Determining Whether *Nosema Ceranae* and a Previously Unreported Virus Are Causal Agents of Colony Collapse Disorder

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PROJECT SUMMARY

Objectives:

- Ascertain whether colony collapse disorder (CCD), which is associated with the disappearance of honey bees, may be caused by the interaction of two specific pathogens—a fungal parasite, *Nosema ceranae*, and a previously unreported and unsequenced insect iridescent virus IIV.
- Apply proteomics analysis to a broad array of samples to determine the prevalence of the virus as well as *Nosema ceranae* in "strong" colonies, colonies failing to grow, and collapsed colonies.
- Determine whether the two pathogens can be used to induce CCD, thereby establishing a causative relationship.
- Isolate the suspect virus and arrange to have it sequenced, so that it can be used for screening and virus identification in bee samples.
- Initiate a longitudinal study of colonies as they fail, using proteomics analysis.

Background:

"Colony collapse disorder" is the term that has come to be used in recent years to identify a still-mysterious phenomenon in which worker bees suddenly disappear from honey bee colonies. Its prevalence in the United States and elsewhere has given rise to serious concern about the future of many food crops, including almonds and other tree crops, which rely on the honey bee for pollination.

The causes of CCD have been the subject of much research and debate. Attention has been focused on a range of possible factors. Among them are honey bee malnutrition, immune deficiencies, and stress; the presence of pathogens, parasites, invertebrate pests, and pesticides; the use of antibiotics; and the long-distance movement of beehives for commercial pollination purposes. Further, it is still not known whether a single factor or combination of factors is operative.

This project is based on a breakthrough in CCD research: the discovery in 2009 of both a fungal parasite and a previously unknown virus in bees from colonies afflicted with CCD. That study, conducted by the present project leader and colleagues, demonstrated a strong correlation between honey bee decline and the pathogens' presence. However, it left unresolved the issue of whether these pathogens are a cause of or associated with CCD.

This follow-up and larger-scale study has the potential of eventually leading to a better understanding of the CCD mystery and how to reduce colony susceptibility.

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- Poster location 44, Pollination Pavilion, Session 3; or on the web (after January 2011) at AlmondBoard.com/AICposters
- 2009-10 Annual Report CD (09-POLL10-Bromenshenk); or on the web (after January 2011) at AlmondBoard.com/ResearchReports