

Research paper on decline of honeybees

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Introduction

Honeybees which have its origin based in South East Asia came into USA via European settlers in 1600s. Honeybees are extensively used in the US for the production of honey and pollination of a wide-ranging variety of farm grown crops including vegetables, fruits and nuts. But in recent times starting from around 2006, honeybee populations in the US have dwindled by 70% and the afflicted colonies showcase similar uncanny symptoms of a consistent reduction of worker bees. Since the sustenance of hives without worker bees is not possible, eventually all the bees including the queen and brood die. The collapse of bee colonies has been termed as CCD or Colony Collapse Disorder. There are several factors contributive to the decline of honeybees and taken into consideration its effect on agriculture and food chain, it is imperative to seek solution for CCD.

Effect of the Decline of Honeybees on Food chain and Agriculture

Honeybees are extremely important for human diet and decline of honeybees would impact the US agriculture massively. About 1/3 of crops produced in the US are pollinated by honeybees and hence decline of honeybees would directly affect the production of staple foods such as broccoli, apples, hazelnuts, strawberries, cucumbers, blueberries, asparagus, turnips, pears, orange and grapefruits. Not only this, the decline of honeybees would endanger the beef and dairy industries as these animals would not be able to feed on alfalfa. According to the estimation made by Cornell University, seeds and crops worth \$14 billion are pollinated by honeybees in the US (Boland, 2010). Therefore, the disappearance of

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honeybees would affect the food chain hiking the price of products pollinated by insects. For instance, the price of almonds in 1983 was \$1. 50 per pound and in 2005 it was \$3. 50. But the deaths of honeybees would escalate the price by double and triple in next two decades.

Almonds are one of the crops hugely dependent on the pollination by bees. California is one of largest producers of almond in the world accounting for 80% of global almond production. California exports about 70% the almonds produce to overseas. Decline of honeybees would lead to less pollination of almond crops which would affect the almond industry and export income earned out of almonds. If the almond industry gets affected, people working in this industry would face financial loss and other industries that use almonds in their products extensively would also encounter financial damage.

Reasons for the Decline of Honeybees

One of the main reasons, for the decline of honey bees, is the increasing uses of pesticides especially insecticides for agricultural pest control.

Insecticides like neonicotinoids, imidacloprid and clothianidin are found by EPA to be especially harmful causing paralysis, amnesia, navigation impairment and so much as death to honeybees. Several European countries have already banned the use of insecticides or are in the process of banning them. These insecticides are frequently used by farmers to control a wide-ranging population of pests. These poisonous chemicals easily assimilate into sap, nectar and pollen posing a danger to honey bees when they move around in search of nectar and pollen.

Varroa mites are another reason for the fast disappearance of honeybees.

These mites looking like a tick are parasitic mites that feed on blood of adult bees. These mites spread a lethal form of disease in honeybees called deformed wing virus and as Dr. Stephen Martin who was one of the researchers studying the honeybees in Hawaii reported that an infected bee contains more viral particles than there are people on the planet (Gill, 2012). Apart from varroa mites, there are other parasitic infection harming honeybees. Nosema parasites infect the digestive tracts of honeybees and tracheal mites infect the breathing tubes of adult bees and suffocate them. These mites are fast spreading from one colony to another by robber bees. There are few scientists who point the finger of blame for the deaths of honeybees at the increasing production of genetically modified crops. GMO crops contain a natural insecticide called bt toxin which is essentially harmful to honeybees and this theory is further corroborated by the fact that colony collapse disorder is not experienced by the organic bee colonies which avoid the use of chemicals and GMO crops.

Bees are also falling vulnerable to electromagnetic radiation due to the prevalence of mobile phones, laptops and wireless communication towers. A study conducted at a Punjab University in Chandigarh, India came out with the finding that within three months of the researchers fitting cell phone to a hive and powering them up for 15 minutes each day has resulted in the cessation of honey production, diminution of egg production by half and the reduction of the hive size (Herriman, 2010).

Malnutrition is another reason contributing to the decline of honeybees. The growing and selling of a single agricultural product round the year by farmers is called mono-cropping which leads to a severe dearth of diversity

in the diet of honeybees. Domesticated honeybees are pollinating monocrops due to which they suffer from malnutrition resulting in atrophy of their resistance against diseases and stresses.

Solutions

Honeybees forage for pollens and nectar during the day when the temperature hovers between 55 and 60°F. They return to their hives with the sunset and therefore if pesticides can be sprayed in the evening then it will reduce the mortality rate of honeybees to a great extent. Furthermore, choice of pesticide formulation is also very important. It has been seen that dusts and wettable powder formulation of pesticides leave residue on the plants which stick to the bees during their pollination period. Not only that the dust particles often enter the hives with the pollen and can cause the collapse of an entire colony. Therefore, pesticides that come in solutions, granular and emulsifiable concentrates are best to use as they dry quickly and don't leave any residual particles. Besides this, less toxic, quickly degradable pesticides should be used so that chemical effect degrades within few hours. Also the method of pesticide application should be taken into consideration. It has been seen that aerial application of insecticides cause maximum damage and spraying of pesticides in windy weather makes the pesticide drift or move from the intended target to apiary or crops that honeybees feed on. Hence granular formulation or equipment that keeps the spraying restricted to the target area should be used to reduce the risk of pesticides drift (The University of Georgia).

There are lots of techniques being tried to address the problem of varroa destructor, the biggest cause of honeybees' wipe-out. Over the years, varroa

mites have become resistant to certain synthetic chemicals and therefore, nonchemical means and genetic weapons are being employed to resist the varroa infestation. Nonchemical means such as heating method, comb trapping method, freezing drone brood method, limited drone brood cell method, use of essential oils like mint, thyme and lemon oil, use of mineral oil as vapor and spraying of anti-fungal talcum powder are used to kill the varroa parasites without harming the bees in the process. Scientists have also come up with a genetic device that will destroy of the genes in varroa mites without causing any danger to the bees (Gill, 2010).

Most of the researchers believe that if the nutrition factor of the honeybees can be properly tackled then the bees will develop a strong defense mechanism to fight any disease. A variety of protein feed mixtures are available in the market commercially with beekeepers customizing the feeds according to their needs. Beekeepers are now taking the subject of malnutrition of bees with more seriousness than ever before. A group of researchers in Tucson, Arizona have developed a pollen substitute called MagaBee which is combined of vitamins, minerals and proteins required for the health of honeybees. Supplemental protein feed programs are being undertaken by many beekeepers in Southern California to provide honeybees with all the nutrients essential for good health (Fischer, 2008).

Conclusion

Honeybees which are extensively used in agriculture for pollination of crops are rapidly dwindling due to a great many factors including an increasing use of pesticides, varroa mites, electromagnetic radiation, genetically modified crops and malnutrition. This rapid decline of honeybees is going to affect the

agriculture, beef and dairy industries and almonds industry and the associated export business, accounting for the loss of billions of dollars for the nation. Therefore, it is imperative to adopt some recuperative measures to arrest the problem of CCD. If measures related to varroa destructor and pesticides can be properly implemented with solid dietary supplements fed to the bees then the problem of CCD would reduce considerably and the food chain balance and agriculture would be saved from irreparable damage.

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