

Essential Oils: New Methodologies to Control *Varroa* Mites

Project No.: 07-POLL2-DeGrandi/Ahumada-Segura

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Objectives:

The project objectives are as follows:

1. Reformulate the delivery system of the starch strips to improve the release rate of the encapsulated oils.
 - a. Contact phase delivery method
 - b. Vapor phase delivery method
2. Field trial to assess the new strip formulations.
 - a. Bee Toxicity
 - b. Mite monitoring
 - c. Bee behavior

Interpretive Summary:

During the past couple of years, we have been working on a variety of delivery systems for essential oils. Working in conjunction with ARS chemists, we were able to show that microencapsulated essential oils have proven to be very effective in controlling *Varroa* mites. We have tested the encapsulated oils in a free flowing powder as well as in a solid strip. Results showed that oils contained in micro-capsules provided a better way of releasing the treatment in the colony. Our previous research with microencapsulated oils demonstrated that Thymol and Clove were very effective on decreasing the number

mites in the colony. Treatments were applied weekly and mite levels were monitored during a 6 week period.

In order to achieve a better effect when applying the oils to the colony, we have been working on a new delivery system by using starch-encapsulated strips. The strips have been reformulated and basically consist on a thin glucose-starch mix saturated with essential oil. A combination of different materials and particle sizes will be utilized in this process.

The focus of the current research project will be on the delivery system of the microencapsulated essential oils, mainly in the contact and vapor phase using the oils that have shown to be very effective in controlling mite population. To determine the efficacy of the treatments, we will monitor the rates of mite invasion and reproduction in the test colonies as well as bee toxicity and bee behavior. The essential oils proposed to be tested are: Clove, Thymol Camphor and Neem oil. Ongoing field trials applying the above described delivery systems will provide us with the research data that will be presented at the Almond Board Conference in December 2007.

We strongly believe that this new technology will enable us to test a wide range of essential oils and derivatives. Starch encapsulation essential oils offer great advantages such as: bioactivity of the product, small particle size which allows a slow release of the oil, minimum volatilization, less labor intense and the most important aspect of all is that this technology reduces human exposure to toxic compounds.

Our delivery system is compatible with commercial beekeeping because it is a known methodology and involves minimum labor. Furthermore, there are no strips to be removed after the treatments as occurs with the current mite control methods.