

**FINAL PROJECT REPORT**  
**WTFRC Project Number:**

**YEAR:** originally 2008-2009, (2011-2012)

**Project Title:** Honey bee colony health

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**Cooperators:** Eric Olson, WA Commercial Beekeeper

**Total Project Request: Year 1:** \$10,000

**Other funding sources**

**Agency Name:** Personal Donations from Beekeepers including Eric Olson (WA) and Tom Hamilton (ID)

**Amount awarded:** Each beekeeper donated \$10,000 (\$20,000 total)

**Notes:** additional funding from these sources has totaled over \$30,000 since 2009

**Agency Name:** WSDA, Washington State Bee Registration Program

**Amount awarded:** \$20,000

**Notes:** Funding was recommended at an emergency meeting of the Apiary Advisory Board on 3 April 2008. Funding was received

**Agency Name:** WSU, Agricultural Research Center (ARC)

**Amount awarded:** \$55,000 per annum for two years

**Notes:** Funding that has allowed the Apiculture Program to hire a technical assistant for a period of two years to assist Dr. Sheppard in coordinating the Colony Health Program

**Budget 1:**

<b>Organization:</b> WSU	<b>Contract Administrator:</b> Mary Lou Bricker; Adam Williams		
<b>Telephone:</b> 509-335-5180	<b>Email:</b> <a href="mailto:mdesros@wsu.edu">mdesros@wsu.edu</a> ; niehoff@wsu.edu		
<b>Item</b>	<b>2008</b>		
<b>Salaries</b>			
<b>Benefits</b>			
<b>Wages</b>	\$9,124		
<b>Benefits</b>	\$876		
<b>Total</b>	<b>\$10,000</b>		

Funds obtained from the WTFRC were used to supplement the salaries of individuals hired to staff a Colony Health Lab that examines parasitic mites and diseases of honey bees in an attempt to understand bee kills in Washington and the Pacific Northwest.

Note: Through an oversight of the Principal Investigator (WSS) the original funds from the WTFRC were not identified in accounting documents and remained unspent until 2011. Funds were expended in 2011 and the final \$3635.75 was expended in 2012.

## Recap original Objectives

The Apiculture program requested funds from the WTFRC to assist in setting up a diagnostic laboratory to perform examinations of mite and pathogen loads in Washington State beekeeping operations. This laboratory was set up using a compilation of funds from numerous sources and has continued to function to serve Washington State Beekeepers in this role since 2008. Numerous beekeeping organizations and individual beekeepers have donated money to keep the laboratory functional and we also received some Honey Bee USDA-CAP funding in 2010 and 2011.

We conducted a targeted survey in 2008 to:

1. Determine seasonal numbers of tracheal and Varroa mites
2. Determine the presence of *Nosema ceranae* in Washington bee colonies
3. Determine spore counts of *Nosema* in relation to seasonal changes

## Significant Findings

1. *Nosema ceranae* was found to be omnipresent in the Pacific Northwest. With the exception of 2 samples out of several thousand evaluated, only *Nosema ceranae* was detected. The previous *Nosema* disease causing organism well-known to beekeepers (*Nosema apis*) was largely absent.
2. The seasonality of *Nosema ceranae* in the Pacific Northwest was verified and published. Beekeepers could adjust treatment regimens to account for natural seasonal variation.
3. Additional research derived from the diagnostic laboratory indicated that sub-lethal pesticide exposure had pronounced effect on the susceptibility of individual honey bees to *Nosema*.

## Methods

Beekeepers in Washington State now submit colony samples to the WSU Honey Bee Diagnostic Laboratory for examination. Collection methods and details of shipment are available on the WSU Entomology Website. (<http://entomology.wsu.edu/apis/diagnostic-lab/>). Diagnostic results are usually available to the beekeeper within 2 weeks. One trained person can analyze about 10-12 colony samples for tracheal mite infestation rates /day. The determination of *Nosema ceranae* species identity is accomplished through a PCR-based molecular protocol that examines genetic variation in small subunit ribosomal DNA.

## Results and Discussion

This project resulted in a clear understanding of the incidence and distribution of the major honey bee pests within honey bee populations in WA. *Nosema ceranae* was found to be widespread and omnipresent in PNW honey bees. Additional research in our laboratory also identified sub-lethal pesticide exposure and *Nosema* disease interactions. As a result we were able to inform beekeepers that regular replacement of wax brood comb could substantially assist in removing a major source of internal hive contamination.

Overall, *Nosema ceranae* is a pathogen that beekeepers now have to live with in their operations in Washington State. The WSU diagnostic laboratory is a valuable tool for management decision-making and this laboratory receives over a thousand samples a year from Washington State beekeepers, both commercial and smaller operators. The information returned to the beekeepers

allows them to make management decisions based on actual infestation or prevalence data, rather than using a scheduled treatment system. Current annual winter losses of honey bees in the PNW average 30% per year.

Reliable treatment and control for *N. ceranae* remains elusive and one of the most promising approach is our WSU breeding effort to develop honey bees that are more tolerant/resistant to *Nosema* infection in the PNW. Ongoing WSU research on honey bee breeding and selection to deal with pathogens have led to importation of honey bee semen from Old World sources to increase genetic diversity for breeding. Since 2008, we have been able to import honey bee semen directly for breeding and have released genetic material to the western US queen production industry. In 2011 and 2012, aliquots of all semen samples were also cryopreserved in liquid nitrogen and deposited in the WSU germplasm repository.

## **Executive Summary**

The funds requested from WTFRC in this proposal were part of a multi-source request to assemble funds to establish a honey bee diagnostic service at WSU, following major colony losses faced by Washington Beekeepers due to “Colony Collapse Disorder”. The WSU Honey Bee diagnostic laboratory became operational in 2008 and has continued to provide diagnostic services for Washington beekeepers, funded with donations from individual beekeepers, local beekeeping organizations and some external grant funds (WSDA, WTFRC, USDA-NIFA Honey Bee CAP grant to WSS). Beekeepers from throughout Washington State continue to submit bee samples from their operations to be screened for 3 major honey bee parasites and pathogens: Varroa and tracheal mites and Nosema (a microsporidian pathogen). From a high of about 2500 sample submissions in 2009, sample submissions in 2011 and 2012 were 1540 and 800, respectively.

Significant colony losses for Washington beekeepers have continued since 2008, with current annual losses estimated to be around 30%. After 4 years of targeted research on Colony Collapse Disorder by a number of research groups nationwide, no single cause for CCD losses has been found. However, a number of potentially interacting factors have been reported to contribute to CCD, including sub-lethal pesticide exposure, nutritional limitations associated with placement on large monocultures, mite-virus interactions, moving “stress” in migratory operations, pathogen transmission in large “holding yards”, microsporidian infections and others. Based on research at WSU, the interaction between sub lethal pesticide exposure and likelihood of infection with Nosema has been demonstrated.

The primary issue related to honey bee colony health continues to be the deleterious effects of parasitism with the Varroa mite. Current registered products for mite control available to commercial operations (fluvalinate, coumaphos) are no longer effective due to mite resistance. Alternative registered treatments (formic acid, hopguard) are less effective in commercial operations. The primary Varroa mite control for many commercial beekeepers is off-label use of Amitraz. Presently, a section 18 request for an Amitraz product in strip form is being considered for Washington.

Overall, the diagnostic laboratory has significantly assisted the beekeeping industry as measured by its use and continued support from beekeepers themselves. The funds provided by the WTFRC in support of the set up of this laboratory helped ensure that adequate numbers of colonies of bees were available to meet the pollination needs of the Washington agricultural community.