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The Declining Population of insect pollinators: a global concern

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ABSTRACT:

Free pollination services given by the pollinators are seriously threatened worldwide, despite the fact that insects improve the yields and quality of 75% of crop plants worldwide. In most parts of the world, reports of declining insect pollinators have surfaced. We must comprehend the primary causes of pollinator populations' global decline in order to develop strategies and action plans to preserve and protect them as well as the vital ecosystem services they offer. Pollinators can be negatively impacted by a variety of issues, such as habitat loss, pesticide use, diseases and infestations, pollution, and climate change.

Keywords:ecosystem, habitat, pollination, yield

1. INTRODUCTION:

Pollinators, including insects, birds, and bats, play a crucial role in the sexual reproduction of many flowering plants, including a significant portion of the crops that constitute our food supply. Their service of transferring pollen between flowers enables fertilization and the subsequent development of fruits, vegetables, and seeds. This process is essential for maintaining biodiversity, ecosystem stability, and global food security. Sixteen percent of the 0.25 million plant species are pollinated by bees. 82 commodities attributed to plant species provide 90% of the world's food supply, and bees pollinate 63 (or 70%) of these plant species and are the most significant known pollinators of 39 (48%) of these plant species. In developed countries, bee pollination provides a direct or indirect source of one-third of the human food (Thakur, 2012). The honeybees, a crucial pollinator and vital component of our ecosystem, has faced a worrying decline in population across the globe in recent years. This alarming trend has significant implications for both the environment and agriculture, as bees play a pivotal role in the pollination of a wide range of plant species, including many crops essential for human sustenance.

2. Economic Significance of pollination:

The economic contribution of pollinators to agriculture is substantial. It is estimated that approximately one-third of the global food supply relies on animal pollination, with the value of insect pollination alone reaching hundreds of billions of dollars annually (Nitharwal *et al*., 2022). Pollinators enhance both the yield and quality of crops, contributing significantly to the profitability and sustainability of agricultural practices.

3. Diversity of Pollinators:

While honeybees are often recognized as the primary pollinators, a diverse array of insects, including bumblebees, solitary bees, butterflies, moths, flies, and beetles, also contribute significantly to crop pollination. Pollinators are found in diverse groups of the animal kingdom, including birds, bats, reptiles, insects, etc. Insects belonging to the Lepidoptera (more than 140,000 species), Coleoptera (approximately 77,300 species) and Hymenoptera (about 70,000 species) are the most diverse and prevalent pollinators. Thysanoptera and Diptera are the least varied groups of insect pollinators. In actuality, Thysanoptera are typically regarded as pests, and their pollination function has received little attention. Hoverflies from two families within the Diptera—the Syrphinae, having around 1800 species, and the Eristalinae, with about 3800—have been identified as pollinators (Katumo *et al*. 2022, Wardhaugh, 2015). Different pollinators exhibit varying foraging behaviors and preferences, making them effective at pollinating different types of crops. Maintaining a diverse pollinator community is therefore essential for ensuring effective pollination across a wide range of agricultural systems.

4. Crops Dependent on Pollinators:

Approximately 70% of 1330 tropical crops and 85% of 264 species grown in Europe had better fruit or seed quality or quantity as a result of biotic pollination (Aizen, 2009). Numerous crops rely on pollinators for successful fruit and seed production. These include fruits such as apples, berries, melons, and almonds; vegetables such as tomatoes, cucumbers, and squash; and oilseeds such as canola and sunflower. The degree of pollinator dependence varies among crops, with some requiring complete animal pollination for any fruit set, while others benefit from increased yield and quality through pollinator activity.

5. Cause of decline in pollinators worldwide

Pollinator populations worldwide are facing increasing threats from a variety of factors, including habitat loss, pesticide exposure, climate change, and diseases. These threats have led to declines in pollinator abundance and diversity, raising concerns about the long-term sustainability of crop production and ecosystem health. A recent study confirmed that According to a recent study, there were 25% fewer wild bee species observed globally between 2006 and 2015 than there were before to 1990 (Drivdal and Sluijs, 2021). Insect populations are declining by 1% to 2% annually, prompting some to predict an imminent "insect apocalypse" in the ensuing decades. Pollinators are important insect species that boost the yields of three-fourths of crop varieties and are essential for the production of healthy foods including fruits, vegetables, and nuts (Boston, 2022). It is a serious global issue with multiple contributing factors. These factors often interact and exacerbate the problem, making it a complex challenge to address. Here's a breakdown of the main causes:

6.1 Habitat Loss and Fragmentation

As natural landscapes are converted to agricultural land, urban areas, and other human-dominated uses, pollinators lose the nesting sites and foraging resources they need to survive. It has been mentioned that habitat loss can be occurred due to building development, farming, and even gardening styles also. Fragmentation of remaining habitats isolates pollinator populations, reducing gene flow and making them more vulnerable to local extinctions (Brunet and Fragoso, 2024)

6.2 Pesticide Use

Widespread pesticide use, particularly neonicotinoids, has been linked to pollinator decline. (Alaux *et al*., 2010) discusses the interaction between pesticides and other stressors like diseases. These chemicals can be lethal to pollinators or have sub lethal effects, such as impairing their foraging ability, navigation, and reproduction. Jones, 2021 noted that while overall pesticide use may have decreased, the increased potency of newer chemicals poses a greater threat.

6.3 Climate Change

Changes in temperature and precipitation patterns can disrupt the timing of plant flowering and pollinator emergence, leading to mismatches between the two. (Bezerra *et al*., 2018) highlighted this issue, specifically mentioning the potential impact on passion fruit production in the Neotropics. Extreme weather events can also directly kill pollinators or destroy their habitats.

6.4 Diseases and Parasites

Pollinators are susceptible to a variety of diseases and parasites, including the Varroa mite and Nosema. (Vincent and Ring, 2009) mentions parasitic mites as a factor in honeybee decline. These can weaken pollinators, reduce their lifespan, and make them more vulnerable to other stressors. (Alaux *et al*., 2010) also points to the interaction between diseases and other factors like pesticides.

6.5 Invasive Species

The introduction of non-native species can disrupt local ecosystems and negatively impact pollinators. Invasive plants can outcompete native plants that pollinators rely on, while invasive predators can directly prey on pollinators. Vincent and Ring (2009) observed the replacement of European honeybees with Africanized honeybees in some regions.

6.6 Monoculture Farming

Large-scale monoculture farming reduces the diversity of flowering plants available to pollinators, limiting their food sources and making them more susceptible to nutritional deficiencies. This practice also often involves heavy pesticide use, further exacerbating the problem. (Garibaldi *et al*., 2009) discusses the importance of pollinator diversity for various crops. Addressing pollinator decline requires a multi-pronged approach that tackles these various threats. This includes promoting sustainable agricultural practices, reducing pesticide use, restoring and protecting habitats, and raising public awareness about the importance of pollinators.

7. Conservation Strategies:

Protecting and promoting pollinator populations is crucial for ensuring food security and maintaining healthy ecosystems. Several strategies can be implemented to support pollinators, including:

7.1 Reducing pesticide use: Minimizing the use of harmful pesticides, particularly neonicotinoids, can protect pollinators from toxic exposure.

7.2 Providing habitat: Creating and restoring pollinator-friendly habitats, such as wildflower meadows and hedgerows, can provide essential nesting sites and foraging resources.

7.3 Promoting sustainable agriculture: Implementing sustainable agricultural practices, such as crop diversification and organic farming, can create more favourable environments for pollinators.

7.4 Raising awareness: Educating the public about the importance of pollinators and the threats they face can encourage individual actions to support pollinator conservation.

8. CONCLUSION

Pollinators are indispensable for crop production and play a vital role in maintaining global food security. Protecting these essential creatures requires a concerted effort from individuals, communities, and governments. By implementing effective conservation strategies, we can ensure the continued provision of pollination services and safeguard the future of our food supply. In conclusion, the decline of pollinators worldwide presents a significant threat to both agricultural productivity and the health of natural ecosystems. The multifaceted nature of this decline, driven by habitat loss, pesticide use, climate change, diseases, invasive species, and monoculture farming, necessitates a comprehensive and collaborative approach to conservation. Protecting these essential organisms requires a shift towards sustainable agricultural practices, including reduced pesticide use and diversified cropping systems. Furthermore, habitat restoration and creation, along with public awareness campaigns, are crucial for ensuring the long-term survival and prosperity of pollinator populations. The interconnectedness of pollinators with global food security and biodiversity underscores the urgency of implementing effective conservation strategies to safeguard these vital creatures and the services they provide.

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