

USDA APHIS Honey Bee Pests and Diseases Survey Project Plan for 2017

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) and conducted in collaboration with the University of Maryland, USDA Agricultural Research Service (ARS) and State Apiary Specialists. This national 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 bee 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* can complete their lifecycle in one week, and thus this mite can outcompete *Varroa* when both mites are present in a hive. Currently, there are no known *Tropilaelaps* species 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. In the previous 2 years of the BIP Colony Loss survey (2014-2015 and 2015-2016), summer losses equaled or exceeded winter losses. These rates of loss threaten 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 2 million colonies, and this need is projected to increase significantly over the next few years. 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 2017 National Honey Bee Survey (NHBS) 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.

The results of analyses will be forwarded to the participating beekeepers and the respective state apiary contacts as well as the State Plant Regulatory Officials (SPRO), APHIS State Plant Health Directors (SPHD), and State Survey Coordinators. Beekeepers participating in this survey should expect a summary report on the average apiary level of *Nosema* spore loads, *Varroa* loads, presence or absence of *Tropilaelaps* and *A. cerana*, and viral results from the molecular analysis in the sampled apiary within 4 months of sample collection. After all samples have been analyzed, SPHDs, SPROs and state apiary specialists will receive a summary report for their state and a report with the national-level results will be published on the APHIS honey bee website. All data collected will be maintained at APHIS and UMD. This data will be entered into the APHIS NAPIS database as well as the Bee Informed Partnership (BIP) database described above.

The survey includes a visual inspection of the hives before sampling. The presence of the following are recorded at the apiaries and entered into both the BIP database and NAPIS database but not included in analysis. Since visual identification of these diseases and pests are dependent on the training and experience of the sampling personnel, they are not included on the reports:

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* presence or absence
3. *Varroa* loads
4. *A. cerana* presence or absence

The live bees shipped directly from the apiary during collection are sent to the UMD Honey Bee Lab addressed to:

Rachel Fahey
University of Maryland
4291 Fieldhouse Drive
Plant Sciences Bldg. Rm. 4112
College Park, MD 20742

There, the honey bees are frozen and transported to the USDA-ARS BRL where 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. Varroa Destructor Virus/Deformed Wing Virus - B (VDV/DWV-B)

Additionally, funding is provided for this survey year for states to collect ~3 grams of wax from brood frames that will be tested for >170 known pesticides. Wax will be collected from one of the 8 colonies undergoing the standard survey sampling and sent to the USDA Agricultural

Marketing Service (AMS) in Gastonia, NC for analysis. Each state is asked to send in samples of wax 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

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 41 states and territories being sampled in the 2017 National Survey are:

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

University of Maryland personnel are responsible for the sample kit fabrication and distribution. Mailing labels for returning samples are included with the kits, however, states are responsible for purchasing postage. UMD is the contact for receiving all alcohol samples and apiary data information forms from the field and should be addressed to:

Rachel Fahey
University of Maryland
4291 Fieldhouse Drive
Plant Sciences Bldg. Rm. 4112
College Park, MD 20742

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*.

The USDA-ARS Bee Research Lab (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. State Survey Coordinators enter collection data into NAPIS, while UMD will be responsible for maintaining the data in the BIP database.

*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, 2012, 2013, 2014, 2015, and 2016 full-scale national surveys were funded. Participation in the survey was 34 states in 2011, 32 in both 2012 and 2013, 28 in 2014, 37 in 2015 and 38 in 2016. In 2014, with limited funding the amount of participating states was reduced to 27 states and 2 territories. The number of participants increased the following year for the 2015 survey to 36 states and 1 territory as increased funding was made available. The number of participants increased again in 2016 survey to 38 states and 2 territories. This National Survey represents 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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