



NAPPC

Honey Bee Disappearance (CCD) and What You Can Do

What is the mysterious problem that has recently emerged with honeybee?

CCD stands for Colony Collapse Disorder, which is defined as the sudden die-off of honey bee colonies. CCD appears to be occurring across the United States. CCD is an infectious disease affecting managed European honey bees (*Apis mellifera*) in commercial beekeeping operations across the United States. CCD has resulted in losses of 50 to 90% of managed colonies in U.S. beekeeping operations during the past several years. It has been estimated that 23% of commercial bee operations in the USA suffered from CCD during the winter of 2006-2007, with colony mortality averaging 45%. The malady was first reported in the media during the fall months of 2006, but may have been noticed by beekeepers as early as 2004, about the time when USDA-APHIS regulations were relaxed to allow for the importation of package bee colonies and queens from Australia and other countries, due to a shortage of colonies to pollinate the burgeoning California almond crop.

What are symptoms of CCD?

According to the [CCD Working Group](#), CCD is characterized by:

- a lack of adult bees in the hive
- little to no build-up of dead bees in the hive or at the hive entrance
- presence of capped brood, and
- presence of food stores, which are not immediately robbed by other bees

Colony collapse disorder presents beekeepers and researchers with unusual symptoms that progress rapidly. Early stages of the disease/infection are often missed. Over a period of days or a few weeks, the vast majority of a healthy bee colony's 40,000 or so worker bees leave the parental colony and die in the field. This is different from a pesticide kill where an "apron" of dead and dying bees can be found a few feet from the colony entrance. Often, with CCD, abundant honey and pollen ("bee bread") is stored within the nest which has healthy brood. The nest has been abandoned by the worker bees. Often when beekeepers remove the hive lid to inspect their colonies, they find only a queen bee and some recently emerged young bees.

What is the cause of this problem?

Unfortunately, no one is clear why there is a sudden die-off of honey bee colonies. There are **many** theories, including:

- chemical residue/contamination in the wax, food stores, and bees
- pathogens or parasites in the bees and brood
- stress to the bees and brood
- lack of genetic and lineage diversity in bees

Various hypotheses have been proposed for CCD (environmental stressors including insecticides and herbicides, migratory beekeeping, malnutrition, immunosuppression due to infection by *Varroa* mites, etc.). A popular but incorrect media darling was that cell phones were causing bees to become disoriented and unable to find their way home.

What have recent studies discovered about potential causes of CCD?

Finally, we have some hard data from a rigorous multi-disciplinary study published in *Scienceexpress* on 6 September, 2007 (<http://www.aaas.org/news/releases/2007/0906beehive.shtml>). A team of 22 scientists from nine institutions published their report "A Metagenomic Survey of Microbes in Honey Bee Colony Collapse Disorder" on a likely disease organism hypothesis. This team used a novel approach (metagenomic analysis) which involves cloning and DNA Amplification (PCR) of nucleic acid

genomic fragments from microflora (contained within bee gut samples, whole bees ground up and sampled). RNA extracts were sampled from four widely separated beekeeping operations across the USA, along with bees from Hawaii and Australia and royal jelly. Samples from both known CCD-infected and non-infected colonies were used.

The metagenomic analysis of all bee samples revealed common pathogens and commensals (various bacteria, fungi, parasites, metazoa and viruses). Bacterial analyses revealed common bacteria previously known to occur within honey bees with the exceptions of *Paenibacillus larvae* and *Streptococcus pluton*, the disease agents of American and European foulbrood, respectively. Among the various known bee viruses determined to be present, were two dicistroviruses, Kashmir bee virus (KBV) and Israeli acute paralysis virus (IAPV), along with an unclassified virus that may be a new lineage of KBV, or a new species. These were found only in the CCD-infected bee operations. IAPV virus was, with a single exception, found in all the known CCD samples. This yielded a predictive value of 96.1% and a specificity value of 95.2%. IAPV virus was first described by Israeli scientists in 2004, where bees exhibited symptoms of shivering wings, paralysis and then death away from their parental colonies.

The authors of this study used metagenomic analysis as a model to investigate epidemics caused by unknown pathogens, as agents of infectious disease. Although they did not conclusively prove that there was a causation relationship between a pathogen (including IAPV) and CCD, the predominance of IAPV in CCD-infected bees, indicate that IAPV is likely a significant marker and indicator of CCD in USA honey bee colonies.

What can be done?

Even with these recent discoveries, we still don't know enough about this massive loss of honey bee colonies yet to be able to conclude responsibly what caused it. While this new data is a great step forward in understanding CCD, we eagerly anticipate more scientific research that will help us better understand the causes, remedies, and preventions of CCD.

Moreover, CCD is a giant wakeup call that we can no longer take honey bees and other insect and animal pollinators for granted. We do know that forces like habitat destruction, misuse of pesticides, invasive species and global warming are placing our pollinator world at risk.

As the major National Academy of Sciences report on the Status of Pollinators recommends, we must:

- improve our scientific understanding
- increase awareness about
 - the importance and fragility of pollinators and
 - their role in our food supply and healthy ecosystems
- take action to protect pollinators and their habitat

What can individuals do?

National Pollinator Week is the last week in June. You, your children and your community groups can become Pollinator Partnership participants and make a difference through actions as simple as creating pollinator-friendly habitat in your back yard! See www.pollinator.org/ for information on how to get started. This includes:

- Plant for pollinators in your yard, garden, farm, ranch, local community.
- Reduce your impact on the environment
- Get involved as a Pollinator Partner (www.pollinator.org)
- Review the USDA-ARS plan to combat CCD:
http://www.ars.usda.gov/is/br/ccd/ccd_actionplan.pdf
- Learn about bees and other pollinators – and teach others of their importance