Control of *Varroa* Mites in the Honey Bee, *Apis mellifera,* through the Application of Vaporized Essential Oils

Project No.: 06-POLL9-Wardell/Sammataro

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Interpretive Summary:

Our goal is to develop a method to deliver standardized quantities of vaporized essential oils into the honey bee colonies that will kill or incapacitate the Varroa mites and ultimately reduce mite populations below detrimental levels in the colonies. The vaporized essential oil delivery method will give beekeepers a new tool to spot treat colonies to reduce phoretic mite populations and promote long term colony health.

Vaporized essential oils demonstrated ability to control mites at 3% active ingredient. Results show that 5 % might be more effective in controlling mites with the oils we used

in this trial. Next year we hope to try different oils and increase the concentrations based on the low toxiticy we were seeing in adult bee mortality.

Objectives:

1. Screen known miticidal essential oils for efficacy in the new smoker. A minimum of three oils will be tested.

2. Determine active concentrations and duration of application needed for each oil to achieve optimum mite knockdown.

3. Conduct field trials on standard colonies, four replicates per oil and one control.

4. Evaluate the toxicity of volatilized essential oils on mites.

5. Determine volatilized oil toxicity to adult bees.

Materials and Methods:

1. **Screen known miticidal essential oils for efficacy in the new smoker. A minimum of three oils will be tested.**

   A number of oils will be tested. Selection will be based on the oil's ability to kill mites in the vapor phase, solubility in the carrier oil and flash point.

2. **Determine active concentrations and duration of application needed for each oil to achieve optimum mite knockdown.**

   Based on recommendations of the manufacturer of the smoker we started with a 3%AI and began the trials. Higher concentrations are to be tested following the first set of trials.

3. **Conduct field trials on standard colonies, four replicates per oil and one control.**

   Nucleus colonies (nucs) were tested for mite ppulations and divided equally between the treatments based on mite populations. Two ml of 3% oil mix and carrier oil were vaporized and injected into each treatment nuc. Mite boards were immediately put into the nucs and replaced each week. Total mite drop was recorded.

4. **Evaluate the toxicity of volatilized essential oils on mites.**

Five mites were placed in a Petri dish lined with filterpaper. A hole was cut in the top of the dish and covered with screen wire. One half ml of 3% essential oils was vaporized and blown into the dish. The dishes were placed in a high humidity incubator for observation. Mites were observed for twenty four hours. Mortality was recorded. Apropriate controls were maintained.

5. **Determine volatilized oil toxicity to adult bees.**

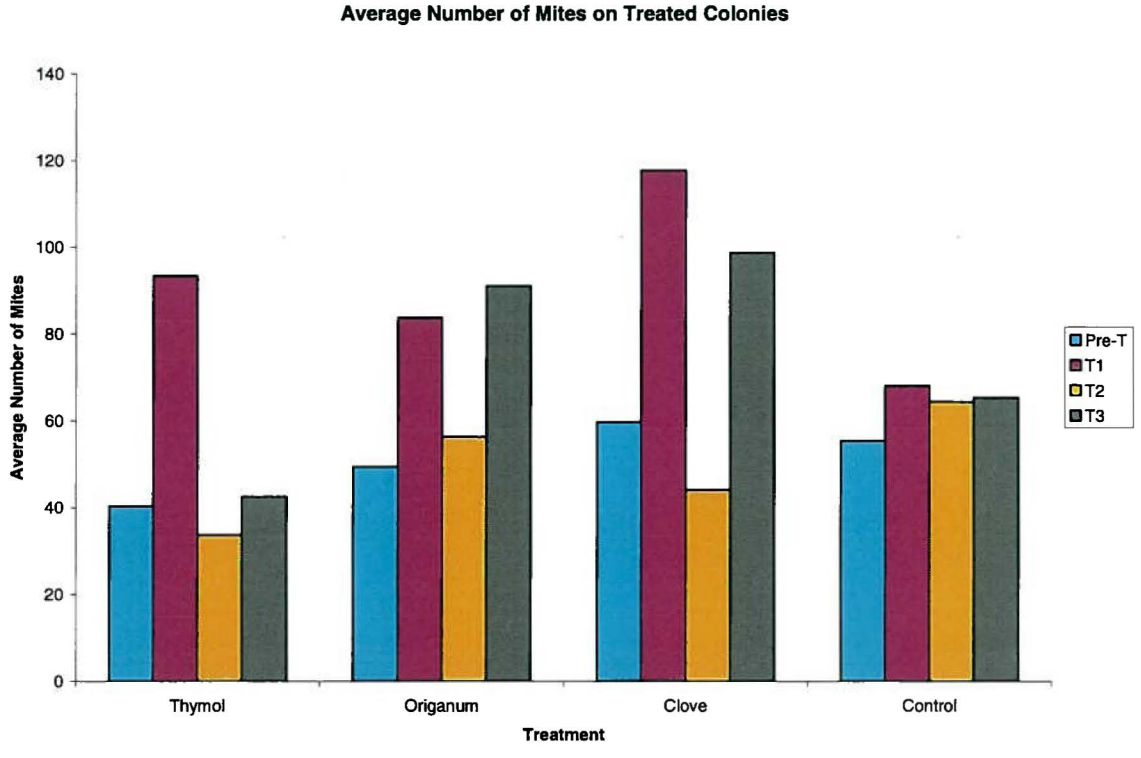
   Colonies were treated with vaporized essential oils at prescribed dosages. Dead bee traps were placed on the colonies to monitor the number of bees being removed from the colonies. Numbers of dead bees were recorded daily and compared against control colonies.

Results and Discussion:

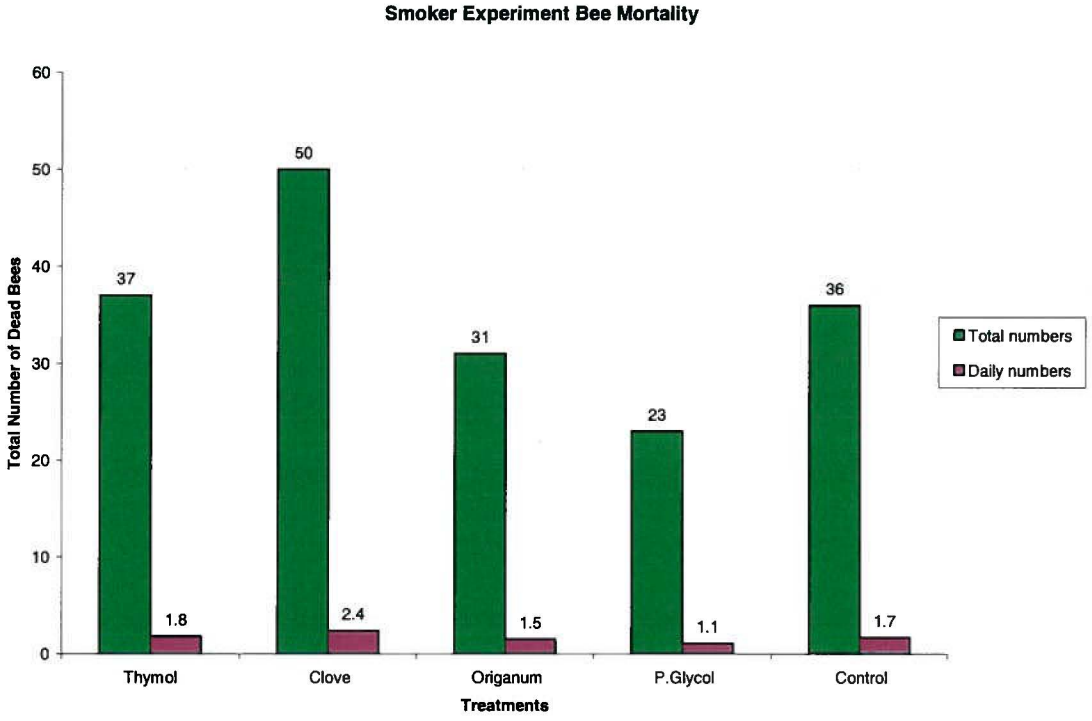
1. We have selected three oils to be used in this trial. Thymol origanum and clove were selected for their reported activity against Varroa mites.

2. Based on toxicity trials conducted in July 2006 we determined the most appropriate level of active ingredient (AI) will be 5.0 %. We observed no significant levels of mortality in honey bees at 5% AI.

3. Mites exposed to 3% essential oils in pitri dish trials all died in less than twenty minutes.



In the above trial, all treatments showed higher levels of mite mortality post treatment that was seen in the pretreatment mite board analysis. The above experiment was conducted at 3%active ingredient. We have determined that 5% AI will be more effective and we plan to conduct those trials in 2007.



The smoker used to vaporize the oils is very effective at producing a consistent amount of essential oil in the vapor phase. The above table shows 5% active oil in the vapor. The system can potentially be improved by increasing the level of oils in the vaporized smoke. Trials with higher levels showed no increase in mortality in the bees.