USDA APHIS Honey Bee Pests and Diseases Survey Project Plan for 2015

Comprehensive Objective

A national survey of honey bee pests and diseases has been funded annually since 2009 by the USDA Animal Plant Health Inspection Service (APHIS). This survey is being conducted in an attempt to document which bee diseases, parasites, or pests of honey bees are present and/or likely absent in the U.S. Specifically, this survey will attempt to verify the absence of the parasitic mite Tropilaelaps and other exotic threats to honey bee populations (e.g., *Apis cerana* and Slow Paralysis Virus). To maximize the information gained from this survey effort, collected samples will be analyzed for other honey bee diseases and parasites known to be present in the U.S. This cross-country survey continues to be the most comprehensive honey bee pest and health survey to date, and provides essential disease and pest load base line information. This information will help place current and future epidemiological studies in context and thus may indirectly help investigations of emerging conditions. The University of Maryland (UMD) is coordinating this survey in collaboration with the USDA Agricultural Research Service (ARS) Bee Research Lab (BRL) and APHIS.

Primary Objective – Exotics

Tropilaelaps spp., a parasitic mite native to Asia, feeds on honey bee brood. Their parasitic feeding actions vector viruses, weaken or kill parasitized brood, and can cause infected colonies to abscond, which spreads the mites to new areas. Tropilaelaps mites can complete their lifecycle in one week, and thus this mite can outcompete the Varroa mite when both mites are present in a hive. Currently, there are no known Tropilaelaps mites in the U.S.

The exotic *Apis* species *Apis cerana*, or Asian honey bee, and Slow Bee Paralysis Virus (SBPV) are also not known to be in U.S. apiaries; this survey confirms their absence. *A. cerana* is smaller but very similar in appearance to *Apis mellifera*, is well adapted to warmer climates, builds smaller colonies, and is known to swarm many times during the year. In tropical areas (e.g., Solomon Islands) *A. cerana* has been shown to outcompete *A. mellifera* in nectar and pollen gathering and exhibits a propensity for robbing European honey bee stores. Its honey yield is far less than *Apis mellifera* making it a less valuable bee for commercial honey production.

Secondary Objective – Honey Bee Health Evaluation

A decline in honey bee health has been documented over the past 60 years. Honey bee health is at risk from factors such as parasites, diseases, poor nutrition, stress and environmental toxins. This national honey bee health survey is continuing to be conducted to ascertain the scope of parasites, diseases, and pests that may have a negative impact on honey bee populations in the U.S. This information provides additional benefit through informing and guiding the direction of honey bee parasite, disease, and pest research and mitigation recommendations to the U.S. apiculture industry. All of the data collected from the National Survey, is included in the nationwide Bee Informed Partnership (BIP) database. The Bee Informed Partnership is an extension project currently funded by the USDA National Institute of Food and Agriculture

(NIFA). As part of its core mission, the database endeavors to capture honey bee health and management practices from around the country to better inform all beekeepers with the goal of reducing colony losses. The data gathered in these extensive surveys are critical for capturing base line information on the status of honey bee health; this in turn will help place beekeeper disease load data in regional and temporal context.

Over the last 8 years, winter losses have been unsustainably high ranging from 22% to 36% nationally. This rate of loss threatens the viability of beekeeping operations and – importantly - the production of crops dependent on bees for pollination as well as honey production. Pollination is responsible for over $15 billion in added crop value, particularly for specialty crops such as nuts, berries, fruits, and vegetables. Of the 2.5 million colonies of bees in the United States, the almond crop in California alone requires approximately 1.7 million colonies, and this need is projected to increase significantly over the next few years. The bee industry is facing difficulty meeting the demand for pollination in almonds because of bee production shortages in California. Consequently, growers depend increasingly on beekeepers from other states to transport honey bee colonies across the country to meet the pollination demand (a practice known as migratory beekeeping).

Scope of work and methodology

The 2015 National Survey has two goals, 1) identify potentially invasive pests such as the exotic mite *Tropilaelaps,* problematic *Apis* species such as *A. cerana* and viruses such as the Slow Bee Paralysis Virus, and 2) conduct an epidemiological survey that would meet the goal of developing a long-term overall baseline picture of colony health.

To accomplish these objectives, cooperators distribute sampling kits, identify stationary and migratory beekeepers that will participate in sampling of their honey bee colonies, collect and preserve samples, quantify parasite loads from bees collected in alcohol and forward live samples for molecular analysis. The results of these analyses will be forwarded to the participating beekeepers and the respective state apiary contacts. Beekeepers participating in this survey should expect a summary report on the average apiary level of Nosema, Varroa loads, presence or absence of Tropilaelaps mites and *A. cerana*, and viral results from the molecular analysis in the sampled apiary within 4 months of sample collection. All data collected will be maintained at APHIS and UMD. This data will entered into the APHIS IPHIS database as well as the Bee Informed Partnership database described above.

The survey includes a visual inspection of the hives before sampling. The presence of the following are recorded at the apiaries but not included in analysis since there isn't a standardized sample technique:

1. American Foul Brood
2. Black Shiny Bees
3. Chalkbrood
4. Deformed Wing Virus
5. European Foul Brood
6. Idiopathic Brood Disease Syndrome (IBDS)

7. Sac Brood
8. Small Hive Beetle Adults
9. Small Hive Beetle Larvae
10. Wax Moth Adults
11. Wax Moth Larvae

The samples taken at the apiary and preserved in alcohol are later inspected using visual and microscopic analysis at UMD for the following:

1. *Nosema* spp. spore count
2. Tropilaelaps Mites
3. Varroa Mite loads
4. *A. cerana*

The live bees shipped directly from the apiary during collection are sent to USDA-ARS BRL. There, the honey bees are frozen until molecular and visual analyses are conducted. The molecular and visual analyses include the following:

1. Lake Sinai Virus-2 (LSV-2)
2. Acute Bee Paralysis Virus (ABPV)
3. Chronic Bee Paralysis Virus (CBPV)
4. Deformed Wing Virus (DWV)
5. Kashmir Bee Virus (KBV)
6. Israeli Acute Paralysis Virus (IAPV)
7. Slow Bee Paralysis Virus (SBPV)

Additionally, funding is provided this survey year for 10 states to collect ~3 grams of pollen from brood frames that will be tested for >170 known pesticides. This pollen will be collected from the same composite 8 colonies undergoing the standard survey sampling and sent to the USDA Agricultural Marketing Service (AMS) in Gastonia, NC for analysis. Each of the 10 states are asked to send in composite samples of pollen from 10 of the 24 apiaries this year. Also, as part of the national survey, training and outreach materials have been developed in the form of videos and written information: http://www.aphis.usda.gov/plant-health/honey-bees-survey

Project Management, Cooperators and Other Participating Institutions

This National Survey is funded and coordinated by USDA APHISand the University of Maryland. A Steering committee comprised of personnel from APHIS, ARS and UMD determined the sampling protocol, and determined the optimal distribution of sample analysis. Sampling is conducted under cooperative agreements with states. Samples are collected by state apiary specialists and university scientists who identify beekeepers whose colonies will be used

for sampling. Some of these beekeepers may also participate in conducting the survey. The states being sampled in the 2015 National Survey are:

Alabama	Michigan	Pennsylvania
Arkansas	Minnesota	Puerto Rico
California	Mississippi	South Carolina
Connecticut	Montana	South Dakota
Florida	Nebraska	Tennessee
Georgia	North Carolina	Texas
Hawaii	North Dakota	Utah
Illinois	Nevada	Virginia
Idaho	New Jersey	Vermont
Indiana	New Mexico	Washington
Iowa	New York	Wisconsin
Kentucky	Ohio	West Virginia
Maryland	Oregon	

University of Maryland personnel are responsible for the sample kit fabrication and distribution. They are also the contact for receiving all alcohol samples and apiary data information forms from the field. The alcohol samples containing any dislodged mites from the hive frames are forwarded to the UMD lab where samples are microscopically analyzed for the presence of Tropilaelaps mites.

The USDA-ARS BRL lab is the contact for receiving all live bee samples. The bees are immediately frozen and held until molecular analysis is conducted. UMD is responsible for all pest, diseases and exotic species and subspecies, as well as pesticide reporting to the beekeeper and the apiary contact for the selected states. Apiary specialists will be responsible for entering collection data into IPHIS, while UMD will be responsible for entering all data resulting from sample analysis.

Guidance for Choosing Apiaries and Hives to Sample for the USDA Honey Bee Pests Survey

- 24 apiaries should be sampled in all states except California where 48 apiaries should be sampled.
- 8 hives should be sampled in each apiary.
- Apiaries sampled should have at least 10 colonies.
- If you are sampling an apiary with a large number (hundreds or thousands of hives), please try to provide a composite sample from all locations within the apiary. This may require that you divide the apiary into quadrants and then sample a few hives in each quadrant. It is critical that hives that appear 'sick' are sampled along with hives that appear 'healthy'.
- 10 queen producers should be sampled unless there are fewer than 10 willing queen producers in your state.
- Of the remaining apiaries sampled, when possible 1/2 of the apiaries sampled should be from migratory operations (move out of state and return prior to sampling) and 1/2 should be from stationary operations (Do not move out of the state but move within the state).

- Apiaries should be chosen in order to give as close to an equal representation of the entire state as possible. Ideally, a state will be sectioned into 4 quadrants with apiaries randomly chosen within a quadrant.
- If there are a limited number of beekeepers within a state, it is allowable to sample up to 50% of the same beekeepers as in previous years.
- Additional apiaries that may occur near ports or other areas that could be considered high risk should also be considered for sampling.

Milestones and Project Timeline

A pilot survey program funded from the APHIS Farm Bill funding was initiated in 2009 and samples were collected from three states to test the inspection and collection process, assess the infrastructures related to shipping, storing and analyzing the specimens, and to gather baseline data for a survey of honey bee pests and pathogens. Hawaii, Florida and California were part of this pilot program. These are high-risk areas that have key ports, long growing seasons and diverse agricultural crops.

The 2010 limited national survey, focusing on 13 states, was performed to expand and augment the baseline pest and pathogen data collected from the pilot study conducted in 2009.   In 2011 and 2012, full-scale national surveys were funded for 34 and 32 states respectively, and these represent the most comprehensive U.S. honey bee pest and disease survey to date. Reports from previous year surveys can be found at http://www.aphis.usda.gov/planthealth/honeybees.

Steering Committee

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