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THE UNEXPLAINED ...

Buzz kill! Is this 'bee Armageddon'?

Nature's most valuable workers mysteriously vanishing out of thin air

Posted: April 25, 2010
6:43 pm Eastern

By Chelsea Schilling

What is devastating the world's honeybees?


Honeybee (photo: USDA, Rob Flynn)

In what appears to be a honeybee mystery of Armageddon proportions that has baffled scientists and beekeepers, more than one-third of the nation's commercial honeybee population is mysteriously disappearing – and researchers warn the unexplained phenomenon threatens one-third of the American diet.

Entire colonies of honeybees are abandoning hives and food stores, including honey and pollen. In collapsed colonies, adult bees mysteriously disappear, and there is no accumulation of dead bees. Even hive pests such as wax moths and hive beetles are nowhere to be found around affected colonies. Likewise, other honeybees are reluctant or unwilling to rob the abandoned hives of honey.

Only days before a honeybee colony collapses, according to Bee Culture Magazine, the colony appears to be strong and fully functional.

Then, it explains, the affliction travels like a wave through a beeyard.

Researchers have termed the phenomenon Colony Collapse Disorder, a syndrome characterized by sudden disappearance of adult honeybees in a colony.

Why should Americans care?

Experts warn the implications for the world's agriculture are nothing to be ignored: according to the United States Department of Agriculture, a full one-third of the human diet depends on honeybee pollination of crops – especially fruit, nut, vegetable and seed production in the United States.

The list of crops that depend on honeybees is long: almonds, apples, apricots, avocadoes, blueberries, boysenberries, cherries, citrus fruits, cranberries, grapes, kiwi, loganberries, macadamia nuts, nectarines, olives, peaches, pears, plums, raspberries, strawberries, asparagus, broccoli, carrots, cauliflower, celery, cucumbers, cantaloupe, honeydew, onions, pumpkins, squash, watermelon, alfalfa hay and seed, cotton lint, cotton seed, legume seed, peanuts, rapeseed, soybeans, sugar beets and sunflowers.

Ohio State University's state honeybee specialist, James Tew, told the Dayton Daily News, "The average person should care. Bees of all species are fundamental to the operation of our ecosystem."

Tew said if bees are unable to pollinate the nation's crops, Americans could be forced to settle for a menu of wheat and corn.

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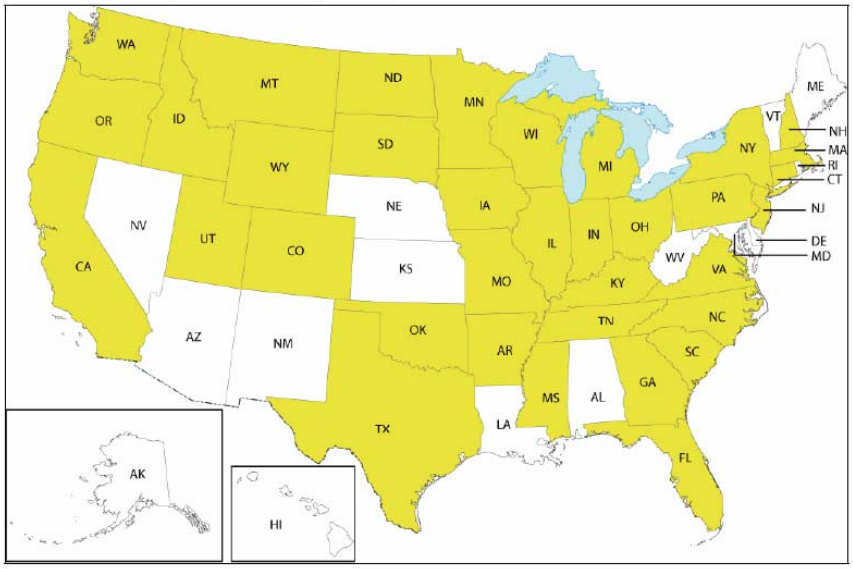
Cindy Kalis, spokeswoman for the Ohio Department of Agriculture, told the Daily News an estimated 50 to 70 percent of hives kept by beekeepers died during the 2009-2010 winter season. The state relies on bees to pollinate an estimated $44 million worth of crops.

The Congressional Research Service reports bee pollination is responsible for an estimated $15 billion to $20 billion in added crop value annually – or 23 percent of total U.S. agriculture production in 2006. The California almond industry, worth an estimated $2 billion annually, relies on nearly 1.5 million honeybee hives for cross-pollination. That's approximately one-half of all honeybees in the United States. Almonds are the top California food export and the nation's sixth-largest food export to more than 90 countries.

Beekeepers began noticing unprecedented losses in the U.S. honeybee population in 2006 – when 600,000 bee colonies in the U.S. mysteriously disappeared.

Figure 1. Colony Collapse Disorder, Affected States



The Congressional Research Service report features this map of U.S. states reporting CCD (yellow states) as of 2009.

The USDA's 2007-2008 progress report indicates that CCD studies led researchers to conclude that "no single factor alone is responsible" for CCD, prompting them to further examine a hypothesis that CCD may be "a syndrome caused by many different factors, working in combination or synergistically," including "an interaction between pathogens and other stress factors." According to the USDA, researchers are focused on the following three major possibilities:

> 1) pesticides that may be having unexpected negative effects on honeybees;
>
> 2) a new parasite or pathogen that may be attacking honeybees, such as the parasite Nosema ceranae or viruses; and
>
> 3) a combination of existing stresses that may compromise the immune system of bees and disrupt their social system, making colonies more susceptible to disease and collapse. Stresses could include high levels of infection by the Varroa mite; poor nutrition due to apiary overcrowding, pollination of crops with low nutritional value, or pollen or nectar scarcity; exposure to limited or contaminated water supplies; and migratory stress.

(Story continues below)

Bee virus transmitted by parasites?

In 2007, scientists found a strong association between CCD and a virus transmitted by parasites.

Deadly, parasitic Varroa mite attaches itself to honeybee's thorax where wings meet (photo: USDA, Scott Bauer).

A USDA research team published results of genetic screening of honeybee colonies affected by CCD and healthy hives. The only pathogen found in 96.1 percent of CCD-plagued colonies – but not in the non-CCD colonies – was the Israeli Acute Paralysis Virus, a virus that may be transmitted by the Varroa mite, a parasite that feeds on the blood of adult bees, larvae and pupae. Varroa mites are visible to the naked eye and attach themselves to a honeybee's body. They are known to transmit a number of pathogens and viruses.

Close-up photo of Varroa mite

According to the Agriculture Research Service, the USDA's principal intramural scientific research agency, "IAPV was initially identified in honeybee colonies in Israel in 2002, where the honeybees exhibited unusual behavior, such as twitching wings outside the hive and a loss of worker-bee populations."

IAPV was also reportedly found in package bees imported from Australia and royal jelly imported from China, the USDA's Bee Research Laboratory stated in a report titled, "Historical Presence of Israeli Acute Paralysis Virus in the United States." According to those researchers, the results from their survey indicate "IAPV has been circulating in U.S. bee populations since at least 2002" and the virus predates the latest incarnation of CCD.

ARS entomologist Jeffrey Pettis, research leader of the agency's Bee Research Laboratory in Maryland, noted, "This does not identify IAPV as the cause of CCD. What we have found is strictly a strong correlation of the appearance of IAPV and CCD together. We have not proven a cause-and-effect connection."

Viruses, bacteria and fungi testing

During a study published in August 2009 and conducted by ARS and university scientists, researchers looked at more than 200 individual variables in 91 colonies from 13 apiaries in Florida and California.

The researchers screened bees for bacteria, mites, Nosema (protozoan parasites), numerous viruses and nutrition status. They were unable to consistently find one single variable in honeybee colonies that had CCD; however, the pathogen levels were found to be higher in those CCD-affected bee colonies.

"Overall, CCD colonies were co-infected with a greater number of pathogens – bacteria, microparasites like Nosema, and viruses," ARS reported. "Overall, 55 percent of CCD colonies were infected with three or more viruses, compared to 28 percent of non-CCD colonies."

Despite the increased pathogen levels, the study was unable to show whether the elevated levels caused CCD or were simply the result of CCD. Researchers explained that higher levels of pathogens may have caused CCD symptoms, but it is still not known how the bees became infected with so many pathogens.

'More complicated than we first believed'

While many have suggested pesticides could be a culprit, the ARS team also screened the bees for 171 pesticides.

The study found no link between increased pesticide levels and CCD. In fact, one insecticide, Esfenvalerate, used to fend off pests such as moths, flies, beetles and other insects on vegetable, fruit and nut crops, was found to be more prevalent in non-CCD colonies. The insecticide was found in 32 percent of healthy colonies but only 5 percent of the colonies with CCD.

Likewise, Coumaphos, used to treat Varroa mites in honeybees, was also found in higher levels in healthy colonies. However, pesticides have not been ruled out as a cause of CCD.

Healthy honeybees on honeycomb

Meanwhile, researchers report the number of managed honeybee colonies has dropped from 5 million in the 1940s to 2.5 million today while demand for pollination has increased. Commercial beekeepers truck hives long distances to provide pollination services in several states. Some researchers believe the stress of long journeys could be impairing the bees' immune systems, making them vulnerable to viruses. The weakened bee industry impacts commercial beekeepers, limits the variety of crops available to consumers and increases costs to both growers and consumers.

The CCD problem is so widespread that Britain's 20,000 amateur beekeepers have been asked to register their insect in a national database, London's Telegraph reported.

A Jan. 7, 2010, Congressional Research Service report revealed that total ARS funding for honeybee and CCD research has averaged $7.7 million in 2007 and 2008, $8.3 million in 2009 and $9.8 million in 2010.

Researchers have been working feverishly to find the cause of CCD, and, according to some estimates, there are as many as 200 proposed hypotheses for the phenomenon. A national USDA survey report on honeybee losses during the 2009-2010 winter season is set to be released within weeks.

The 2010 prognosis doesn't look good, Jeff Pettis, research leader at the USDA's Bee Research Laboratory, told Discovery News.

"We obviously think it's more complicated than we first believed as in we don't believe that we're looking for a single virulent pathogen, although that can't totally be ruled out," Pettis told Discovery News. "At first we were thinking that we'd find a single causative agent, a virulent pathogen sweeping through the bee population, and that doesn't appear to be the case."

In 2007, beekeepers lost 32 percent of colonies. In 2008 they lost 36 percent, and in 2009, 29 percent. Pettis said the 2010 numbers may be just as bad – or worse.

If you'd like to sound off on this issue, please take part in the WorldNetDaily poll.
