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The Great Bee Decline: A Threat to Us All

TSANTAS APOLLON

KEY POINTS

Both domesticated and wild bees play a crucial role as pollinators in preserving the natural ecosystem's equilibrium, while at the same time facilitating the economic growth of the agricultural sector. The significant decline in Europe's bee population that has been observed in the last two decades can cause not only an environmental catastrophe but also economic instability negatively impacting both the people that are being employed in the agricultural industry and the economy as a whole. This gloomy scenario prompted the European Union to take action and to try to combat this decline by using a number of different strategies such as restricting the use of certain types of pesticides that are proven to be harmful to bees. Nevertheless, there is still much work to be done in order for this issue to be completely eradicated. This policy brief suggests:

- Promoting alternative methods to combat pest infestation.
- Enacting a gradual ban on all pesticides that are proven to be harmful to bees.
- Conducting further research on bee friendly pesticides and on the different species of wild bees.
- Amending the existing EU legislation on pesticides in order to take into consideration new scientific knowledge about active substances.

- Developing groundbreaking bee drugs, that can combat bee pathogens and viruses more effectively and a new species of bee through crossbreeding, that is more resilient to these pathogens and viruses.
- Offering financial support to the beekeepers of the European Union.
- Creating a series of campaigns to raise public awareness about this alarming issue.

INTRODUCTION

The European bee population has been declining for the last two decades at an alarming rate affecting both wild and domesticated bees. The IUCN Red List report states that at the EU 27 level 9,1% of all bees are threatened with extinction. (Nieto et al,2014). To make matters worse the findings of that report also indicate that 150 different species of the European bee have declining populations (Nieto et al,2014). At the same time according to the report 1,048 species (55.6%) at the EU 27 cannot be evaluated due to insufficient data (Nieto et al,2014). This means that data deficiency prevents us from understanding the true extent of the problem and thus combating it effectively.

The diminution of bees is especially extensive during winter when bee colonies are at their most vulnerable state. This negative trend can be attributed to a series of stress factors that have adverse effects on bees such as climate change and specific bee diseases.

Although these stress factors influence wild and domesticated bees equally, wild bee populations have been diminishing at a far faster rate than domesticated ones due to the fact that beekeepers can intervene and salvage domesticated bee colonies that are being threatened by extinction.

As a consequence, honeybees must embrace a more prominent role in crop and wild plant pollination in order to offset the wild bee populations diminished numbers. If beekeepers and honeybees are unsuccessful in fulfilling this task, the lack of pollination will have devastating implications for the environment, the economy and the quality of human life in general considering the fact that pollinators are the backbone of the agricultural industry and a keystone species of the environment.

THE SIGNIFICANCE OF BEES

Bees are of the outmost importance for the environment because they play a vital role in the reproduction cycle of plants. Both wild and domesticated bees are one of the biggest contributors when it comes to crop and wild plant pollination ensuring that over 80% of crops and wild plants in Europe are being pollinated (Laurent et al, 2016). By transferring pollen from flower to flower they act as a gateway connecting the male anther of a flower to the female stigma resulting in fertilization and consequently in seed production. This crucial transfer of floral genetic material which perpetuates the existence of plants elevates the bees as the cornerstone of a stable and flourishing ecosystem.

As a result, bee pollination greatly affects not only the yield and stability of a crop but also the quality of the agricultural products that are being produced. This means that the existence of bees or lack thereof can have serious repercussions for the environment as well as for the economy. It is estimated that pollinators, including honeybees, bumblebees and wild bees, contribute at least 22 billion EUR each year to the European agriculture industry (Gallai et al,2009) in which millions of European citizens are being employed.

Furthermore, the alfalfa plant which is being used extensively as a primary component of cow and chicken feed by the meat and poultry industry relies

on bee pollination for reproduction making the existence of bees of the paramount importance for the stability and growth of these two industries.

However, the importance of pollinators goes further than the aforementioned contributions. Bees also play a pivotal role in the betterment of human life in general through contributions in the pharmaceutical field and the renewable energy sector. The honey that bees produce is being used by the pharmaceutical industry due to its antibacterial properties. Additionally, a wide variety of plants such as the Jatropha that are being used as biofuel rely on bee pollination to reproduce.

WHAT HAS BEEN DONE SO FAR

The decline of Europe's bee population has been a cause of concern for professionals and the wider public alike, prompting the European Union to take decisive action against this alarming issue. The constant deterioration of bee's numbers in Europe must be halted so the adverse effects of the ecological imbalance caused by insufficient pollinators can be avoided.

The European Union through its Environmental Policy is funding research that aims to shade a light in the complex reasons as to why many European bee colonies are collapsing and consequently use the findings of the research to better the actions that are already being taken to combat this issue. One such research is the European Red List of Bees (published in 2014) that helps to uncover different species of European bees that are being affected and to create a more suitable course of action to support and conserve those exact species.

Additionally, in 2018 the European Union launched the EU Pollinators initiative in close collaboration with its member states which aims to accomplish three strategic goals. The main focus of the initiative is to give insight into why the wild pollinators of Europe are diminishing, to develop strategies that will combat the issue of said decline and to make the wider public cognizant of the issue.

Also, one decisive action that the European Union took which was based on the findings of the aforementioned research was to heavily regulate and, in some cases, restrict the use of certain type of pesticides that are harmful to bees such as imidacloprid (Regulation (EU) 2018/783), clothianidin (Regulation (EU) 2018/784) and thiamethoxam (Regulation (EU) 2018/785). Although the European Union has taken a step in the right direction, there are still many things to be done in order to firstly halt and then reverse this decline of Europe's bee population.

THE SOURCE OF THE PROBLEM

Before we start contemplating what can be done to further tackle this issue, it is of paramount importance that we first recognize the main factors behind the deterioration of bee's numbers in Europe. Although the research is still ongoing, the experts have concluded that there are a number of causes acting in conjunction with each other or separately that greatly affect the survivability of the European bee population and consequently cause its decline in numbers. Unfortunately, human activity can be characterized as one of the main culprits in pollinators decline.

First of all, the rapid enlargement of the agricultural industry and the intensification of urbanization pose a major threat for bee populations considering the fact that they can lead to the degradation and even to the destruction of the natural environment of bees. Habitat loss and deterioration greatly reduce the number of plants that are available to bees, which in turn limits their sources of food. There is a strong correlation between quantity and quality of food and bee health. This means that if bees are unable to feed from an abundance of quality sources their health deteriorates which in turn decreases their chances of survival.

Furthermore, habitat destruction not only affects the nutrition of bees but also greatly diminishes the number of appropriate nesting sites, which are vital for bees in order to lay their eggs and perpetuate their existence.

Another human activity that poses a threat to bees is the extensive use of agrichemicals in farming which can have adverse effects on colony survivability. Pesticide use can diminish bees' numbers either via direct contact or via sublethal effect. This means that pesticides not only can cause the death of bees directly but also can have disorienting effects resulting in bees being unable to return to their nests. Also, another documented sublethal effect of pesticides is that it reduces the chances of survival during wintertime for bee colonies. Additionally, the use of herbicide, which is also an agrichemical, can disrupt the feeding cycle of bees by decreasing the number of available plants and modifying the blooming period.

Climate change, which is also a manmade phenomenon, is considered to be one of the main causes of bee decline, because the rise in temperature and the prolonged summer droughts that are directly linked to global warming modify the composition of the vegetation which is crucial for bees considering its their source of food, leaving bees struggling to adjust in a new lesser hospitable environment.

Another factor that causes the decline in pollinators is the existence of pathogens and parasites. The most infamous parasite is the Varroa mite, which is also called Varroa destructor, due to the fact that its presence can lead to the infection of a bee colony with a number of deadly viruses and consequently to its destruction.

RECOMMENDATIONS

A series of comprehensive measures need to be taken in order to further combat the decline of Europe's bee population and maybe one day even reverse it.

1) Utilizing the aforementioned restriction on pesticides as a foundation, a gradual ban on all pesticides that are scientifically proven to harm bees needs to be enacted while at the same time alternative methods to combat pest infestation without the use of pesticides need to be promoted. Additionally, research on 'Bee-friendly' pesticides needs to be funded with the support of LIFE programme, so that safer alternatives can be accessible to farmers.

2) A project that aims to create a new species of bee that is more resilient to pathogens and viruses using different crossbreeding techniques needs to be created and funded with the support of the LIFE programme.

3) The EU legislation on pesticides (Regulation (EC) No 1107/2009), that provides the criteria for the approval of active substances, needs to be amended in order to take into consideration the new scientific knowledge that has emerged in the field of risk assessment of active substances to bees.

4) The gap in information between domesticated and wild bees should be bridged by funding the appropriate research through the LIFE programme. Additional research into the different species of wild bees is crucial in order to better understand their ecology which in turn will facilitate their conservation. Wild bees in many instances play an even more vital role than their domesticated counterparts in plant pollination.

5) Using funds from the European Agricultural Fund for Rural Development a program which will offer financial support to the beekeepers of the European Union needs to be created so it can alleviate some of the pressure that honey imports cause, considering the fact that this pressure in some instances can lead to a number of beekeepers changing profession and thus reducing the population of domesticated bees. Keeping the apicultural sector alive is of the outmost importance if we take into consideration the fact that domesticated bees play a crucial role in the perpetuation of the existence of plants.

6) The development of groundbreaking bee drugs needs to be promoted, so new treatments can be found that can combat more effectively bee pathogens and viruses such as the deformed wing virus, that plague bee colonies and cause their collapse. This research will be financed using funds that derive from the LIFE programme.

7) A series of campaigns that aim to raise public awareness about this pressing issue need to be formulated. Scientists with the help of artists and other influential figures can highlight the presence of interconnection between humans, bees and plants and the vital role that pollinators play in preserving the natural ecosystem's equilibrium.

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