Evaluation of Bait Traps for Field Detection of Light Brown Apple Moth (*Epiphyas postvittana*) in California

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Introduction

The recent invasion of the Light Brown Apple Moth (LBAM) into California severely threatens the viability of California's $ 3.8 billion ornamental nursery industry. Moth migration is regularly monitored by regulatory officials using traps containing synthetically derived pheromones to capture male moths. For regulatory, management, and experimental purposes, it is desirable to have a field trap that would capture both female and male migrating moths. For example, in an experiment to determine the effectiveness of pheromone mating disruption in ornamental nurseries, we wanted to monitor LBAM populations in general and to trap female moths to determine if they had been mated.

Objective

This experiment's objective was to evaluate the trapping effectiveness of various liquid baits in bucket traps. The effectiveness of these traps is compared with conventional pheromone and ultraviolet traps.

Data was collected in and outside of commercial ornamental nurseries, before and after pheromone mating disruption was applied to the nurseries.

Fig. 1

Method

General

From March 5, 2009 to November 30, 2010 we monitored bait traps and commercial LBAM pheromone traps in and outside of 4 ornamental nurseries surrounded by LBAM infested areas in Santa Cruz County, California. The liquid bait was placed in a 9.5 L bucket with eight 3.8 cm holes placed around its upper circumference, and topped with a lid **(Figure 1)**. Each bucket contained a Hercon® Vaportape II Insecticidal strip and 1.5 L of one liquid bait. A screen at the bottom of the bucket prevented insects from dropping into the solution. Commercial pheromone traps and ultraviolet light traps were also used to monitor migrating moths.

Baits for bait traps

• **Port wine solution** (25% v/v, port wine/ water) (Fairbanks Port, Gallo Vineyards , CA).

• **Terpenyl acetate + brown sugar solution** (10ml terpinyl acetate + 4lb brown sugar + 9.5L water).

• **Vinegar solution** (0.5% v/v, acetic acid/water) (Four Monks Distilled Vinegar, Dutch Valley Food Distributors Inc. Myerstown, PA).

LBAM pheromone and ultraviolet traps

· **Jackson pheromone trap:** white triangle with metal hanger and a 3mg Light Brown Apple Moth lure (Hercon®, Emigsville, PA. Traps monitored every week for moths. The sticky insert was replaced every 4 - 5 wks or as needed. Pheromone lure was replaced every 5 weeks.

• **Ultraviolet light trap**: 22 watt, with photo-electric switch (Bioquip®, Rancho Dominguez, CA). A Hercon Vaportape II Insecticidal Strip was hung inside bucket. A single light trap was placed near the center of each nursery above the nursery crops.

Mating disruption experiments were established at 3 of the 4 nurseries (nurseries #1,2, and 4) on March 15, 2010. Isomate® LBAM twist ties (Pacific Biocontrol Corp., Vancouver, WA) were applied uniformly at the maximum registered rate of 300 per acre at each nursery site.

Trapped LBAM were quantified and sexed.

Results

As expected for a new invasive pest, trap catches were low, but moths were trapped every month for over 20 months. In general, ultraviolet traps were the most effective trapping method for LBAM moths, followed by synthetic LBAM pheromone traps, followed by bait traps **(Table 1)**. All traps trapped LBAM when pheromone mating disruption was employed, although at even lower numbers than before.

In total, UV light traps trapped 19% female LBAM while bait traps collectively trapped 59% female moths, and all but 2.5% (one moth) were mated.

Other insect taxonomic groups were identified in the ultraviolet light and bait traps. There were a wider variety of insects (especially moths) found in ultraviolet traps than bait traps. Flies were mostly found in terpinyl and port wine baits. Lacewings were mostly found in terpinyl and vinegar solutions.

Ultraviolet light trap bulbs burned out frequently when powered by a battery. This occurred less frequently when powered by an AC power source. Ultraviolet traps are relatively expensive (approximately $400 each).

Conclusions

Bait traps using solutions of vinegar, terpinyl acetate + brown sugar, and portwine can be useful for monitoring LBAM adult populations although their rate of trapping is lower than commercial synthetic pheromone and ultraviolet light traps. They have an advantage as they attract a greater proportion of female moths than that trapped with ultraviolet traps. Commercial pheromone traps by design, almost without exception, only trap male moths. Bait traps can be used to monitor for LBAM even when mating disruption is employed. Bait and pheromone traps are inexpensive and relatively easy to maintain. Ultraviolet light traps are expensive and work best when they can be powered by an AC power source, so they are not adaptable to many field monitoring situations.

Table 1. COMPARISON OF LBAM TRAPPED IN BAIT (PORT WINE, TERPINYL ACETATE , OR VINEGAR), PHEROMONE, AND ULTRAVIOLET TRAPS

	WITHOUT MATING DISRUPTION*			WITH MATING DISRUPTION*		
Nursery #1	**# OBS.**	**MEAN**	**ERROR**	**# OBS.**	**MEAN**	**ERROR**
BAIT / LOCATION						
Port / Inside nursery	284	0.00012	0.00388	228	0.00439	0.00179
Port / Outside nursery	264	0.00000	0.00401	228	0.00000	0.00179
Terpinyl / Inside nursery	284	0.01048	0.00388	228	0.00000	0.00179
Terpinyl / Outside nursery	264	0.00379	0.00401	228	0.00000	0.00179
Vinegar / Inside nursery	285	0.01068	0.00387	228	0.00000	0.00179
Vinegar / Outside nursery	263	0.00002	0.00402	228	0.00000	0.00179
PHEROMONE						
Inside nursery	339	0.28614	0.04286	228	0.02632	0.04931
Outside nursery	349	0.43840	0.04224	304	0.49013	0.04270
ULTRA VIOLET LIGHT						
Inside nursery	38	0.39474	0.26129	38	0.26316	0.35060
Nursery #2						
BAIT / LOCATION						
Port / Inside nursery	142	0.00000	0.00294	114	0.00000	
Port / Outside nursery	132	0.00000	0.00303	114	0.00000	
Terpinyl / Inside nursery	142	0.00000	0.00294	114	0.00000	
Terpinyl / Outside nursery	132	0.00000	0.00303	114	0.00000	
Vinegar / Inside nursery	142	0.00017	0.00294	114	0.00000	
Vinegar / Outside nursery	132	0.00758	0.00303	114	0.00000	
PHEROMONE						
Inside nursery	152	0.00000	0.01756	114	0.01754	0.02482
Outside nursery	220	0.05455	0.01460	190	0.06316	0.01922
ULTRA VIOLET LIGHT						
Inside nursery	38	0.15790	0.26129	38	0.42105	0.35060
Nursery #3						
BAIT / LOCATION						
Port / Inside nursery	142	0.00025	0.00587	114	0.00000	0.00715
Port / Outside nursery	132	0.00000	0.00607	114	0.00000	0.00715
Terpinyl / Inside nursery	142	0.00708	0.00587	114	0.02632	0.00715
Terpinyl / Outside nursery	132	0.00758	0.00607	114	0.00000	0.00715
Vinegar / Inside nursery	142	0.00782	0.00587	114	0.00877	0.00715
Vinegar / Outside nursery	132	0.00758	0.00607	114	0.00000	0.00715
PHEROMONE						
Inside nursery	197	0.22335	0.06634	114	0.14035	0.04439
Outside nursery	135	0.38519	0.08014	114	0.28070	0.04439
ULTRA VIOLET LIGHT						
Inside nursery	38	2.02632	0.26129	38	2.86842	0.35060
Nursery #4						
BAIT / LOCATION						
Port / Inside nursery	284	0.01795	0.00527	228	0.02193	0.00684
Port / Outside nursery	264	0.00379	0.00545	228	0.00439	0.00684
Terpinyl / Inside nursery	284	0.01087	0.00527	228	0.02193	0.00684
Terpinyl / Outside nursery	264	0.00000	0.00545	228	0.00439	0.00684
Vinegar / Inside nursery	284	0.01453	0.00527	228	0.01316	0.00684
Vinegar / Outside nursery	264	0.00000	0.00545	228	0.00000	0.00684
PHEROMONE						
Inside nursery	226	0.45133	0.04779	152	0.09211	0.06508
Outside nursery	283	0.34276	0.04271	190	0.58421	0.05821
ULTRA VIOLET LIGHT						
Inside nursery	38	0.23684	0.26129	38	0.21053	0.35060

*** Nurseries monitored 3/5/09 to 11/30/10. Mating disruption implemented 3/15/10 to nurseries #1, 2,and 4 (not 3).**

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