

Colony collapse disorder

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Introduction Honey bees are so vital to the horticultural sector that any problem in their colonies would mean disaster to fruit, nut, seed and vegetable production. In Colony Collapse Disorder, also known as CCD, the worker bees in cultured bee colonies abruptly disappear, leaving combs that are full of honey. There was no appropriate name for this unexplained disappearance of adult worker bees; hence, the name “ Colony Collapse Disorder” was crafted. To date, the cause of Colony Collapse Disorder remains largely a matter for speculation. Various speculative causes of this phenomenon have been forwarded by scientists.

With the several proposed reasons, scientists have not been able to put a finger on one cause, and many of them are of the view that CCD can be a result of a combination of factors. The factors proposed to cause CCD include malnutrition due to the limited variety of plant flowers to feed on, pesticides containing harmful chemicals to bees such as neonicotinoids, environmental pollution, and climate change. This article will deal with the proposed toxicological causes of CCD, specifically antibiotics, miticides and neonicotinoid pesticides. Background information on the Groups of Studied Chemicals Chemicals that have been implicated in CCD are often used by beekeeper for the benefit of the colony. For some time, such chemicals, which include antibiotics and miticides, had been removed from the list of possible causes of CCD, but recent research has once again deemed them a potential cause of stress for the worker bee population, and a potential cause of CCD as a result.

Antibiotics are used in bee-keeping for controlling bee diseases. Scientists have observed that non-organic beekeepers, who use antibiotics, are more

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likely to lose their bees because of CCD than organic farmers, who do not use antibiotics. Organic farmers do not usually lose their bees due to CCD, even though they live in close proximity to non-organic farmers, who use antibiotics to treat their bees. As far as antibiotics are concerned, neither specific antibiotics, nor mechanisms have been implicated in the development of CCD. This makes the theory of antibiotics highly speculative.

One of the reasons that have been proposed as the causes of CCD is the fact that there are parasites, which may make bees susceptible to it. Farmers have a particular loathing for the varroa mites, which not only cause damage as parasites but also transmit viruses to bees. Paradoxically, however, miticides used to treat mite infestation have also fallen under suspicion. Some researchers believe that chemicals in the miticides might be the cause of CCD. Research conducted in North American apiaries, where the incidence of CCD was particularly high, revealed that 98 pesticides and metabolites had been detected in the mixtures to 214 ppm (Mullin et al., 2010).

This represented an extremely high level of toxicants in the brood of honey bees. The research concluded that although it had serious implications for the fitness of honey bees, scientists could not determine a direct association of these toxicants with CCD. Another group of chemicals that has been linked with CCD is the neonicotinoid pesticides, which are used in pest control of plants in the field. In the research published in the *Journal of Economic Entomology*, Girolami et al. (2009) state that there is no indubitable evidence of sources that are able to take intoxicated doses directly from plants to honey bees. However, the research concludes that guttation drops,

which are the drops of plant fluid secreted at leaf margins, contain a number of active ingredients that are close to those of sprays applied in the field.

If honey bees come into contact with guttation drops, they will encounter death in a short time. This article implicates neonicotinoid pesticides in the CCD phenomenon. Analysis of Key Potential Causes of the Phenomena Colony Collapse Disorder is still an enigmatic phenomenon. However, in order to single out its potential causes from the plethora of reasons that have been postulated, a proper understanding of the phenomenon is necessary. In a descriptive study of the phenomenon, Evans et al.

(2009) state that one of the characteristics witnessed in colony collapse disorder is a noticeable lack of dead worker bees within the affected hives. In addition, there is a slow invasion of such hive pests as beetles and wax moths. This suggests that the bees do not necessarily die, although it is presumptuous to state that they do not actually die. This begins to cast doubts on some of the projected causes of CCD. For instance, neonicotinoids have been stated to kill worker bees almost instantly on contact. This shows that neonicotinoids are unlikely to be the single-handed cause of CCD.

It is, however, impossible to rule out completely the possibility that they act in concert with other factors in order to bring about CCD. In studies conducted to find out the characteristics of CCD bees, CCD colonies had higher pathogen loads than control colonies. This indicates either of two things: increased exposure to pathogens and reduced resistance to pathogens. Moreover, the levels of acaricide coumaphos, a miticide, were found to be higher in CCD bees (Evans et al., 2009).

This research finding is duplicated by other research that implicates miticides in CCD. Antibiotics used to control bacterial growth in colonies are known to have several side-effects. It has been shown that bees develop resistance to antibiotics, making them more susceptible to bacterial infections in such a way. This has led to the loss of several colonies of bees. Research conducted in Yale University shows that colony collapses were first recorded in 2006 when the use of tetracycline antibiotic was introduced.

As with other causes of CCD, however, it is not completely certain that CCD is caused by antibiotics, but there is a big chance that they are the reason. Summary Colony Collapse Disorder is not a very new problem that affects bee rearing, but it has become more common recently, engendering much research. Several factors have been incriminated for causing CCD, but research has not been able to come up with decisive conclusions concerning the causes of CCD. From a toxicological point of view, CCD may have a number of causes, including antibiotics, miticides and neonicotinoid pesticides. The research has concluded that antibiotics cause resistance in worker bees, increasing their vulnerability to bacterial infections.

This can cause CCD. Moreover, miticides and their metabolites were also found in much higher quantities in CCD colonies than control colonies. This suggests that miticides might be a cause of CCD. The research that implicates neonicotinoid pesticides in CCD is not consistent with the description of CCD. The reason is that neonicotinoid pesticides are understood to cause death of worker bees that come in contact with them in minutes. In CCD, however, there is no evidence of the death of bees; hence, this discredits the fact that neonicotinoids are responsible for CCD.

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Though, it is not entirely possible to rule out the possibility that neonicotinoids bring about CCD in concert with other factors.