California Tree Fruit Agreement Project Report

Leafrollers as Secondary Pests to Codling Moth Mating Disruption in Pears

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ABSTRACT

Leafroller pheromone dispensers reduced oblique-banded leafroller damage by more than half but the plot still sustained a 3% infestation level. Codling moth pheromone dispensers with one cover spray of guthion gave as good codling moth control as four guthion cover sprays in a pear orchard in Mendocino County. Moths caught in an organic pear orchard in Philo had the same susceptibility to Lorsban as did those in a commercial pear orchard in Hopland. Moths caught in the Philo orchard were 6.75 times more susceptible to Guthion than those from the Hopland orchard. Imidan susceptibility curves were obtained from the Philo orchard.

INTRODUCTION

University researchers and farm advisors are currently implementing mating disruption as a new technique for controlling codling moth. In several areas where codling moth disruption has been tried, the growers suffered as much as 15% loss due to leafroller damage (Weakley, 1987). A generic leafroller pheromone dispenser was available for research purpose. We evaluated the effectiveness of these dispensers for controlling leafroller populations through mating disruption. We monitored the population of parasites attacking the leafrollers and evaluated their impact on the leafroller during the transition period from the standard grower insecticide use to mating disruption for codling moth control.

In addition to leafroller problems in transition orchards, there have been reports of sporadic poor leafroller control in commercial pear orchards. One possible explanation is that, in the past, the insecticides used for codling moth control gave a background control to the leafrollers but are no longer doing so. It is possible that the leafrollers have become resistant to insecticides targeted for codling moth control but these insecticides are still detrimental to the leafroller parasites, causing a secondary leafroller pest outbreak. We performed preliminary studies to test the susceptibility of adult leafroller moths to insecticides used for codling moth and leafroller control.

OBJECTIVES:

1. Determine if leafrollers become a pest during the transition period between standard grower practices and pheromone confusion for the control of codling moth.

2. Evaluate mating disruption on oblique-banded leafroller using a generic leafroller dispenser.

3. Determine oblique-banded leafroller parasitization levels and determine parasite species.

4. Obtain preliminary data on the susceptibility to insecticides of oblique-banded leafroller.

MATERIALS AND METHODS

Leafroller and Codling Moth Pheromone Disruption

Two trials were established, one in Lake County with codling moth and leafroller pheromone confusion and one trial in Mendocino County with codling pheromone confusion alone. Both pheromones were provided by Pacific Biocontrol Ltd. The application rate was of 400 ties per acre for either pheromone.

Four treatments were established in the Lake County trial: 1) 4 acre block treated with codling moth pheromone dispensers with treated borders, 2) 4 acre block treated with codling moth and leafroller pheromone dispensers with treated borders, 3) grower standard organophosphate program (Guthion), 4) an untreated control of 7 X 7 trees. Due to high codling moth populations the two treatments under pheromone confusion received one cover spray during the first generation leaving only 15 X 10 trees unsprayed in each treatment. The Mendocino County trial had three treatments: 1) 8 acre block treated with codling moth pheromone dispensers with treated borders, 2) grower standard organophosphate program (Guthion), 3) an untreated control of 14 X 8 trees. The pheromone confusion treatment received an accidental Guthion cover spray during the second generation.

In the Lake County trial oblique-banded leafroller (OBLR) overwintering generation was sampled at post petal fall by sampling 20 fruiting spurs and associated shoots per tree from 20 trees per treatment. The summer generation was sampled on July 20 by examining 20 fruit and associated shoot per tree from 20 trees per treatment. Leafrollers were collected bi-weekly during both generations and reared on artificial diet to establish parasitization rates and to determine the species of parasites. Leafroller was assessed at harvest (August 20-24) by randomly selecting 1000 fruit per treatment. Male leafroller moth populations were monitored with OBLR and orange tortrix pheromone traps.

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In the Mendocino County trial, codling moth populations were sampled at the end of the first generation on July 6 by sampling 20 fruit from 50 trees per treatment. Infestation of ground fruit was evaluated on July 13 by examining 500 ground fruit per plot. Codling moth damage at harvest (August 5) was evaluated by sampling 1000 randomly selected fruit from each treatment. Male codling moth adult population was monitored with pheromone traps. Pear psylla, spider mites and European red mite were sampled with bi-weakly shoot samples during the season and after harvest. Beneficial insects were sampled with monthly beating tray samples.

Testing for insecticide susceptibility in Leafrollers

The pheromone assisted bioassay developed by Riedl (1985) for testing insecticide resistance in codling moth was modified to test insecticide susceptibility in oblique-banded leafroller. Moths were collected in the field using pheromone traps. Traps were deployed in the orchard in the late afternoon and removed at daybreak to avoid high daytime temperature. Insecticide was applied to the abdomen of each moth trapped on the bottom of the pheromone trap liner with a microsyringe. Four insecticide concentrations and acetone as the control were tested at each site. Treated moths were placed in rearing chambers and mortality was assessed 48 hours after treatment. Bioassay was repeated for three consecutive nights per site and insecticide. Moths were collected in organic apple and pear orchards during the first OBLR flight and tested for Guthion, Imidan and Lorsban susceptibility. During the second flight, moths were collected from two commercial orchards in Ukiah and one commercial orchard in Hopland. Moths collected at the commercial orchards were tested for susceptibility to Guthion and Lorsban.

RESULTS AND DISCUSSION

Leafroller and Codling Moth Pheromone Disruption

Results from the Lake County trial on oblique banded leafroller is presented in Table 1. Maximum OBLR percent infestation (8.3%) occurred in the plots under codling moth pheromone confusion. Even though the pheromone traps did not catch any OBLR moth in the plot under codling moth and OBLR pheromone confusion, infestation during the second generation reached 3%. The OBLR dispensers appear to have reduced OBLR infestation in half but was 4 times higher than in the Guthion plot where infestation was 0.7%. Further studies are needed to determine the correct placement of the dispenser on the tree. Two dispensers were placed on the top of each tree. We need to determine if, by placing the dispensers one on the top and one on the middle of the tree, better control is achieved.

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Larvae collected during the second generation were reared on artificial diet until OBLR or parasite adults emerged. Of the larvae collected, 12% were parasitized by a tachinid fly of the genus *Actia*, 19% were parasitized by *Cotesia* sp. and 5% by *Exochus nigripalpis*, the latter two are hymenopteran parasitoids. The total parasitization level was 36%. Further studies are needed to determine if parasitization levels will increase to a level which will control OBLR if the orchard remains unsprayed.

In the Mendocino trial, codling moth percent infestation at harvest in the codling moth pheromone and guthion plots was 0.2 %, and 15% in the control (Table 2). This orchard was under heavy pressure (over 135 moths in 1993). This was the first year under codling moth pheromone confusion and the plot accidentally received a cover spray during the second generation. Damage at the end of the first generation was 0 for the pheromone and guthion plots and 0.8% for the control. Ground fruit scored at the end of the end of the first generation had an infestation of 0.2, 0 and 7.5% for the pheromone, guthion and control plots respectively.

Early in the spring, pear psylla was present equally in the three plots where 15 out of 20 shoots were found containing psylla nymphs or eggs. The pheromone and guthion plots were sprayed with 20 oz. of avermectin. After harvest pear psylla population was significantly lower in the control, there were 40, 53 and 2 pear psylla adults per 20 beats. Beating tray samples yielded no natural enemies throughout the season in the pheromone and guthion plots. Beneficial arthropods present throughout the season in the control were ladybird beetles, green lacewing, minute pirate bug and spiders.

Testing for insecticide susceptibility in Leafrollers

During the first generation mortality curves to guthion were generated from an organic apple orchard located in Sebastopol. This orchard was selected at the beginning to adjust the bioassay developed for codling moth to test OBLR. Results from this orchard were then verified with moths collected at an organic pear orchard Philo (Table 3). Results from these two orchards were not significantly different. Mortality curves for Imidan and Lorsban were obtained from the Philo orchard.

During the second generation, traps were set at four orchards: two commercial orchards in Ukiah, one commercial orchard in Hopland and the organic orchard in Philo as the susceptible comparison. Not enough moths were collected from the two orchards in Ukiah. Traps were set 12 times during the peak of the second flight. These two orchards were selected because in some years they had had leafroller outbreaks. Both orchards received a Lorsban spray at green tip for leafroller control which may explain the low trap catches. Therefore comparison were only possible between the organic orchard in Philo and the commercial orchard in Hopland. There were no significant difference between these two orchards when tested with Lorsban. OBLR moths from the Philo orchard were 6.75 times more susceptible to guthion than the Hopland orchard. There were not enough moths to test for Imidan susceptibility in the Hopland orchard.

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Table 1.- Percent oblique banded leafroller damage evaluated during the first and second generation and at harvest in a pear orchard in Lake County.

	% OBLR damage		
Treatment	First generation	Second generation	Harvest
CM pheromone	0.5	8.3	5.7
CM + OBLR pheromone	0.0	3.0	2.4
Guthion	0.0	0.7	0.5
Control	0.0	0.1	0.0

Table 2.- Percent codling moth damage evaluated during the first generation and at harvest in a pear orchard in Mendocino County.

	% codling moth damage		
Treatment	First generation	Ground samples	Harvest
CM pheromone	0.0	0.2	0.2
Guthion	0.0	0.0	0.2
Control	0.8	7.5	15.0

Table 3.- Bioassay results of insecticides tested against oblique-banded leafroller moths collected in an organic pear orchard in Philo and a commercial pear orchard in Hopland.

Pesticide Site	LC50 (mg ai/ml)	Slope	n
Guthion			
Philo	0.08	1.54	152
Hopland	0.37	1.93	144
Lorsban			
Philo	0.087	2.7	123
Hopland	0.079	3.9	135
Imidan			
Philo	0.097	2.2	139