



Scientists have an official name for the disappearing honeybees — **colony collapse disorder**.

But they don't know what's actually happening to the bees.

MAES entomologist Zach Huang has some ideas about the disease.

In late 2006, beekeepers across the country began to panic. Their honeybees were disappearing. Keepers would open a hive to check on the insects, and instead of the 40,000 bees they had seen just the week before, a scant 200 would be buzzing around the combs. And there were no dead bees in the hive. The bees were just...gone.

By January 2007, the entire agricultural and ecological community began to share the beekeepers' panic. Amid reports of unprecedented colony losses, bee populations were rapidly declining. Honeybees are the main pollinators for hundreds of crops — experts estimate that about one-third of the food eaten in the United States has been pollinated by the honeybee. Almonds, apples, blueberries, avocados, cherries, broccoli, pumpkins, sunflowers, and many other fruit, vegetable and nut crops are almost totally dependent on honeybee pollination. Scientists at Cornell University estimate the value of honeybees as commercial pollinators to be about \$15 billion. In Michigan, about \$455 million worth of crops depend on honeybees. Almond growers in California need about 1.5 million colonies to pollinate their trees during a 3-week window in late February and early March. If the bees keep disappearing, the crops eventually will, too. No other pollinator can take the place of the honeybee.

As more and more empty hives were found across the country (so far 35 states have confirmed incidents), scientists coined a new term, colony collapse disorder (CCD), to ensure that everyone was talking about the same thing. ▼



Going, Going, Gone

MAES entomologist Zach Huang inspects one of his hives on campus. So far, none of his bees have been afflicted with CCD. He wonders if CCD is caused by a combination of factors, which would make a definitive cause — and a cure — difficult to tease out.



“CCD is a very puzzling problem,” said Zachary Huang, MAES entomologist. “So far, we’ve been able to rule out a number of causes. We know it’s not genetic because it can’t be linked to a specific queen breeder. We know it’s not linked to genetically modified plants. We know it’s not geographically clustered because it’s been reported at locations across the country. We’ve ruled out radiation from cell phone towers, imadocloprid [a pesticide] and bee feeding. But we’re not close to figuring out what *is* causing CCD.”

In January 2007, the CCD Working Group was formed to identify the causes of the disease and develop strategies to prevent further bee casualties. Huang wasn’t part of the initial working group, but he was invited to the first CCD conference in Washington, D.C., and has formed some theories about what’s causing CCD. Huang also provides CCD information for Michigan beekeepers and farmers on his Web site, www.cyberbee.net.

According to Huang, CCD shows up most often in migratory colonies, though the disease is not limited to these traveling bees. Because there is such a demand for bees as pollinators, many beekeepers rent out their hives to farmers across the country. One hive could pollinate almonds in California, apples in Washington, cotton in Texas and oranges in Florida.

Reports of dead bees in Europe and China ignited fears that CCD had spread to those continents. But Huang said

this turned out to be untrue. The Chinese and European bees were dying and had different symptoms than colonies with CCD.

“The latest paper on the subject postulates that CCD is caused by a pathogen,” Huang said. “But because we don’t have any corpses to study, it’s hard to be definitive. The evidence is circumstantial.”

Scientists recommend that beekeepers avoid using the old equipment that was in contact with colonies with CCD. When new colonies are introduced to the old equipment, they, too, develop CCD.

“Irradiating the equipment did seem to kill whatever is causing CCD,” Huang said, “which suggests some sort of pathogen or parasite. But we don’t know anything more than that.”

For his part, Huang wonders if CCD is caused by a combination of factors, which would make a definitive cause difficult to tease out. On its own, each factor might be relatively benign, but when they’re layered on top of one another, the result might be deadly. For example, if a hive is infested with Varroa mites, the colony is weakened — there are fewer bee offspring and more deformed bees. Varroa mites are parasites that inject an immunosuppressant into the bees while they suck the bees’ blood. This could then make it difficult for the bees’ immune systems to fight off other diseases. In addition, moving a hive every few weeks during pollination season

stresses the bees. While they're working as pollinators, the bees are also exposed to pesticides. In this stressed, immunosuppressed, weakened state, the colony might be vulnerable to an opportunistic infection that wouldn't affect healthy bees or bees that hadn't been exposed to all these hazards.

In September, the CCD Working Group announced that a disease, Israeli acute paralysis virus, seemed to be strongly associated with beekeeping operations that had experienced big losses. The research found some evidence of the virus in some Australian bee samples, though Australia hasn't reported CCD levels comparable to those seen in the United States.

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“This is a nice development,” Huang said, “but the virus must be working together with some other factors because Canada has been importing bees from Australia, and those bees do not have CCD. Australia has the virus but not much CCD, probably because there are no mites to transmit the virus. So there's a link between the virus and CCD, but there's no proof of causation.”

Intriguingly, this isn't the first time bees have disappeared. In his research, Huang found a paper from 1879 saying that honeybees seemed to have developed a “disappearing disease” that lasted for about 5 years. Other reports have described symptoms similar to those of CCD in the more recent past. Scientists are unsure if the conditions are all caused by the same factors. One thing everyone is sure of is the need for more research.

In March, a bill was introduced in Congress that would give the U.S. Department of Agriculture \$50 million over 5 years to study colony collapse disorder. Legislators also are discussing a possible emergency appropriation and are considering adding research money for CCD to the farm bill. At the end of June, a group of senators upped the ante by introducing the Pollinator Protection Act, which would authorize \$89 million in federal funding over 5 years for research on protecting bee and native pollinator populations.

“More work definitely needs to be done,” Huang said. “If the funding is authorized, I hope to compete for some of these grants and help figure out this problem.”

::: Jamie DePolo



Yulun Fu, an entomology graduate student working with Zach Huang, does maintenance on a hive at the MSU apiary. In Michigan, about \$455 million worth of crops depend on honeybees.