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Scientists Untangle Multiple Causes of Bee Colony Disorder

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PULLMAN, Washington, July 29, 2009 (ENS) — A microscopic pathogen and pesticides embedded in old honeycombs are two major contributors to the bee disorder known as colony collapse disorder, which has wiped out thousands of beehives throughout the United States and Europe over the past three years, new research at Washington State University has confirmed.

Working on the project funded in part by regional beekeepers and WSU's Agricultural Research Center, entomology professor Steve Sheppard and his team have narrowed the list of potential causes for colony collapse disorder.

"One of the first things we looked at was the pesticide levels in the wax of older honeycombs," Sheppard said. Using honeycombs contributed by U.S. Department of Agriculture, Sheppard found "fairly high levels of pesticide residue

Bees raised in those hives "had significantly reduced longevity," he said.

One easy solution is for beekeepers to change honeycombs more often. In Europe, for example, apiarists change combs every three years.

"In the U.S., we haven't emphasized this practice and there's no real consensus about how often beekeepers should make the change," said Sheppard. "Now we know that it needs to be more often."



Many researchers are investigating the reasons for a variety of agricultural crops in the United States. Beekeepers fly their hives cross country to pollinate almond groves in California, field crops and forages in the Midwest, apples and blueberries in the Northeast and citrus in Florida.

Unlike other diseases that have plagued bees in the past,

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Honeycomb may contain pesticides applied years ago. (Photo by [Hi Paul](#))

does not kill bees within the hive. It leaves a hive with few newly hatched adults, a queen and plenty of food.

Another aspect of Sheppard's work, which is being conducted by graduate student Matthew Smart, focuses on the impact of a microsporidian pathogen known as *Nosema ceranae*, which attacks bees' ability to process food.

Beekeepers have considered it to be "the smoking gun" behind colony collapse disorder.

"*Nosema ceranae* was only recently described in the U.S., the first time in 2007," Sheppard said. "But while no one really noticed, it has spread throughout the country."

But in a 2007 study, Jeffery Pettis, who heads the U.S. Agriculture Department's Bee Research Laboratory, and colleagues reported that *Nosema ceranae* had been in the United States for at least 10 years.

Smart surveyed numerous bee colonies in both the Pacific Northwest and in California, and found *Nosema ceranae* to be very widespread.

Sheppard's earlier research found *Nosema ceranae* to be a tough bug to battle. Of 24 hives checked in early 2008, *Nosema* build-up was high in a majority of the bees sampled.

Beekeeper Eric Olson of Yakima, Washington said he treated a hive with a mega-dose of the antibiotic fumagillin. "That should have caused the *Nosema* to either disappear or at least go down," he said, "but the levels went up."

"What it basically does is it causes bees to get immune-deficiency disorder. So it's actually causing the bees to almost get a version of HIV," said Mark Pitcher, president of Babe's Honey and the biggest beekeeper in Saanich on Canada's Vancouver Island.

Pitcher told the "Saanich News" that once the bees' immune systems are compromised, they become susceptible to dying from a wide range of causes, including chemicals once used to protect the bees from parasites such as varroa mites.

Last summer, researchers at Pennsylvania State University found unprecedented levels of fluvalinate and coumaphos - pesticides used in the hives to combat varroa mites - in all honeycomb and foundation wax samples. They also found lower levels of 70 other pesticides and metabolites of those pesticides in pollen and bees.

The Penn State researchers worked with the National Science Laboratory of the U.S. Department of Agricultural Marketing Service that already tests commodities such as milk and fruits and vegetables.

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"When we began doing this work, honey was not regularly analyzed, and bee pollen was not a commodity and so was not analyzed," says Mullin. "We decided to go with the types of screening the lab does for milk and apples which look at over 170 pesticides. Now, honey is included in the commodities to be analyzed."

All of the bees tested showed at least one pesticide and pollen averaged six pesticides with as many as 31 in a sample.

"We do not know that these chemicals have anything to do with colony collapse disorder, but they are definitely stressors in the home and in the food sources," says Penn State's Dr. Maryann Frazier. "Pesticides alone have not shown they are the cause of CCD. We believe that it is a combination of a variety of factors, possibly including mites, viruses and pesticides."

While beekeepers will have a difficult time controlling pesticide exposure outside the hive, the Penn State researchers tested a method for reducing the chemical load in beeswax.

Using gamma radiation from a cobalt 60 source housed at Penn State's Breazeale Reactor, they irradiated the sheets of beeswax that beekeepers use as the structural foundation for the bees to build their combs. They used radiation levels at the high end of that used to irradiate foods and found that in the wax, irradiation broke down about 50 percent of the acaricides, pesticides that kill mites.

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