Rise of the Zombie Bees

By Virgene Link

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Our commercial honeybees pollinate enough crops to account for every third bite of food we take. They are not native to North America, but were brought over by the early colonists as an agricultural helper. In fact, honey bees and their food importance has been recognized for thousands of years. They have been mentioned in early Egyptian hieroglyphics.

But now, something is happening to our honeybees. We've all heard of the "perfect storm," and then the maelstrom of the "super" storm. A similar circumstance is now playing out with our already beleaguered bees.

It's called "colony collapse disorder" or "CCD." This is the disappearance of bees from the hive, which leaves it unable to support itself. Many different maladies have been implicated with the rise of CCD in recent times.

The Varroa mite is one of them. It is a parasite that feeds on a bee pupa host, taking nourishment and stressing its host with possible malnutrition and also stressing its immune system.

Bee colonies may also have microsporidium infections which are an added stress. Microsporidia, single celled organisms related to fungi, can only multiply inside cells of the host. In bees, it is in the mid gut. (Think of it as living with hepatitis C in your bloodstream.)

While this is bad news for bees, microsporidia act as a biological agent against corn earworms, gypsy moths, tent caterpillars and others. This is typical of the good/bad relationships in the natural world.

When the Israeli Acute Paralysis Virus (IAPV) was identified in the U.S. in 2002, scientists thought at that time that this must be the cause of CCD, since bee colonies have been successfully living with the mite and other infections for a long time. This was probably brought in with the import of queens from Australia, an idea for introducing genetic diversity.

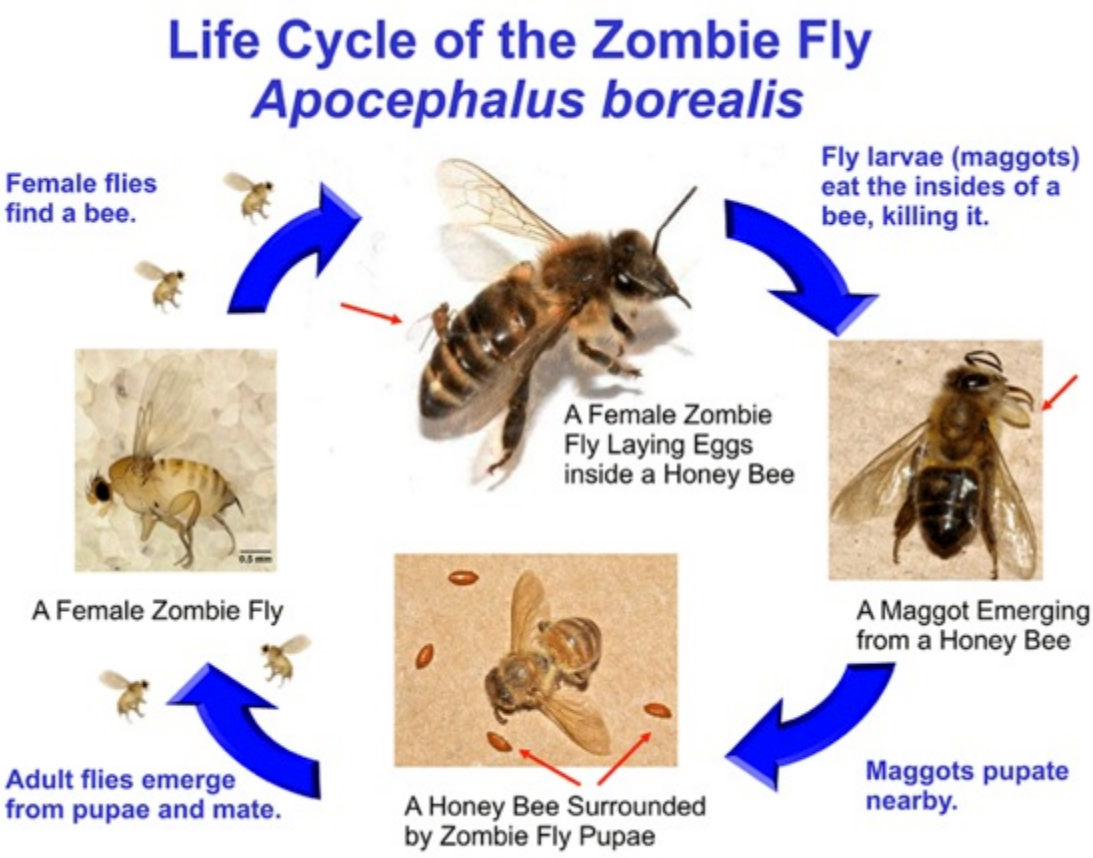
Scientists also speculated that commercial bees were stressed by being constantly moved around the U.S. for the different crop flowering sequences. Poor nutrition was also considered as hives are usually placed in a monoculture with little variety in their diet. Pollinate these almonds! Pollinate these squash!—or this cherry orchard, or this alfalfa field, etc. with never a chance to take a break and just live for the hive . Their only break was being transported a thousand miles or so on a truck.

In addition to the cultural problems (stress in transportation, limited diet, lack of rest) and biological problems (mites and infectious agents), another problem recently getting press is chemical, specifically, the pesticide clothianidin. This is one of the neonicotinoids that has been banned in Europe.

Neonicotinoids were promoted as they are safer for humans to handle than organophosphates. Unfortunately they seem to scramble a bees' sense of direction and increase the toxicity of fungicides.

Let's not forget, it's not just commercial users of pesticides, but the rain of pesticides we homeowners sometimes use without thinking of the consequences to all our beneficial insects that are living in our environment too. Fewer than 1% of insects are pests to man, his plants or his animals. That means 99% are beneficial, interesting or some of both!

Enter the "zombie" bees. They were first identified in the California Bay Area, infected by the phorid fly (*Apocephalus borealis*), a parasitoid. To differentiate, a parasite lives on or within a host, and while it may weaken the host, it doesn't kill it. A parasitoid, on the other hand, lives within a host until it is near ready to start its metamorphosis, at which time it kills the host (usually by consuming vital organs) and then emerges to pupate.



Courtesy zombeewatch.org

This phorid or zombie fly was known to parasitize bumblebees and yellow jackets—but until this discovery, was not known to use honeybees as well. At least we humans didn't know it. The bees undoubtedly did!

When infected with this fly maggot, the honeybee starts behaving erratically. It either abandons its hive during the night or doesn't return in the evening and flies off and dies. This would explain the empty hives of CCD but does not necessarily mean it is the total cause. This also explains the term "zombie" bee. It's the flying, soon–to-be-dead bee.

At www.ZomBeeWatch.org, John Hafernik, PhD, a biologist at San Francisco State University, is gathering information to help observers watch for, identify and collect the pest.

Left: These honeybees are feasting on the abundant pollen of a peony. Providing a diverse diet in the vicinity of a hive will help to improve the overall health of the bees. **Right:** Agriculture is extremely dependent on a good supply of healthy bees. Without the help of the insect world we would not be able to grow healthy food for ourselves. *Photos by Christine Farrow, Skagit County Master Gardeners*

Meanwhile, Steven Sheppard, PhD, a professor of entomology in the Center for Reproductive Biology at Washington State University, is also tracking fly locations. (It is already here in Washington State, having been identified in King County.)

At least one commercial operation in Yakima has not sent their bees to California for the past two winters. Instead, it has placed the hives in cold storage to approximate winter and force hibernation. This gives the bees a chance to rest.

During the bees' confinement, the beekeepers noted higher levels of carbon dioxide (CO_2). The next spring, the hives were surprisingly very healthy. Is it the rest, the increase in CO_2, less stress in not being transported, lack of exposure to a larger population of phorid flies, some other element, or all of the above?

Our beekeepers and our gentle honeybees have survived many attacks on hive health in the past. With constant vigilance, improved genetic diversity, and understanding of the complications they face, our extra effort on behalf of functioning colonies may result in a development of resistance to---or eradication of--- CCD. That gives us all hope.

RESOURCES:

- *Skagit Valley Herald*, Home & Garden, May 9, 2008
- *The Capital Press*, Front Page, September 28, 2012
- http://www.zombeewatch.org/
- http://www.care2.com/causes/parasite-drives-honey-bees-to-doomed-zombie-flight.html
- King 5 News story: "Yakima Beekeeper", October 21, 2012."Honeybee Survival", 2February 2, 2012 and September 24, 2012.