Save the Honeybee or Starve: An Argument for Preserving Honeybees

Addison Hanna

Alvernia University

Abstract

This essay addresses the need to change current beekeeping practices in the United States. Today, beekeeping practices are under-regulated and are placing excess amounts of stress on colonies. As a result, there has been a significant and alarming drop in honeybee populations. Through the use of databases and websites, this essay proves that current beekeeping practices are destroying the species. Furthermore, this essay offers solutions to recovering the honeybee population and ensuring it survives in the future. In order to save the honeybee, it is necessary for beekeepers and lawmakers to change their practices and legislation to take better care of the colonies.

Keywords: Honeybee, Colony Collapse Disorder (CCD), Beekeeping Practices

Save the Honeybee or Starve

Honeybees are responsible for pollinating one-third of all agriculture in the world, making the species the most important factor in producing food for humans. This is concerning because, globally, honeybees are dying at an alarming rate and are nearing extinction. The University of Maryland (2016) reports that, "beekeepers across the United States lost 44 percent of their honey bee colonies during the year spanning April 2015 to April 2016, according to the latest preliminary results of an annual nationwide survey". 60 years ago there were 6 million beehives in the USA; that number is now 2.4 million – meaning over half of the species has been lost (USDA, 2016). Modern beekeeping practices are destroying the species. It is important to realize that beekeepers must change their current practices to ensure honeybees stay alive. To save the bee, it is necessary to understand threats to the honeybee, to identify destructive aspects of current beekeeping practices, and to take preventive steps to ensure the future of the species.

Before considering the need to change current practices, it is important to understand that bees are the most essential pollinators on Earth. They are known as a keystone species, meaning if they die countless other species will die with them. According to Greenpeace USA, losing the honeybee is a threat to nature and a threat to agriculture: "Seventy out of the top 100 human food crops — which supply about 90 percent of the world's nutrition — are pollinated by bees" (n.d.). In other words, humans depend on bees to provide foods that are essential to our diet. Additionally, the Natural Resources Defense Council (NRDC) estimates that over 90% of wild pollination relies on honeybees (NRDC, 2011). The world's remaining bee population is being spread thin and is over-worked. Every year, half of American bees are shipped thousands of miles to California to pollinate the almond crop (NRDC, 2011). Each year more people are born, meaning more food is needed. With the lowering number of bees and the rising number of

mouths to feed, it is only a matter of time before a breaking point is reached. In 2007, beekeepers began noticing sharp declines in their bee populations. Some reported 80%-100% of their hives being empty that year (Oldroyd, 2007). While colony losses are not new to beekeeping, the large amount of bee deaths was alarming. What is more alarming is that in the past, honeybee colonies rebuilt and reestablished after a few years. Oldroyd explains that "This[annual colony loss] is certainly the extreme end of a continuum, so perhaps there is indeed some new factor in play" (2007). 10 years after the initial decline in today's populations, the species is still swiftly declining and shows no indication of rebounding, suggesting that something is killing the honeybees that humans are not aware of.

In order to protect the honeybee population, it is important to identify what natural threats there are to this population. Like many other species, there are countless pathogens and parasites that can infect honeybee hives. According to Oldroyd, a professor at the University of Sydney for over 20 years and an experienced beekeeper, these include European Foul Brood (caused by Mellisococcus pluton), American Foul Brood (caused by Paenibacillus larvae), a fungal disease of the brood Ascosphaera apis, Tarsonemid mite Acarapis woodi (infects the trachea of adults), Nosema apis (infests the guts of adult bees), and a variety of viruses (many paralyze the bees or cause trembling) (2007). These diseases are well studied and documented; there are clear signs in hives and honeybee colonies to indicate pathogens, yet none of these indicators have been noted by beekeepers worldwide. The most prevalent idea as to what is causing the honeybee populations to crash is Colony Collapse Disorder (CCD). According to Oldroyd, CCD is a condition where there is a sudden and unpredictable drop in adult bees in a colony – leading to the eventual death of the colony, is what is causing the honeybee colonies to be disappearing so rapidly: "The syndrome is mysterious in that the main symptom is simply a low number of adult

bees in the hive" (2007). It is debated whether the causes are human, natural, or a combination. According to an article from 2014 by Moore, Wilson, & Skinner, viruses are likely to be one of the contributing factors to CCD. Their study found that over 80% of sampled honeybee hives tested positive for at least one virus, but the virus was inactive and not effecting the activities of the hive. The group noted, "Viruses persist in normal, healthy colonies, only to explode during times of stress" (Moore, Wilson, & Skinner, 2014). This indicates that there is a trigger that causes the virus to become active and decimate a hive. In order to keep the colony safe, the trigger(s) must be identified to prevent future colony destruction.

In addition to natural threats to the honeybee, there are also numerous manmade threats to the species. According to Oldroyd, in-hive chemicals, agricultural insecticides, and genetically modified crops are thought to be responsible for the elimination of the honeybee (2007). In-hive chemicals are a problem because

> Some chemicals, particularly fluvalinate, may accumulate in comb wax, perhaps exposing commercial honey bees to levels of chemical residue that are inimical to worker longevity. Other beekeepers have tried more "organic" approaches, including fumigation with formic acid, oxalic acid, or essential oils. Although these approaches do not place insecticides in colonies, they may also be less effective at controlling mites, and can be directly toxic to the bees (Oldroyd, 2007)

These chemicals may be responsible for forcing bees from their own homes, resulting in a colony that has little or no adult bees. Insecticides on agriculture can come in contact with bees when they pollinate the treated plant. The bee then returns to the hive with the toxic material on its body and in the pollen it has collected, where it can spread the poisonous pollen throughout the hive. In France, the nicotine-like insecticide named Imidacloprid was blamed for wide colony

losses due to its toxic nature and the fact that it harms invertebrates (Oldroyd, 2007). Genetically modified organisms (GMOs) have recently been introduced to agriculture, resulting in plants that "naturally" resist pests and insects. While these plants drastically reduce the need for toxic pesticides and insecticides, they are not yet well understood and still need a different type of herbicide applied to them. According to a 2014 article written by Parker, GMOs are treated with the herbicide glyphosate. Since the plants are resistant to this herbicide, massive quantities of it can be dumped onto crops to eliminate weeds. Their study "shows that glyphosate, the active ingredient in Monsanto's Roundup herbicide, can disrupt learning behaviors in honeybees and severely impair long-term colony performance" (Parker, 2014). This means that a hive exposed to this chemical through pollination of the treated crops and through consumption of the pollen, will not develop properly, likely leading to CCD. While these chemicals are undoubtedly harmful to insects and honeybees alike, changes in cultural practices are likely the trigger activating the honeybee viruses, and are the most compelling reasons the honeybees are dying at such an alarming rate.

Activating viruses due to beekeeping practices is killing honeybee colonies, so recognizing damaging aspects of current beekeeping practices is imperative to ensuring the survival of the species. Traditionally, honeybees were used locally and were kept on the farms in which they pollinated plants. There existed a symbiotic relationship between the honeybee and the honeybee keeper; the honeybees ate their fill of honey while they pollinated vast fields for farmers. Today, honeybees are shipped all over the country for pollination purposes:

> Beekeepers transport their hives on trailers all over the country. These bees are coming from different regions and all converge on the Central Valley in February. Not all of these bees are unhealthy when they are moved from whichever state they come from, but

> once they arrive in California it is extremely difficult for their handlers to restrict the movement of the bees. This leads to the bees being exposed to all manner of possible problems that could adversely affect the beekeepers and the bees livelihood (Gay, 2015).

This illustrates how current beekeeping practices can place excess stress on the bees. They are not only being shipped across the country, but also they are forced into overcrowded fields with millions of other bees under the same stress. This single event starts a domino effect of spreading pathogens to other colonies, because after starting in California, beekeepers take their bees, "to a number of other states to pollinate everything from apples and apricots to watermelons and cranberries. The bees will then be around all the colonies that did not travel to the Central Valley, ensuring that there is a high possibility of exposing many bees to these problems across the entire country" (Gay, 2015). We can conclude that after a few years of this practice, every commercial honeybee colony in the national will have been exposed to the same pathogens due to the homogenization and overcrowding of bees used for commercial pollination.

In addition to exposure to toxic chemicals and deadly pathogens, current beekeeping practices result in malnutrition in honeybees. After the honeybee has finishing pollinating a few different types of food, it is drained and needs to replenish its energy. According to the Nutritional Guide for taking care of honeybees, "Honey bees, like all animals, require a balanced diet of sugar, protein, vitamins and minerals". Feeding on three or four different genetically modified crops each year is not a balanced diet. According to Oldroyd's findings, "Many crops cause nutritional stress to the bees" (Oldroyd, 2007). The lack of diversity in the honeybee's diet has negative effects on it. Additionally, Oldroyd notes that after pollinating crops,

> they[honeybees] must feed on high quality pollen to restore body protein levels. This can be achieved by trucking the bees to a location with excellent floral resources or by

> feeding them. Presumably this is not always done. Anecdotal evidence suggests that CCD is more common in businesses in which bees are trucked large distances and rented for pollination. (Oldroyd, 2007).

It is important for today's beekeepers to allow their hives to feed on nutritious plants to stay healthy. This is possible to do while shipping bees around the country, however, many beekeepers err on the side of profit and force the bees to continue pollinating crops instead of giving the colonies time to replenish their energy by feeding on nutritionally dense flowers. Neglecting to properly nourish a honeybee colony will place unnecessary stress on the hive and will ultimately lead to the collapse of the colony.

Another factor of modern beekeeping that is killing the honeybee is lack of genetic variation in commercial bees. It is understood that inbreeding in many species reduces genetic variation and can lead to many different complications; any reduction in expression of certain genes can result in problems in an organism. This is true for honeybees, too. According to Oldroyd, "commercial bees are more likely to mate with close relatives than they were in the past, potentially leading to reduced genetic diversity within colonies" (2007). This means that honeybees may currently be experiencing lack of genetic variation due to inbreeding, which would cause a reduction in immunity to diseases the honeybees were once naturally able to resist. This suggests that lack of genetic variation is a cause of CCD. A similar study by Castle in 2013 suggests the same idea. In the article she claims,

> There was evidence of reduced expression of certain genes involved in insect immunity, one of which was from a family of genes that are central in insect immunity. This gene is involved in the complex network of responses to infection and environmental stress and optimises energy allocation in the bee. Therefore, any additional stress factor triggering a

> response mediated by this gene will deplete the immune system and will allow a gradual increase in the viral replication until uncontrolled viral replication ensues" (Castle, 2013, p. 16).

This clearly illustrates that lack of genetic variation in a honeybee colony will allow viruses to replicate until all the bees in the hive have either fled or died. Reintroducing genetic variation to commercial beekeeping will help the inbred honeybees regain their strength and immunity to harmful pathogens.

Current beekeeping practices are killing the honeybee and preventive measures must be introduced to help the dying bee recover. Commercial honeybees can experience stress leading to CCD from any or all of the following natural or manmade triggers: malnourishment, exposure to high levels of toxic chemicals, lack of genetic variation from inbreeding, and excessive traveling (Oldroyd 2007; Castle, 2013, p. 16; Gay, 2015). Any of these triggers can compromise the honeybee's immune system, leaving them vulnerable to deadly pathogens the bees once had natural defenses against. In order to reverse this, commercial beekeepers must end their profit-centric ideology and transition into more environmentally friendly and hospitable practices. According to the Coordinated Agricultural Project (CAP), the best practices for keeping commercial honeybees include: ensuring hives are sufficiently spread out, properly nourishing honeybees with a variety of different flowering food sources, minimizing toxin exposure, maintaining genetic quality, and allowing the bees to store honey for the winter (Heintz, Ribotto, Ellis, & Delaplane, 2011). Based on the rapid decline of honeybee colonies and anecdotal evidence from scientists and beekeepers, we can conclude that these practices are not being followed.

Since the best practices for keeping honeybees is not being followed, changes to current beekeeping practices must be implemented in the form of legislation to guarantee beekeepers are taking care of their honeybees properly. First, as suggested by Oldroyd, honeybees must be allowed to replenish on flowering plants between commercial pollinations (2007). This will allow the honeybee to nourish itself and regain its energy before pollinating another nutritionally-nonexistent cash crop. Legislation must be passed that forces beekeepers to feed on flowers that are appropriate for their diet. This can be achieved by sampling random colonies and measuring honey reserves or general health to determine if the colony has been allowed to feed on nutritious plants. Commercial honeybee colonies that do not meet these nutrition standards will not be allowed to pollinate crops, forcing beekeepers to take care of their bees.

In addition to honeybee nutrition and feeding laws, stricter legal limitations must be placed on the amounts and types of insecticides, pesticides, and herbicides used in agriculture. Currently, there is legislation allowing certain amounts of certain chemicals to be dumped on crops, but there is no set wait period determining when honeybees should be reintroduced to a treated field. According to an article written by Mayer, Johansen, & Baird, entomologists from around the country, honeybees are most vulnerable to agricultural chemicals for up to three days after application, “our tests have shown that 50 to 90 percent of the killing of bees by insecticides occurs during the first 24 hours after application. Do not move hives back into fields treated with hazardous insecticides until at least 48 to 72 hours after the application” (2010). Preventing honeybees from entering chemically treated areas will ensure they are not exposed to poison. This will help keep colonies strong and will help inhibit the erosion of colonies’ immune systems.

Along with legislation changes, an individual can also help make an impact on saving honeybees and preventing the species from becoming extinct. The Honeybee Conservancy (HC) offers many ideas for individuals that are interested in making an impact on saving the bee. HC states that one of the most basic ways to help is by planting a bee friendly garden with lots of indigenous flowers (2016). This will help feed local bees and other beneficial pollinators. Additionally, individuals can start their own honeybee hive. There are countless online tutorials available for anyone interested in getting started with beekeeping and many local beekeeping organizations host free informational sessions for new beekeepers. If one is unable to become a beekeeper, sponsoring a hive is also an option.

The sudden drop in honeybee populations due to CCD must be addressed. Current beekeeping practices are placing excess stress on colonies, weakening the honeybee's immune systems and allowing pathogens to destroy colonies. Since there are many factors that can cause CCD, it is imperative that beekeepers familiarize themselves with the triggers that can lead to the demise of their colonies. Proper treatment of honeybees decreases the likelihood of CCD infecting and destroying a colony. Therefore, the destructive, profit-centric practices in beekeeping need to end. Additionally, legislation must be passed to ensure the honeybee is not mistreated by commercial beekeepers. To save the species and ensure humans can be fed in the future, changes in beekeeping practices must take place now. The impact of losing the honeybee is so severe that mankind and much other life on Earth may not survive without this essential pollinator. What was once a friend of the farmer is now nothing more than a tool of the trade.

References

Castle, D. (2013, May). Factors-Affecting-Global-Bee-Health-June-2013.pdf. Retrieved from https://croplife.org/wp-content/uploads/pdf_files/Factors-Affecting-Global-Bee-Health-June-2013.pdf

Gay, U. (2015, February 6). Savannah Bee Company. Retrieved from http://savannahbee.com/blog/swap-meet-honey-bee-pathogens/

Greenpeace. (n.d.). Save the Bees - Greenpeace USA. Retrieved from http://www.greenpeace.org/usa/sustainable-agriculture/save-the-bees/

Heintz, Ribotto, Ellis, & Delaplane. (2011, March). bmpcalagr. Retrieved from http://www.beeccdcap.uga.edu/documents/bmpcalagr.html#2.Best_Management_Practices_for_Pest.2FVarroa_Control

Honeybee Conservancy. (2016). What You Can Do -The Honeybee Conservancy. Retrieved from http://thehoneybeeconservancy.org/act-today/what-you-can-do/

Mayer, Johansen, & Baird. (2010). How to Reduce Bee Poisoning from Pesticides | Beesource Beekeeping. Retrieved from http://beesource.com/point-of-view/joe-traynor/how-to-reduce-bee-poisoning-from-pesticides/

Moore, Wilson, & Skinner. (2014, August 21). Honey Bee Viruses, the Deadly Varroa Mite Associates - eXtension. Retrieved from http://articles.extension.org/pages/71172/honey-bee-viruses-the-deadly-varroa-mite-associates

Natural Resources Defense Council (NRDC). (2011, March). bees.pdf. Retrieved from https://www.nrdc.org/sites/default/files/bees.pdf

Oldroyd BP (2007) What's Killing American Honey Bees? PLoS Biol 5(6): e168. doi:10.1371/journal.pbio.0050168

Parker, J. (2014, October 21). New study shows honeybees harmed by herbicide used on GMO crops. Retrieved from http://gmwatch.org/index.php/news/archive/2014/15710-new-study-shows-honeybees-harmed-by-herbicide-used-on-gmo-crops

University of Maryland. (n.d.). Nation's Beekeepers Lost 44 Percent of Bees in 2015-16 | Bee Informed Partnership. Retrieved from https://beeinformed.org/2016/05/10/nations-beekeepers-lost-44-percent-of-bees-in-2015-16/

USDA. (2016). Retrieved June 21, 2016, from www.ars.usda.gov/News/docs.htm?docid=15572