Microbial team may be culprit in colony collapse disorder

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New research from the United States Department of Agriculture (USDA) identifies a new potential cause for "Colony Collapse Disorder" in honeybees. A group of pathogens including a fungus and family of viruses may be working together to cause the decline. Scientists report their results today at the 110th General Meeting of the American Society for Microbiology in San Diego.

"There might be a synergism between two very different pathogens," says Jay Evans of the USDA Agricultural Research Service, a researcher on the study. "When they show up together there is a significant correlation with colony decline."

Beginning in October 2006, some beekeepers began reporting losses of 30-90 percent of their hives. Although colony losses are not unexpected during winter weather, the magnitude of loss suffered by some beekeepers was highly unusual.

"Domesticated honey bees face numerous pests and pathogens, tempting hypotheses that colony collapses arise from exposure to new or resurgent pathogens," says Evans.

To better understand the cause of these collapses, in early 2007 Evans and his colleagues collected bees from both healthy and declining colonies across the country but primarily from California and Florida where most of the commercial pollination activity takes place. They have screened these samples and similar samples from each year since then for both known and novel pathogens.

They found a slightly higher incidence of a fungal pathogen known as Nosema ceranae in sick colonies, but it was not statistically significant until they began pairing it with other pathogens.

"Levels of the fungus were slightly higher in sick colonies, but the presence of that fungus and 2 or 3 RNA viruses from the family *Dicistroviridae* is a pretty strong predictor of collapse," says Evans.

Nosema are transferred between bees via the fecal-oral route. When a bee initially ingests the microbes and they get to the mid-gut, they harpoon themselves into the gut wall and live inside the epithelial cells there. Evans believes that the slightly higher numbers of the fungus somehow compromise the gut wall and allow the viruses to overwhelm the bees. In colonies with higher Nosema numbers they found virus levels to be 2-3 times greater than healthy colonies.

While this is a working theory and they are still in the discovery phase looking for new pathogens, Evans and his colleagues are also actively looking for a way to boost bee defenses against Nosema.

"A way to protect against Nosema might be the key for now," says Evans.

Provided by American Society for Microbiology