The **Research** Buzz

by Hannah Whitehead, Honey Bee Extension Educator, UMass Amherst, **February 2021**

Welcome back to the Research Buzz, a recurring column that summarizes the newest and coolest in bee research. Over the past few months, several exciting papers based on multi-year multi-state datasets were published: two using data from the Bee Informed Partnership's loss and management survey, and one summarizing pesticide results from the APHIS National Honey Bee Survey. You'll also learn about a new screened bottom board meta-analysis (which asks: do they reduce *Varroa* after all?), and hear about an exciting new honey bee textbook. You can also read this column on the UMass Extension website.

1 Determining Baseline Pesticide Levels in US Pollen

USDA APHIS Sampling.
Photo credit: Hannah Whitehead

As part of the annual USDA APHIS national honey bee survey, state bee inspectors from 39 states gather pollen and bee samples from large-scale apiaries. These samples are then assessed for diseases and pesticides in order to track longitudinal national trends. You can learn more about the survey here, and explore the data here. In a paper published this past month, researchers analyzed pesticide results from seven survey years (2011-2017), in order to develop a baseline for future studies. They found that >80% of samples were contaminated, with an average of 2.78 pesticides per sample. Overall, miticides were the most commonly detected pesticide type, following by insecticides and fungicides. The detected pesticides with the highest toxicity to bees were insecticides (especially neonicotinoids), miticides, one fungicide (THPI), and one herbicide (atrazine). Over all seven years, insecticide prevalence decreased but herbicide and fungicide prevalence increased. Interestingly, higher fungicide concentrations were correlated with a higher risk of ***Nosema***, brood disease and queen problems. The authors hypothesize that the fungicides may destroy beneficial colony fungi, leaving bees vulnerable to more destructive fungal spores like ***Nosema***.

Why is this research important?

Establishing baseline national information on in-hive pesticides will allow us to detect future trends. The results from this study are consistent with other pesticide surveys, including one conducted in MA in 2018 (which you can read about here). The fact that this study finds a link between fungicides and ***Nosema*** is also important because even though fungicides are not very toxic to bees directly, researchers are beginning to realize that they may impact hive health in significant ways.

Read the full study here.

2

Testing Best Management Practices from the BIP Survey

For a decade, the Bee Informed Partnership has collected data on US colony loss and hive management (you can take a look at the data here). This past year, they published two exciting papers: in one, they use survey data to identify beekeeping strategies associated with lower losses, and in the other, they test those best management practices in seven apiaries across the United States. I've summarized both studies below:

Study #1

First, the researchers used survey data from 2012-2015 to tease out the management practices that were most associated with lower winter losses. **They identified four key actions: (1) reusing dead-out equipment immediately rather than storing it (2) adding new hives through splits or nucs rather than packages, (3) treating for Varroa whenever mites exceeded thresholds, rather than simply once a year, and (4) freezing stored comb before reuse.** They call these actions "Best Management Practices", or BMPs. Interestingly, they did not find correlations with supplemental feeding, or queen renewal and queen age. (Note that actions 1 and 4 are somewhat contradictory. However, they both imply that storing old equipment at room temperature can be problematic: beekeepers should either reuse it immediately or freeze it before adding it to a hive)

Study #2

Second, **researchers tested these four BMPs in experimental apiaries.** They established seven apiaries in five states (Minnesota, Maryland, North Carolina, Oregon and Tennessee). Each apiary contained 20 colonies, split into two groups of 10. One group was managed using BMPs and the other using Average practices, as determined by BIP survey responses (see table on the right). The apiaries were maintained over three years, and assessed for population size, queen status, brood pattern, honey production, disease, and colony loss.

	Average Practice	*BMP*
Action on deadouts	Store equipment for later use	Reuse equipment immediately by adding to living colonies or using for a split
Varroa control frequency	Apply miticides once in fall	Monitor monthly and apply miticides when above 3.0 mites/100 bees
Starting new colonies	Packages	Make splits when possible and buy nucs if splits impossible
Comb culling technique	Do not treat old brood comb before reuse	Freeze old brood comb before reuse

from Kulhanek et al. 2021

In the end, the two groups were similar in terms of population size, queen pattern, brood pattern and honey production. **However, BMP colonies had consistently lower *Varroa* levels, and lower winter losses. Notably, these effects compounded over the years, with *Varroa* levels increasing over time in Average colonies, and winter losses decreasing over time in BMP colonies.** The researchers also noticed that mite populations in BMP colonies tended to rebound shortly after treatment, suggesting that they were picking up mites from nearby colonies via robbing or drifting.

Why is this research important?

There are several key take-aways from these studies: (1) *Varroa* treatment dominated the results of study 2, further emphasizing the importance of *Varroa* management. Future research is needed to understand the effects of comb management and colony origin. (2) Treating for Varroa once a year is not enough. Beekeepers should treat whenever hives exceed the 2-3% treatment threshold. (3) It is important to think of *Varroa* management in multi-year time scales. And (4) we need more research on the way horizontal mite transmission (via drifing and robbing) affects mite levels.

Read the first study here, and the second study here.

Formic acid applied to a hive. Photo credit: Wyatt Shell

3 Do Screened Bottom Boards Reduce *Varroa* mites?

For years, the science has been inconclusive about screen bottom boards: do they reduce *Varroa* mites, or not? In theory, if a hive has a screened bottom board, any in-hive mites that are dislodged would fall through the screen onto the sticky plastic insert below and have a harder time crawling back into the hive (thereby reducing the mite population in the hive). However, studies have found that the impact of screened bottom boards on *Varroa* is so small that it is not statistically significant. Michigan State's Zachary Huang along with international collaborators wondered whether the lack of a strong trend was because the boards were ineffective, or because the sample sizes (e.g. the number of hives being tested) were simply too small to detect a statistically significant effect. **In order to answer this question, they conducted a meta-analysis on the existing literature.** They compiled data from seven published papers, comprising 145 hives total. They found that, across all of the studies, *Varroa* populations in hives with screened bottom boards were significantly lower than in hives with solid bottom boards.

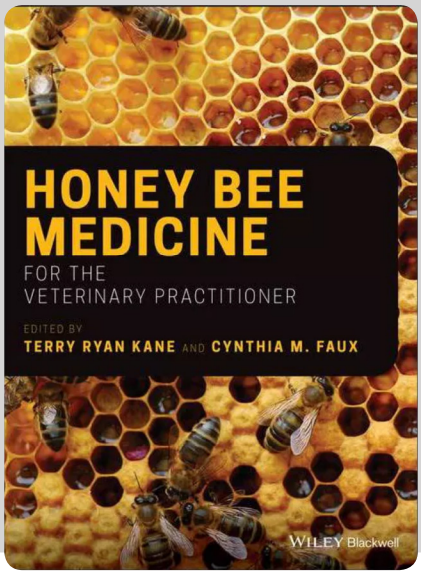
glorybee.com

Why is this research important?

For a long time, it's been unclear whether screened bottom boards impact *Varroa* mite levels. **This meta-analysis finally finds that they DO in fact reduce varroa.** This does not mean that screen boards are a silver bullet. It does mean that they are another non-chemical tool that beekeepers can use along-side other chemical (e.g. oxalic acid) and non-chemical (e.g. drone brood removal) tools, as part of an **integrated pest management strategy**. (Learn more about IPM here).

Read the full study here.

4 New Honey Bee Textbook for Veterinarians (and beekeepers!)



A new veterinary textbook on honey bee heath was published this winter: **Honey Bee Medicine for the Veterinary Practitioner**. It is the most comprehensive textbook on honey bee veterinary medicine for US practitioners published in recent years, and features rock-star authors including Tom Seeley, Randy Oliver, David Tarpy, Meghan Milbrath, Dewey Caron, Margarita López-Uribe, Jay Evans and many more. It is also exciting because it complements national and local efforts (like the Honey Bee Veterinary Consortium and the MA Bee-Vet Project) to train veterinarians to diagnose and treat honey bee diseases.

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