Discovery of Resistance Breaking Chemistries for Varroa Mite Management

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PROJECT SUMMARY

Objectives:

- Evaluate standard-use acaricide efficacies to varroa mites
- Evaluate standard-use acaricide resistance mechanisms in varroa mites
- Evaluate field efficacies and target-site activities of alternative acaricides to varroa mites

Background and Discussion:

The hematophagous mite, *Varroa destructor*, is a major pest of the honey bee, *Apis mellifera*. It is considered to be a primary driver for the periodical losses of managed bee colonies in the United States. The varroa mite requires bees for food and reproduction and, in turn, elicits physiological deficiencies and vectors infectious diseases that can compromise the health status of bee colonies. If varroa mite infestations are not effectively controlled, the number of bee colonies available for crop pollination services in the apicultural and agricultural industries will continue to decline.

The varroa mite nervous system is a proven target site for standard-use acaricides, including *tau*-fluvalinate (pyrethroid), coumaphos (organophosphate), and amitraz (formamidine). These acaricides not only have adverse health effects on bee colonies, but resistance or resistance potential to these chemistries limit their use against varroa mite infestations. Therefore, acaricide resistance is considered a serious pest management challenge for the apiculture and agriculture industries and warrants a better understanding of the mechanisms that confer acaricide resistance and the development of improved chemistries for varroa mite management.

The voltage-gated chloride channels (VGCCs) are involved in the maintenance of electrical excitability in nerve and muscle membranes. The involvement of VGCCs in this critical physiological process suggests that they might be exploited as new targets for alternative acaricide chemistries against varroa. A natural product stilbene, and related analogs, elicits paralytic activity by blocking arthropod VGCCs. It remains to be determined whether stilbene(s) have paralytic activity against varroa mite and, thus, provide an opportunity for the target-site discovery of alternative acaricides for varroa mite management.

This research study provides a targeted approach to discover alternative acaricides for varroa mite management. The investigators are focusing on the field efficacies, laboratory toxicities, and metabolic detoxification and target-site activities of stilbene chemistries on acaricide-susceptible and -resistant varroa mites. This information is anticipated to not only guide the discovery of alternative, resistance-breaking acaricides for varroa mite management, but also will also evaluate standard use miticides with respect to their efficacy against varroa and the resistance mechanisms in varroa mites.

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Project Cooperators and Personnel: Dennis vanEngelsdorp, University of Maryland; Lacey Jenson, Virginia Tech; Jeff Pettis, USDA-ARS

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- Poster location 4, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2015) at Almonds.com/ResearchDatabase
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