

## **FINAL REPORT FOR 1999-2000**

**TITLE:** Plant Based Repellents for Codling moth

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**FUNDING HISTORY:** Funding in 1999-2000 (Year Initiated): \$13,400

### **SIGNIFICANT FINDINGS:**

Methods of formulating lavender essential oil were inadequate to protect apple fruit from codling moths.

### **OBJECTIVES:**

The overall project objective is to define and develop chemical attractants for codling moth adults and codling moth larvae based on host plant chemistry. Specific objectives of the current year are to:

Develop formulation methods for essential oils

Evaluate 2 plant essential oils to protect individual apples

Characterize the odors emitted by essential oils.

### **PROCEDURES:**

Two approaches were tried for formulating essential oils of interest for testing as repellents against codling moth. The objective of the formulating was to slow down the release of repellent chemicals from the essential oil because this was found to be short-lived in laboratory assays. That is, the oil soon lost its repellency, due to evaporation of repellent chemicals from the oil. One approach was to dilute the plant essential oil in a heavier mineral oil. The mineral oil was then loaded onto cotton dispensers for use in trials on apple trees. A second approach was to load a plant essential oil into slow release dispensers used presently for feeding attractant chemicals. These also were then used on apple trees in an attempt to repel codling moths. Field cage assays lasted one week, at which point the fruit was removed and replaced with new fruit for additional assay replicates.

The objective of assays conducted on apple trees was to prevent codling moths from infesting apples by repelling them with lavender essential oil. This should occur both through the repelling of ovipositing moths and the repelling of newly hatched larvae searching for fruit. Mated female codling moths were released into field cages containing small apple trees with 20 fruit per tree. The two types of formulation or dispenser were evaluated using this assay design, with comparisons made of the percentages of fruit infested on treated versus untreated trees. Formulations were evaluated at 20 units per tree.

The major components of the odor of lavender oil were determined through a combination of available scientific literature and air collections made on oil used in tests. These air collections were made using solvent extractions of SuperQ filters and extracts were analyzed by GC-MS to make structural assignments.

### **RESULTS AND DISCUSSION:**

There were no significant effects of the repellent treatments on the rate of infestation of apple by codling moth and most apples were infested by released codling moths on both treated and control trees. These negative results were similar with both methods of formulation.

It is assumed that the discrepancy between these results and those obtained in laboratory bioassays is due to insufficient quantities of the repellents around fruit for a long enough time to prevent moths from laying eggs near fruit and for larvae to find fruit. In previous testing of essential oil repellency of codling moth larvae, it was determined that this effect was short lived (Landolt et al. 1998) indicating that the active ingredient (s) in the oil are very volatile and leave the oil in a short space of time. The disadvantage of extending the repellency of the material in time is that reduces the release rate and we run the risk of losing the repellent effect. If this is the problem, it might be corrected either by greatly increasing the numbers of dispensers per tree or by identifying the active chemicals in the essential oil and then using highly concentrated synthetic chemicals as repellents.

The most abundant compounds volatilized from the essential oil of lavender are identified. Most are commercially available and these will be purchased for use in additional assays. If one or a small number of compounds is found to deter or repel larvae or adults at a low dose, the use of a synthetic chemical in place of the oil may give new hope to this approach.

### **CONCLUSIONS:**

Attempts to protect fruit on trees with dispensers loaded with essential oil of lavender were unsuccessful. It is assumed that the lack of protection was due to the volatilization of too little material for too short of a space of time to be effective. This might be overcome by determining which volatiles from the essential oil repels codling moth and then using the synthetic repellent chemical instead of the oil in larger scale tests.

### **REFERENCES:**

Landolt, P. J., R. W. Hofstetter, and L. L. Biddick. 1999. Plant essential oils as arrestants and repellents for neonate larvae of the codling moth (Lepidoptera: Tortricidae). *Environ. Entomol.* 28: 954-960.