Honeybee disease investigated through hive microbes research

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Bees work in the hive near Kirk Grubbs' desk in the Microbial Sciences Building.

(Phys.org)—If you spot a honeybee in the UW-Madison's Allen Centennial Gardens and are wondering where it came from, look up.

There's a good chance it lives on the top floor of the nearby Microbial Sciences Building. Six floors up in bacteriologist Cameron Currie's lab, doctoral student Kirk Grubbs maintains a hive right next to his lab bench. Bees come and go through a tube that passes through the building's brick wall.

"I like to have a hive in the lab so I can see what's going on. It's really helped me conceptualize what actually happens inside a hive and how it

acts as one big organism," says Grubbs. He often has more research hives on a deck just down the hall, and still more off campus, at Madison's Vilas Park Zoo and at the university's West Madison Agricultural Research Station.

Grubbs is unique among the researchers on Currie's team. Most of them study leaf-cutter ants-exploring the complex symbiosis between the ant and the beneficial bacteria they grow on their bodies-but Grubbs is the lab's honeybee guy. He is studying the microbial communities associated with healthy honeybee hives, in hopes of better understanding why a lot of them are getting sick.

Honeybees are vital to our food system. U.S. farmers count on them to pollinate about $15 billion worth crops each year. But today's bee colonies are at risk. Since 2006, commercial hives have been plagued by what's known as colony collapse disorder, a perplexing phenomenon in which large numbers of bees abruptly disappear. Scientists aren't sure what causes this to happen, but they speculate that a number of factors may be involved-from mites and diseases to malnutrition and pesticides.

Grubbs' research aims to see how the bee's microbial partners might fit in.

So far, he's gathered baseline data about the microbial community in a typical, healthy hive. As it turns out, the make-up of the microbial community varies from one part of the hive to another, depending on what's going on in each location-whether bees are storing honey, pollen or brood-and these different microbial communities seem to be consistent across hives.

"There are unique and steady microbial communities for each of these components," says Grubbs. "This suggests we need to shift the way we think about hives. Instead of looking at the hive's microbial community

as a whole, we need to look at the different communities associated with hive components. This will create a much more accurate picture of what's going on."

By establishing what's normal, scientists can now begin to look at if and how microbial communities shift when hives are under stress from disease or other causes. This information could have valuable, real-world applications.

"One of the big worries is how to develop more effective and environmentally-friendly methods of treating hives that are sick," says Grubbs. "But even before that, we need to find inexpensive and quick ways to identify hives that are sick or becoming sick. We could potentially do that by looking for changes in their microbial communities."

In addition to helping identify hives that are sick, these microbial communities could also potentially help cure them. A large share of the bacteria in hives are actinomycetes, a type that is the source of most our current medicinal compounds. As he studies actinobacteria in hive components, Grubbs, working in collaboration with Harvard's Clardy lab, has come across leads on a number of promising, previously unknown antibiotic-like compounds. One of them, it appears, could help bolster honeybee health and perhaps protect hives from colony collapse.

"We isolated an actinobacteria that is producing a novel antibiotic-like compound that appears to specifically inhibit the growth of a common hive parasite," says Grubbs. "If bees are already using actinobacteria to produce antibiotics to help protect the hive, then its plausible that we could use these same antibiotics to treat diseased hives."

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