The Fight Against Codling Moths

Erica St.Clair

Abstract

Apple growers have had an increasing problem with codling moths damaging apple crops. For years, research has been focused on a way to better control these pests, but now it's not how to control them, it's what is the best way to do it. Mating disruption has been shown to be less harmful than insecticides, making it the better way to fight codling moths. This cuts back on the amount of residue left on apples from the insecticides because less is being used and is also specific to one insect. Now that it is known that mating disruption is the better option, research has been focused on the best way to implement mating disruption. So far, researchers have found that using aerosol dispensers work just as well as the hand-applied dispensers, while also providing cheaper costs of labor and supplies and increasing economic return.

Introduction

Apple growers need a way to make sure their apple crop isn't damaged by the infamous pest we call "the worm in the apple." This pest is known to growers as the codling moth, *Cydia pomonella*. Codling moths are able to mate, which creates larvae that burrow into the apple causing stings or deep entries. Stings are where the larvae only bore into the flesh of the apple a short distance, whereas deep entries are when the larvae penetrate the skin and bore into the core of the apple. No matter which type of damage is being caused, both are harmful to the value of the crop.

Pheromones are chemical compounds that enable members of the same species to communicate with each other (1). Female codling moths release a form of pheromone known as sex pheromone. Sex pheromones are specifically used to signal to the males that they are available and this signal attracts the males over long distances (1). This pheromone is released from glands with external ducts and influence the male codling moths by affecting the central nervous system and causing immediate behavioral response upon reception.

To control the population of codling moths, insecticides have been used, but over time, research has shown that there are hazards associated with their use. Insecticides are associated with health hazards and cause damage to the environment. To get away from these harmful effects, mating disruption is a newer method of control for these pests. The use of pheromones in mating disruption was first researched in Washington State in 1987 (2). Mating disruption is a method of control where dispensers are applied in the orchard that release the same sex pheromone as the female moth releases in nature. The males can detect very small amounts of this chemical and will fly to find the source. This will inhibit the ability of the male moth to find and mate with the female because they are following the synthetic pheromone (3).

There are different types of dispensers used in mating disruption. There are hand-applied dispensers and aerosol dispensers, which are the subject of new research. There are many types of hand-applied dispensers, but the one used in this research is the Isomate®-CM FLEX dispenser (Figure 1) produced by Pacific Biocontrol Corporation. This dispenser is a twin-tube design that has the pheromone inside the tubes and emits the chemical via diffusion from the plastic. This design allows for a uniform release rate of the pheromone throughout the whole growing season. The second type of dispenser is an aerosol dispenser. The aerosol dispensers utilized in this research were Isomate®-CM Mist (Figure 2), which are also produced by Pacific Biocontrol Corporation. These dispensers are electronically controlled and are programmed to release specific amounts of pheromone at set intervals each day.

Figure 1. Isomate-CM FLEX dispenser

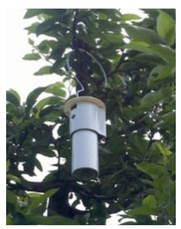

Figure 2. Isomate-CM Mist dispenser

Experimental Method

The experiments were conducted in triplicate at three different commercial apple orchards, and each treatment was put in a 9-10 acre plot, with the control plot being upwind of the treatment plots to prevent pheromone drifting. The first experiment looked at the number of hours the mister was on and there were treatment plots of control (No MD), 3, 6, and 12 hours. The second experiment was the number of puffs per hour and the treatments were No MD, 1, 2, and 4. The third experiment was performed for a shorter period of time and counts were taken each week, 5 days after releases, for three weeks. This experiment was the number of misters per acre and the treatments were No MD, 0.5, 1, 2, 4, and 8

Each plot was monitored and the treatment effects were assessed using Trécé CM L2-baited Pherocon® IV traps (Figure 3) that were spaced uniformly in each plot in the top part of the tree on bamboo poles.

To determine the effects of the treatment. Sterile Insect Releases (SIRs) were performed each week so that the density population of the codling moths could be controlled. The moths had a dye incorporated into their diet making them pink inside which made it clear to see which were wild or released moths. They were also dusted with colored powder each week to provide information about their life span and their flight pattern to see if they migrated from the treatment of origin. The same kind of experiment involving SIRs and trap monitoring was performed using the the Isomate®-CM FLEX dispenser so the use of misters could be compared to hand applied dispensers.

Figure 3. Trécé CM L2-baited Pherocon® IV trap

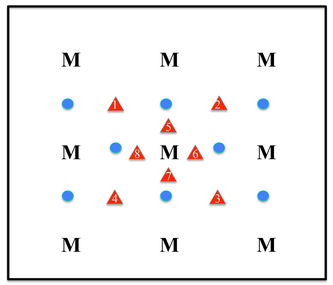

Figure 4. Example of plot setup. M is the mist unit, blue circles are SIR sites, and red triangles are traps. Traps 1-4 are 220' apart and traps 5-8 are the tree next to the mister.

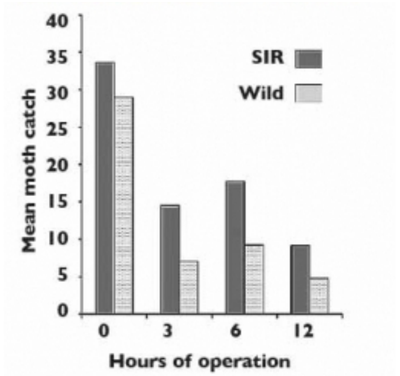

Figure 5. Three and six hours of operation effective as 12 hours

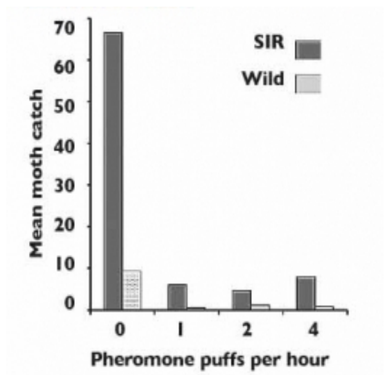

Figure 6. Fewer aerosol puffs per hour as effective as more

SOURCE: Peter McGhee

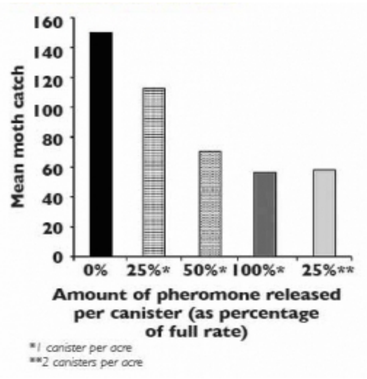

Figure 7. Aerosol emitters at half rate as effective as full rate

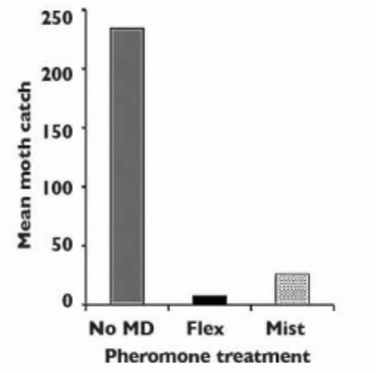

Figure 8. Aerosol emitters as effective as twisty ties

SOURCE: Peter McGhee

Results and Discussion

The results of these four different experiments give great insight into the use of aerosol misters compared to the hand applied dispensers. First off, Figure 5 shows that the emitters are just as effective at 12 and 6 hours and that 3 hours was almost as effective as 6 hours. Figure 6 is looking at the amount of pheromone released every hour. These results show that the number of puffs per hour can be cut down to twice or even once per hour, which is half or a quarter of the standard, which is 4 puffs per hour. Figure 7 looks at the amount of pheromone emitted per puff. The results show that half as much pheromone can be released and be just as effective. We also saw that using 2 dispensers per acre at a quarter of the amount of pheromone released in the puff worked just as well as one canister at half strength. This combined with cutting the hours of use in half and the number of puffs per hour will reduce the amount of pheromone used to one-eighth of what is normally used. It is also important to note, in figure 8, that the hand dispensers and aerosol emitters were equally effective in deterring codling moths. All of these things combined will make controlling codling moths much more cost efficient and less labor intensive. Fewer dispensers cuts down on the labor involved in putting them up in the orchard and less pheromone reduces the cost of using the dispensers.

Acknowledgements

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References

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2. Thomson, Don, Jay Brunner, Larry Gut, Gary Judd, and Alan Knight. "Ten years implementing codling moth mating disruption in the orchards of Washington and British Columbia: starting right and managing for success!" IOBC wprs Bulletin 24 (2001): 23-30. <http://phero.net/iobc/hohenheim/bulletin/thomson.pdf>.
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