Can stress management help save honeybees?

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Honeybees foraging on sunflower. Credit: F.M. Buian, University of Udine

Honeybee populations are clearly under stress—from the parasitic *Varroa* mite, insecticides, and a host of other factors—but it's been difficult to pinpoint any one of them as the root cause of devastating and unprecedented losses in honeybee hives. Researchers writing in the Cell Press journal *Trends in Parasitology* on November 24th say that the problem likely stems from a complex and poorly understood interplay of stresses and their impact on bee immunity and health. It's a situation they suspect might be improved through stress management and better honeybee nutrition.

As the bees have grown weaker with stress, they are left susceptible to diseases that the beneficial insects can normally carry without issue. That's especially problematic given that honeybees live together in such close quarters.

Honeybees live in complex societies, characterized by densely packed populations, and have evolved unique mechanisms for interacting with pathogens, explained Francesco Nazzi and Francesco Pennacchio of the Italian universities of Udine and Napoli, respectively. Some pathogens, such as the deformed wing virus, can cause asymptomatic infections that are normally kept under control by the immune system.

"These covert infections are very common all over the world and represent a kind of Damocle's sword for honeybee colonies," Nazzi said. "When bees are exposed to stress agents, which may adversely affect the immune competence, a sudden health decay can occur due to uncontrolled pathogen proliferation."

The first records of mysterious deaths of honeybee colonies were reported in the United States in 2006, followed shortly by similar reports in other countries. Systematic monitoring in Europe and the United States has shown that losses in the range of 20 to 30 percent of hives are common, and, in some places, the situation has been much worse.

The Varroa mite certainly doesn't help matters, as it sucks hemolymph (the equivalent of blood) from the insects' bodies, debilitating the bees and facilitating viral transmission. Neurotoxic insecticides like neonicotinoids, at sublethal doses, may also impair the bees' immune response and contribute to colony decline and eventual losses.

"But," Nazzi and Pennacchio say, "their importance depends on the health conditions of exposed bee populations and cannot be considered the sole factor responsible for colony losses. Looking at bee colony losses from this perspective may allow us to partly explain the multifactorial origin of this multifaceted event."

They call for more basic science to produce sound knowledge of the underlying immune responses and the molecular mechanisms that drive them. Those should be followed by tests under natural, field conditions, along with efforts to select for natural bee populations that are more resistant to those stresses. New schemes of "Integrated Stress Management" are also needed.

Honeybees might be fortified not only by helping to manage their obvious stresses—by keeping parasites in check, for example—but also by paying more attention to their diet, the researchers say.

"Beekeepers should pay extreme attention to parasite control, not only by acting directly on them, but also by enhancing the bee competence to face the challenge of environmental stress that may negatively influence immunity and health conditions," researchers said, drawing special attention to breeding for resistance and supplementary nutrition in the form of sugars, pollen, and other food sources.

More information: Nazzi et al.: "Disentangling multiple interactions in the hive ecosystem" *Trends in Parasitology*, 2014.

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