Assessment of Actions of the United States, Europe, and China to Address Colony Collapse Disorder

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Introduction:

Without pollinators like the honeybee, the economic portions of many nations would be affected, and a significant setback in the food supply among the many crops that solely depend on pollinators would occur, as pollinators contribute in 30% of pollinating services in the world (Natural Resources Defense Council 2011). As contributors of one third of the food supply in the world, one can tell the role honeybees play in today’s agriculture. Agriculture and its practices, such as pesticide use and deforestation, have then needed to drastically expand as global food demand has been increasing rapidly (Tilman et al 2011). With the expansion of agriculture, environmental impacts, such as soil degradation and deforestation are believed to be one of several other anthropogenic and non-anthropogenic contributors in the recent phenomenon called Colony Collapse Disorder (CCD) that poses a great threat to the population of honeybees (United States Department of Agriculture 2013). CCD has been growing in magnitude, concern and attention starting in 2006 with honeybee keepers noticing 30-90% losses of their hives, and currently the United States has only 2.5 million honeybee colonies, which is low in comparison to the 5 million it had back in the 1940’s (United States Department of Agriculture 2013). CCD presently has the attention of many powerful governments, such as the United States, European Union, and China, in which they too are taking notice of the potential dangers of CCD. We see these three different governments taking notice and action against CCD, but there is a differential take on action and policy-making between them. A great divide is at hand, as countries must address CCD but in doing so, it put today’s technological advances such as pesticide use in question, some of which have even already placed bans on certain pesticides. With such bans or propositions of potentially doing so on certain aspects in agriculture, the rise of objections from certain interest groups, put into question the legitimacy of the accumulation of studies on issues
such as in the connection between neonicotinoids and CCD. Through the analysis of several studies and peer-reviewed articles, we will observe the different types of actions nations such as the United States, Europe, and China are taking in order to combat CCD, and whether to see if any of the different approaches are showing promising results. The paper will also look deeper into finding the reasons why some governments are able to take more proactive steps in their legislation while others appear to let the issue get worse before reacting to it, as extensive and similar studies have been done worldwide and are constantly replicating the similar answers when it comes to observing practices such as pesticide use, which will be one of our main focuses on this paper.

Background:

Honeybees are a subset of bees in the genus Apis, which compromise of 10 species, 9 which are only in Asia (Whitfield et al. 2006). The most commonly domesticated species of honey bee many are familiar with is known as Apis mellifera “honey-bearing bee,” which is going to be the focus pollinator of this paper. Apis mellifera are believed to originate from Africa and expanded into Eurasia at least twice and a third expansion in the New World (Whitfield et al. 2006). Honey bees and humans have had a long association, as Apis mellifera has been depicted in 7000-year-old cave paintings, demonstrating the collection of honey from wild bee nests (Whitfield et al. 2006), so honey bees are extremely important currently and in the past as at least 20 recognized subspecies of the western honey bee currently exist, and have been spread extensively beyond the original natural range due to the benefits it has on many nations economy due to their pollination and honey production services (Mortensen 2013).

Economic Importance:
The common honey bee is not simply important due to its production of honey; they also aid in the pollination of many commercial crops. Honey bees contribute to the pollination of at least 30% world’s crops and 90% of wild plants (Natural Resources Defense Council 2011). This pollination service contributes up to 15 billion dollars a year in the United States in crops like apples, berries, cantaloupes, almonds, and alfalfa (American Beekeeping Federation 2013). As stated by the American Beekeeping Federation (2013), some of these crops solely or mostly depend on pollination from the common honey bee, such as blueberries and cherries that rely 90 percent on honeybee pollination, whereas almonds depend 100 percent on honeybees when they bloom, and other crops would simply do poorly without the pollinator. With such importance and relevance to our current agriculture and economy, the American Beekeeping Federation (2013) states that there is an estimated 2.4 million colonies in the United States today, in which two-thirds are moved around the country to provide their pollinating services, such as in California, which needs more than one million colonies to pollinate the almond crops state-wide. As an added bonus to their billions of dollars already in pollinating services, their production of honey provides 150 million dollars per year alone (Natural Resources Defense Council 2011).

Colony Collapse Disorder:

Colony Collapse Disorder (CCD), was first observed during the winter of 2006-2007, in which beekeepers were beginning to note the disappearance of 30-90% of their hives (United States Department of Agriculture 2013). What was more alarming and confusing was the absence of the dead bodies, a significant amount of the colony’s worker bee population would go missing, leaving the queen, brood, honey, and pollen reserves back in the hive, which would result in a non-functional hive that would collapse (United States Department of Agriculture 2013). The
EPA points to potential factors for CCD, such as parasites, diseases, pesticide poisoning, foraging habitat modification that lead to inadequate foraging and poor nutrition, along with immune-suppressing stress on bees due a combination of all factors noted (EPA 2013).

**Varroa Mite:**

An example of a parasite honeybees are exposed to is the Varroa mite. The University of Kentucky describes the Varroa mite as an external parasite that feeds on both adults and brood, with a preference for drone brood. These mites do not immediately kill their victim, but instead feed on the blood which weakens and shortens the life-span of the adult form, and potentially leads to the emergence of the brood with deformities. Originally confined within the region east of Urals and up to Afghanistan, the Varroa mite only affected other species from where it was native, such as the Asiatic honeybee, *Apis cerana* or *Apis indica*, but due to anthropogenic factors, the mite is now widespread globally within simply a span of 50 years (Satzburg 2011). They were first reported in Kentucky in 1991 and have spread and became a major pest for the honey bees in many states since their introduction into Florida in the mid 1980’s. These mites spread between colonies through drifting workers and drones. As the mites are introduced to the hive, the females will lay their eggs on brood cells before being capped. As the bee larva matures within its cell, the mites will have matured, fed on the larva, and mated, so as the brood emerges, the mites are prepared to infect neighboring cells. Untreated hives lead to the overall death in honey bee colonies, and can often be mistaken for winter mortality or queenlessness if not thoroughly examined, and so early detection is important along with the treatment of Apistan strips within the brood nest (Bessin 2010). Parasites such as the Varroa mite is believed to be a component of CCD, in which honey bees are undergoing multiple stressors that are affecting the health of colonies all over the world (United States Department of Agriculture 2013).
Neonicotinoids:

Neonicotinoid pesticides are new nicotine-like chemicals that act on the nervous systems of insects, but were deemed less dangerous to mammals and the environment than many of the older sprays (EPA 2013). These pesticides are often applied to seeds before planting and are water soluble, allowing them to be applied to the soil and be taken up by the whole plant, making it “systemic,” and so the plant turns into a poison factory with toxins coming from various parts of it, such as the roots, leaves, stems, and pollen (Maxim 2013). In the United Kingdom, five neonicotinoid insecticides were used in agriculture, such as for seed treatment for cereals, sugar beet, soil treatment of potted plants in ornamental sectors, treatment of turf in amenity sector, foliar sprayed on apples, pears, and along many available for public use in lawns, house plants, etc. (Pesticide Action Network 2013).

These pesticides are rather powerful with only small doses of a neonicotinoid needed to be able to kill many pollinators when exposed (Maxim 2013). These pesticides don’t all stay within the plant, about 90% of the applied pesticide goes into the soil and is able to last a while and be retaken up by other crops or wild plants, any potential side effects of these pesticides are not fully known, but recent studies show that avian and aquatic organisms may be affected by neonicotinoids as well (Maxim 2013).

Recent studies have researches in Italy believing they have found a molecular trigger in which neonicotinoids affect a key molecule in a protein that regulates the immune response, and so making honey bees more prone to viruses. Such studies have involved treating bees with levels of neonicotinoids that would normally be found in the field and then infecting them with a common pathogen that would normally be kept in check and inactive by the bee’s immune system. The results showed that the bees treated with normal levels of the neonicotinoid and...
pathogen showed a significant increased replication of the virus from the introduced pathogen, which suggests that these insecticides may in fact be suppressing the immune systems of honeybees and contributing to CCD (Hadlington 2013)

**Policy and the Honeybees:**

Beekeepers are not the only ones to notice the current trend of bee populations, governments are taking notice also. Last April of 2013, the European Commission agreed to an EU wide restriction of certain neonicotinoid pesticides (clothianidin, imidacloprid, and thiametoxam), specifically banning the use of them such as for public use like gardeners. The ban was voted in favor by 15 countries, while 8 countries, such as the UK, voted against it, and 4 refrained from voting, leaving a major split among the EU states, so the European Commission was left to take a decision unilaterally, and that has resulted in much debate along appeals from those that are pro neonicotinoids. The ban will last for 2 years, specifically on crops and plants that are attractive to pollinators as research is being done on the pesticides (Maxim 2013). The British government has since accepted the ban but still rejects the science behind it, saying that there isn’t enough evidence for such ban, and it isn’t the only big entity to reject the European Commission’s ruling, the Swiss agrochemical company, Syngenta, is taking the EC to court. The company expresses the action as undesirable on their part, but needed due to the incorrectness of the ruling by the Commission stating that the decision of the ban was inaccurate and incomplete as it was based on the studies by the European Food Safety Authority, along that it lacked the full support of the EU member states, so Syngenta states that the link between thiamethoxam, the type of neonicotinoid they use in their product, and decline in bee health is wrong, and that it will leave farmers and farming organizations with less sustainable alternatives. The proceedings of
the lawsuit from Syngenta can be up to two years, but regardless, neonicotinoids have been placed in moratorium for the next two years since December 2013, even though partial bans have already existed in Italy, France, Germany, and Slovenia before (Maxim 2013).

The United States has been taking less of an active approach, and although a lot of the studies match the ones from Europe, the USDA has instead taken lead into the CCD issue and established a steering committee back in 2007, while the EPA remains an active participant. The steering committee involves various components such as survey and data collection to see the extent of CCD, analysis of bee samples, research, and mitigation along prevention (EPA 2013). Also on July 16th of this 2013, representatives John Conyers and Earl Blumenauer introduced the Save America’s Pollinators Act, H.R. 2692, a bill that would make the EPA take off the neonicotinoid pesticides from the market until properly tested for the safely of pollinators, which is an action similar to the one the European Commission has taken this current year. The bill has been referred to a committee and has a chance of 11% of getting passed (Pesticide Action Network 2013).

When it comes to neonicotinoids and China, China is a huge traditional agricultural country with immense pressures from pests, weeds, and plant pathogens, so it relies a lot on pesticides to keep up with its enormous expansion as a developing country, and so China is not only a big pesticide consumer, but also producer. As older pesticides are being removed from domestic use, a need for more efficient and aggressive pesticides are needed, such as imidacloprid, one of several neonicotinoids used, but the most common. Imidacloprid accounts for 24% of the insecticide market. So as other countries are banning or studying the effects of neonicotinoids, China happens to be a big supplier, it is the largest exporter and producer of pesticides in general (Shao et al. 2013). When it comes to neonicotinoids, China will not be
banning them any time soon, but due to the current excessive production rate of imidacloprid and acetamiprid, limits of production will be established by the Chinese Ministry of Industrial and Information Technology (Shao et al. 2013)

Decline of Honeybees:

Honeybee losses have been well recorded both in the United States and Europe, with the United States experiencing the highest losses between 1947 to 2005, it has lost 59% of managed honey bees, where Europe experienced only 20% (Zhenghua 2011). China is one of several countries and territories in which there hasn’t been a lot of recorded data to know the trend of the honeybee population, but it currently has the most abundance of honeybee colonies and honey production than any other country. A study discussed in Zhenghua’s paper had collected the number of honey bee hives, production, and exported honey within the last five years to observe the change of managed honeybees. From the data collected from the last five years, it was compared to other data available, such as from 1980-1984 for honey production and managed honeybee colonies, and the comparison showed that out of 24 provinces assessed, 21 of them had increased in honey production, and one of the twenty-four had reduced in honeybee colonies while the rest increased. Zhenghua’s paper discusses that China focuses a lot on honeybees due to their great importance to their agricultural economy, and so when a parasite, disease, etc. emerges endangering the pollinator, a lot of research is invested to find a solution.

Conclusion:

Many studies and articles are being published every so often discussing the dangers of pesticides, habitat loss, and invasive species for the species such as the honeybee that are very valuable to the global economy. CCD isn’t a small or local problem, it is happening globally. CCD is also no longer a minimal and over-blown issue by environmental groups or beekeepers,
since the issue is being taken up by governments that are funding research in order to regulate the phenomenon, which is generating much political friction as agrochemical companies such as Syngenta are at risk if pesticides such as neonicotinoids are indeed found to be a major component for the decline in honeybee health. This paper is observing a spectrum of approaches to CCD between the United States, Europe, and China. Although China being the bigger supplier and consumer of pesticides such as neonicotinoids, the current studies on its honeybee population show that it is not experiencing a loss such as the U.S. or Europe, but we need to take into consideration that the study is only comparing the minimal data it has available, and so a reliable trend won’t be available till further data is collected. What we can see is that Europe compared to the United States has a much lower loss in honeybee population and also has the more aggressive approach in limiting neonicotoids, and so with further studies and data collection, a true trend might be visible between these three countries.
Bibliography


USDA. “Honey Bees and Colony Collapse Disorder.” 
