Genetically Modified Crops Implicated in Honeybee Colony Collapse Disorder

As the disappearance of honeybees continues, researchers are trying desperately to discover the cause of Colony Collapse Disorder (CCD). General concensus at this point is that there is more than once cause and the latest culprit may be genetically modified crops. This is one area of research being neglected as mainstream scientists insist GM crops are safe.

For the last 100 years, beekeepers have experienced colony losses from bacteria, (foulbrood), mites (varroa and tracheal) and other pathogens. These problems are dealt with by using antibiotics, miticides and and other methods of pest management. Losses are slow and expected and beekeepers know how to limit the destruction. This new mass die-off is different in that it is virtually instantaneous with no warning of the impending collapse.

John McDonald, a bee keeper in Pennsyvania with a background in biology, speculated that genetically modified crops could play a role in CCD. Although the government constantly reassures us that these genetic manipulations are safe for both humans and the environment, his hope is that looking more closely at these issues might raise questions about those assumptions.

The common bacterium, *bacillus thuringiensis (Bt)* supplies the most commonly used segment of transgenic DNA. *Bt* has been used for decades by farmers and gardeners to control crop damage from butterfy larvae. Now, instead of spraying this bacterium directly on the crops, where it is eaten only by the target insects, the genes containing the insecticidal traits are incorporated into the genome of the plant itself. As the genetically modified plant grows, these *Bt* genes are replicated in every cell of the plant, including pollen. Therefore, every cell of each GM plant contains its own poison aimed to kill the target insect. The target insects consume some portion of the plant, then once ingested, the toxin produced by the *Bt* genes causes crystallization in the guts of boring larvae and thus death. The primary toxin is a protein called Cry1Ab. In the case of field corn, the targeted insects are stem and root-borers and butterfly larvae.

Although scientists “assure” us that bees (hymenopterans) are not affected, there are *Bt* variants available that target beetles, flies and mosquitoes. There is indisputable proof that Cry1Ab is present in beehives. Beekeepers spray *Bt* under hive lids to control the wax moth because the larvae cause messy webs on the honey. Canadian beekeepers have noted the disappearance of this moth even in untreated hives, apparently the result of bees ingesting Cry1Ab while foraging in GM canola plants.

Bees forage heavily on corn flowers to obtain pollen for the rearing of young bees. These pollen grains also contain the *Bt* genes of the parent plant, because they are present in the cells from

which pollen forms. Mr. McDonald believes it may be possible that while Cry1Ab has no direct lethal effect on young bees, there may be some sub-lethal effect, such as immune suppression, acting as a slow killer.

Tens of millions of acres of genetically modified crops are allowing the *Bt* genes to move off crop fields and contaminate other flowers from which bees gather flowers. "Given that nearly every bite of food that we eat has a pollinator, the seriousness of this emerging problem could dwarf all previous food disruptions".(John McDonald) He proposed an experiment to compare colony losses of bees from regions where there are no GM crops to losses of colonies where they are exposed. He wanted to put test hives where GM crops are so distant from the hives that the foraging worker bees would have no exposure to GM crops. Researches readily dismissed his ideas and no one followed through with such an experiment.

At this point, he decided to do his own investigation at his own expense. He established 8 colonies in new wooden hives to ensure no possible disease transfer from old hives. The bees were fed continuously with sugar syrup until the hives were placed at the selected locations.

"At both sites the flowers of goldenrod provided ample pasturage, with the honey flow commencing in the middle of August and tapering off by the second week in October. Medium-depth empty honey storage supers (a super is the part of the beehive used to collect honey) were put on the hives at this time in addition to the three brood chambers already there. By the simple expedient of lifting the hives from behind, progress could be roughly monitored.

This monitoring showed that the hives of the farmland bees, while numerous, were not gaining weight. Meanwhile, the non-farm colonies steadily gained weight. This part of the experiment was terminated Oct. 14 with the removal of the honey storage supers, with these results: The farmland bees had not even started to work in the honey supers and will require extensive feeding before winter sets in. The non-farm bee colonies produced, in total, nearly 200 pounds of extra honey in addition to about 150 pounds per hive stored in the over-wintering brood supers. These colonies will be left in place to see whether the die-off of last season is repeated. These results should encourage new research to determine what factor or factors are present in farm country to cause such a discrepancy in honey production." John McDonald

John McDonald is a beekeeper in Pennsylvania. He welcomes comments or questions about the bee problem at mactheknife70@hotmail.com.

Another study indicating that *Bt* may be contributing to the death of honey bees was undertaken in Mexico. This study compared the effects on young adult honeybees of 2

concentrations of Cry1AB (3 and 5000 parts per billion) to a chemical pesticide, imidacloprid. 3 different effects were evaluated by the researchers:

1. Survival of honeybees during sub-chronic exposure to Cry1Ab.
2. Feeding behavior.
3. Learning performance at the time that honeybees become foragers.

Neither test concentration of Cry1Ab had lethal effects on the honeybees, however, when exposed to the higher concentration, feeding behavior was affected. The bees spent longer ingesting the syrup which contained the Cry1Ab which could mean smaller amounts of pollen would be collected. These bees also had impaired learning performance. Honeybees normally do not continue responding to an odor when no food is present, but should be discouraged and seek other sources. These bees continued responding to the odor which again, could affect pollen gathering efficiency. This study indicates that although *Bt* is not directly lethal to honeybees, it could indirectly lead to colony death due to failure to collect enough food to sustain the hive.

These findings may be the key to the difference in honey production in Mr. McDonald's experiment. *Bt* appears to have non-lethal effects which become apparent only when the lethal effect is absent. Although not directly lethal to non-target organisms, the toxins from the *Bt* gene potentially puts non-target insects such as honeybees at risk.

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