminated. Counts obtained from cooperators in this system, however, provide only an indication of what might be happening in a nearby grove without monitoring traps operated and properly maintained. Growers would best be served by operating traps in their own groves.

At this time, we are pleased to announce that the Trécé Company, of Salinas, California, will begin to market commercially all three of our pheromones in March of 1989. It is our understanding that these are the first pheromones to have been developed for pests of avocados anywhere in the world. We are proud to have been able to take this work from its original concept, about ten years ago, to its present state

of commercialization.

We thank all of the cooperators who have made this become a reality, the California Avocado Commission for its financial support, and Dr. McDonough, Pheromone Chemist, and his staff for their outstanding work in the original identification and synthesis of all three of these pheromones.

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