



[News](#) - March 31, 2009

Is Life Too Hard for Honeybees? Researchers zero in on the culprits behind colony collapse disorder

By Wendy Lyons Sunshine

Commercial honeybees are tough. They get trucked cross-country to pollinate vast crops, often while fed unnatural diets such as sugar water and soy flour. Their hives are treated with chemicals to deter parasites, and they're exposed to pesticides and fungicides in the fields where they work and feed.

"I can feed you a diet of Hershey bars, keep you up all night, truck you around, and spray Raid in your face, and I guarantee you'll get sick," says Jerry Hayes, Florida's assistant chief of [apiary inspection](#). "That's kind of what's happening to bees."

Just how much physical abuse do honey bees face? And what are the implications? Those questions inform research into [colony collapse disorder](#) (CCD), a phenomenon that has killed over a third of commercial honeybees in the U.S. and some European countries since 2006. With no obvious cause, scientists have begun examining how beekeeping practices and environmental contamination may be impairing hive immunity.

CCD research poses challenges, because stricken bees disappear, taking forensic evidence with them. Lab experiments offer clues, but translating those into reliable, controlled field studies poses difficulties, because bees roam for miles. Still, with [valuable crops](#) such as almond, apple, blueberry and others at stake, even ordinary citizens are trying to help.

"The interest from the general public has been tremendous," says entomologist Jeff Pettis, lead researcher at the [U.S. Department of Agriculture Agricultural Research Service's \(USDA-ARS\) Bee Research Laboratory](#) in Beltsville, Md. He has received phone tips and even jars of bees from people hoping to help solve the mystery. Lately, he tells them several suspects have already been ruled out, including tracheal mites, small hive beetles, genotype differences, cell phone exposure, melamine contamination and genetically modified crops.

"For almost two years we've been documenting and sampling colonies that are dying and examining healthy colonies in the same area, trying to determine what factors are involved," Pettis says. "I think there are interactions going on, like low-level pesticide exposure and poor nutrition weakening the host honeybees and then pathogens doing the killing. It's similar to a human who might not be eating, or is frail and traveling too much, and as a result is more susceptible to pathogens. If you go into a hospital in excellent health, you don't contract pneumonia, but if you go in weakened, pneumonia kills you."

Pesticides and fungicides

How much [pesticide exposure](#) is too much for a honey bee? Traditionally, Pettis says, manufacturers seek clearance for pesticides by using the LD-50 test, which "essentially applies toxic stuff to bees and sees if half or more of them drop dead." This brute force test does not, however, gauge long-term systemic effects.

"The general feeling is that we need to move beyond mortality testing to sublethal testing that looks at the



shortening of life span, disorientation, reduced vigor, and other things," says Pettis, who has been in discussions with the U.S. Environmental Protection Agency (EPA) about developing newer, more sensitive pesticide tests.

EPA spokesperson Dale Kemery says that the EPA's Office of Pesticide Programs, industry stakeholders, and academics have huddled at least twice over the past six months to discuss additional pesticide testing. He refused to provide details of the meetings.

Pesticide residues show up in a variety of ways. For example, "entombed pollen" in the hive can display pesticide and fungicide content, according to a study by Pennsylvania State University researchers and Pettis now in press at the *Journal of Invertebrate Pathology*. Pettis says he is working on additional pesticide studies that may provide important new insights into hive risks.

Nutrition

Bees forage in a 2.5-mile (four-kilometer) radius of their colony and are designed to feed on [multiple flowers](#). "Like the food pyramid for humans," Hayes says, "bees need variety in their diet." The problem is they get shipped into orchards and cropland where they are surrounded by nothing but a single crop for many miles. Beekeepers must feed them nutritional supplements, but questions remain about whether those feeds can sustain bees adequately.

For example, in nature, honey bees do not actually eat pollen. They add moisture, nectar, bacteria and fungi to ferment it and make it digestible. "We are looking at trying to duplicate the fermentation process that bees naturally use, using it with beekeeper feed, and manipulating those to improve an artificial diet," Hayes says. Researchers from his office offered bees different foods, and found they prefer fermented pollen feeds, but avoid common soy-based feeds and treat them as debris. These findings are set to be published in the *Journal of Apicultural Research*.

Pathogens and parasites

There is also the looming specter of illness, whether a viral infection or some kind of parasite. "We've looked for specific viruses and see them sometimes but not consistently," Pettis says. "For example, the *Nosema* gut parasite [which invades a bee's digestive tract]—we see those at high levels in some bees but not in others. There doesn't seem to be one pathogen in particular that's implicated."

Israeli researchers recently pinpointed a genetically based treatment to control Israeli acute paralysis virus ([IAPV](#)), which had been the leading pathogenic suspect earlier in CCD research. Later findings suggest that the deformed wing virus (in which bees suffer from misshapen wings), Kashmir bee virus (an RNA-virus that affects a bee's mitochondria) and other pathogens also pose threats.

Varroa mites are external parasites that weaken bees and spread viruses. To combat them, beekeepers traditionally apply miticides. Researchers at Michigan State University and the USDA-ARS's Carl Hayden Bee Research Center in Tucson, Ariz., are finding that sublethal doses of essential oils seem to offer mite-control benefits with fewer side effects.

Dozens of [CCD-related studies](#) are still ongoing across the country, examining everything from parasite control devices to the migratory stress of bouncing around on a truck in fluctuating temperatures. Answers can't come too soon for the agricultural industry. And with commercial hives affected, CCD could expand into the wild. Research now suggests that bees brought in to pollinate greenhouses could escape and infect nearby wild bees. And when wild bees are affected, scientists worry that they will no longer play the role of genetic insurance policy.

Rachael Winfree, an associate professor of entomology at Rutgers University in New Jersey, studied 23 small New Jersey and Pennsylvania watermelon farms and found that wild, native bees were depositing 62 percent of the pollen on the crops.

"Given concerns about [CCD](#), in this region for this crop we actually have a backup plan, even if we lost all the honeybees," she says. "Ninety percent of these farms would be okay because wild bees serve as a backup plan from the ecosystem."

Further Reading

[Bill Ford: Prepare for Auto Industry Transformation](#)

[Future Solutions: Green Jet Fuels](#)

[What Makes Us Human?](#)

[Obama Administration Relies on Fast and Furious Rebound in Car Sales](#)

[Taking the Pulse of Patents](#)

[Solving the Mystery of the Vanishing Bees](#)

[Sausage without the Squeal: Growing Meat inside a Test Tube](#)

[A Chip against Cancer: Microfluidics Spots Circulating Tumor Cells](#)