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Honey Bees- The Super Pollinators

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ARTICLE ID: 37

Abstract:

As a fundamental building block for crop development, pollination is important to the agriculture industry. Water, wind, and animal pollinators such as bats, moths, hoverflies, birds, bees, butterflies, wasps, thrips, and beetles can all act as vectors for the movement of pollen, which is what plants depend on. Animals usually pollinate domesticated plants. 30% of the world's food production is based on animal pollination, and around one-third of the food consumed by humans comes from crops that are pollinated by bees. Given their efficiency and widespread availability, bees are regarded as important pollinators. The quality and quantity of crops are greatly enhanced by bee pollination, which also benefits worldwide dietary and economic consequences. This article emphasises the important role that bee pollination plays in influencing the economy and food security.

Introduction:

Agriculture and the cycle of life are connected by pollination, which is essential for maintaining the ecological balance of ecosystems and the foundation of food production. As a result of the increase in quantity and quality, pollination plays a part in the economy. The act of moving pollen from the male anthers to the female stigmata, either within the same flower (self-pollination) or between plants (cross-pollination), is known as pollination. Since plants fully rely on vectors to transport their pollen during cross-pollination, pollinators play a crucial role in the crop production process.

In light of issues like climate change, changing land use, habitat degradation, and an expanding human population, there is an ever-increasing demand for food security. Fruit, nut, oil, and other crop production can all benefit from proper pollination in terms of quantity and quality. The biggest economic benefits have been observed in the Mediterranean, Southern and Eastern Asia, and Europe. According to market prices, animal pollination increases the

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output of crops worldwide by an additional USD 235-577 billion each year. A higher demand for pollination services results from increasing productivity, nevertheless. Without animal pollination, 5-8% of crop production would be lost globally. Pollination also benefits ecosystems in various ways, such as improving biodiversity and food production without endangering the environment.

Fig 1: "Honey bee – The Super Pollinator"

Insects are thought to be responsible for 80–85% of all pollination, with honeybees accounting for 75–80% of this, according to Johannsmeier and Mostert (2001). Solitary bees, bumblebees, and honeybees are the largest insect groups for pollination (Free, 1993); this is due to their ample body hair and behavioural traits (Du Toit, 1988). Many flower and fruit crops depend on insect pollinators to increase seed set, as well as seed quality, early flowering, oil content, pyrethrin content, rubber content, and lavender oil production (Free, 1993).

To increase cross-pollination, for instance, a territory can have both wild and managed bee species. Other potential vectors include the water and the wind, and animal pollinators include bats, birds, butterflies, hoverflies, wasps, thrips, diptera, and other creatures. 87 global crops, including watermelon (Citrullus lanatus), passion fruit (Passiflora edulis), kiwi (Actinidia deliciosa var. deliciosa), chocolate (Theobroma cacao), and kiwi from 200 different nations, are produced thanks to animal pollinators. Involved in the worldwide economic food production are 30% of these crops.

In 2005, the economic value of global pollination was estimated to be EUR 153 billion, or 9.5% of the total agricultural output of food for human consumption. Vegetables

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and fruit are the most profitable insect-pollinated agricultural groups, bringing in about EUR 50 billion annually, followed by edible petroleum crops, stimulants, nuts, and spices. A tonne of crop production that does not rely on insect pollination is worth roughly EUR 151, as opposed to an average of EUR 761 for crops that do.A large number of agricultural products are produced all over the world thanks to insect pollination, including aromatic and medicinal plants like black cumin (Nigella sativa linn), cumin (Cuminum cyminum linn), anise (Pimpinella anisumlinn), sunflower (Helianthus spp.), and coriander (Coriandrum sativum linn). 48 of the most important crops on earth are pollinated by honey bees, native bees, and flies every season, which has a substantial impact on the world economy. For instance, pollination generates USD 16 billion in revenue annually in the USA alone, of which USD 12 billion can be directly linked to honey bee accessibility.

The Western honey bee (Apis mellifera L.) is the primary species responsible for bee pollination on a global scale, and it satisfies 34% of pollination service demands in the United Kingdom. A small number of other bee species, notably the bumble bee, have received the most attention from researchers despite the fact that they also contribute to pollination (Bombus spp.). Greenleaf and Kremens found that interactions between wild and honey bees increased pollination rates by a factor of five and increased the predominance of hybrid sunflowers by a factor of two when compared to wild bees alone.

The majority of pollinators for plants are bees. Insect pollination generated EUR 153 billion, or 9.5% of the entire economic value of agricultural production used directly for human nourishment, according to Gallai et al. As a result, nations that cultivate cash crops like coffee (Coffea spp.), cocoa, almonds (Prunus dulcis ((Mill.)), and soybeans (Glycine max L.) rely considerably more heavily on large-scale pollination in agriculture. Scientists have utilised a variety of techniques to calculate the annual benefit of various ecological expenses suffered by native insects in the United States, which have been demonstrated to total more than USD 57 billion, of which USD 3.07 billion is a result of bee pollination.

Over 100 commercial crops in North America depend on honey bees for pollination. In addition to being commercially significant, honeybees and wild bees are also necessary for the production of sunflower seeds, a sector with a rising market value of about USD 10.4 million each year. Crops grown on farmland produce more thanks to bee pollination. For example, bee pollination improves cotton yield to 62% in sub-Saharan Africa, the region that

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is thought to be the world's largest producer of the fibre, from an estimated 37% without bee pollination.

In addition, smallholder farming systems in Kakamega (western Kenya) have seen financial benefits from bee pollination. These farming systems grow a variety of crops, including green gramme (Vigna radiata), beans, cowpea (Vigna unguiculata L. Walp), sunflower, tomato (Solanum lycopersicumlinn), bambara groundnut (Voandzeia subterranean L.), passion fruit, and capsicum and pollination, which is responsible for over 40% of the annual crop yield and significantly increases the production rate.Approximately USD 564,000 in the north (Serra da Bocaina, Pará) and USD 246,000 in the southeast were the projected yearly values of pollination services provided by bees in Brazil's protected areas in 2016. (Mata do Jambreiro).

Twenty (55%) of the 36 crops grown in the state of Pará rely on animal pollinators, and in 2016, the whole cost of pollination services was USD 983.2 million, or 33% of the entire cost of crop production (USD 2.95 billion). Four groups—cocoa ($187.6 million), acai palm ($635.6 million), watermelon ($26.1 million), and soybeans—accounted for 96% of the value of pollination services in Para (USD 98.4 million).In the USA, both honey bees and wild bees have contributed roughly the same amounts of pollination to the majority of crops, even in agriculturally active areas. Over USD 1.5 billion is produced annually from wild pollinators for seven different crops. With a value of USD 1.06 billion, apples are the fruit with the highest estimated value of wild pollinators, followed by watermelon ($146 million), blueberries ($50 million), sweet cherries ($145 million), art cherries ($32 million), and pumpkin ($101 million). The economic impact of honey bees on crop yield is estimated to be USD 6.4 billion.

Honeybees' significance as pollinators:

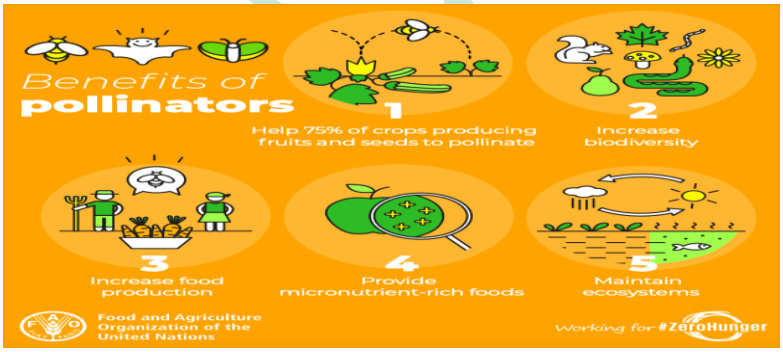

Fig 2: Benefits of Honey Bee Pollination

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The transfer of pollen from one plant's stigma to another plant's stigma, which results in fertilisation, is called cross-pollination, and honeybees play a key role in this process. Fruit and seeds grow and mature following fertilisation. For both monoecious and dioecious plant species, which have an individual plant bearing both male and female reproductive organs, as well as those with an individual plant bearing only one set of reproductive structures, pollination by insects, especially honeybees, is crucial.

The majority of blooming species would not produce fruit or seeds without this help. Numerous agricultural crops, including Aeschynomene americana L., Ageratum conyzoides L., Amomum xanthioides Wall., Anacardium occidentale L., and Antigononleptopus Hook. Honeybees pollinate the following plants: BalakarabaccataRoxb., CastanopsisacuminatissimaRehd., Cinnamomum kerriiKosten, Coccinia grandis CL.Voigt, Cocos nucifera L., Coffea Arabica L., and Conyza sumatrensis Retz (Suwannapong et al., 2011).

Honeybees are crucial pollinators in part because they actively seek out blooms containing pollen rather than just nectar, in contrast to other pollinators like bats and hummingbirds that mostly visit flowers for nectar. Without honeybee pollination, some plants cannot yield fruit. Bees' devotion to certain flowers is a result of their choice for sugar-rich nectars and pollen with better nutritional qualities.Before European settlers introduced them in the 17th century, honeybees did not exist in the Americas, Australia, or New Zealand (Zander and Weiss, 1964).

A wide variety of honeybee species can be found in Asia. These include the native bees of the area, Apiscerana, A. dorsata, A. florea, A. laboriosa, A. breviligula, A. binghami, and A. andreniformis, as well as the European honeybee, A. mellifera, which was brought and encouraged for use in beekeeping. Through a range of goods and services, local honeybees significantly improve the rural poor's standard of living and contribute to environmental protection (Partap, 1992).They are extremely effective pollinators thanks to the honeybee's morphological structure, which co-evolved with the form and characteristics of flowers. The setae and hairs on their bodies help pollen adhere to them. The next flower they visit receives some of this pollen, which fertilises it. A long proboscis on their mouthparts is the right length for floral structures holding nectar. Pollen can also be returned to the hive via static electrical charge thanks to pollen baskets on their legs.

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This makes pollen (and other tiny particles) attach to them and allows them to pollinate nearby blooms while they forage. Some plants require honeybee pollination in order to yield fruit. This floral fidelity of bees is a result of their preference for nectars with sugar content and pollen with better nutritional contents, according to New Perspectives in Plant Protection.It is believed that honeybees' contribution to crop yield improvement and biodiversity preservation is significantly greater than the value of the hive goods they produce. (Partap and Verma, 1994; Partap and Verma, 1976; Crane, 1991; Free, 1993; Suwanttopong et al., 2011) As a result of increased and ongoing pesticide use, the supply of natural insect pollinators is quickly declining on a global scale.In order to maximise fruit yield, it is urgently necessary to improve management of hive honeybees like A. cerana and A. mellifera. Worldwide crop quality and productivity are improved as a result of knowledge of honeybees' involvement in pollination (McGregor, 1976; Crane, 1991; Free 1993; Partap and Verma, 1994; Suwannapong et al., 2011).

Factors that affect the Bee pollination:

- Pathogens, nutritional shortages, climate change, and deforestation are a few of the factors that affect bees' ability to perform their function as pollinators.
- The longevity and health of bees are negatively impacted by pathogens including viruses and bacterial diseases, which puts the pollination of crops and wild plants in danger.

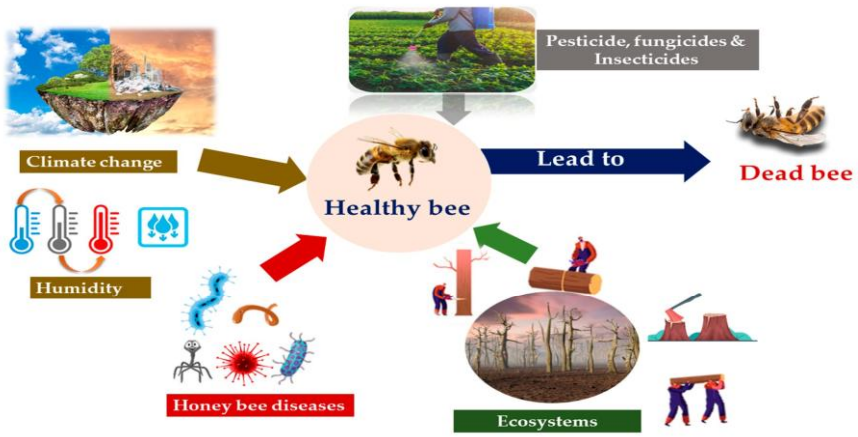

Figure 3: Factors affecting the Bee Pollination

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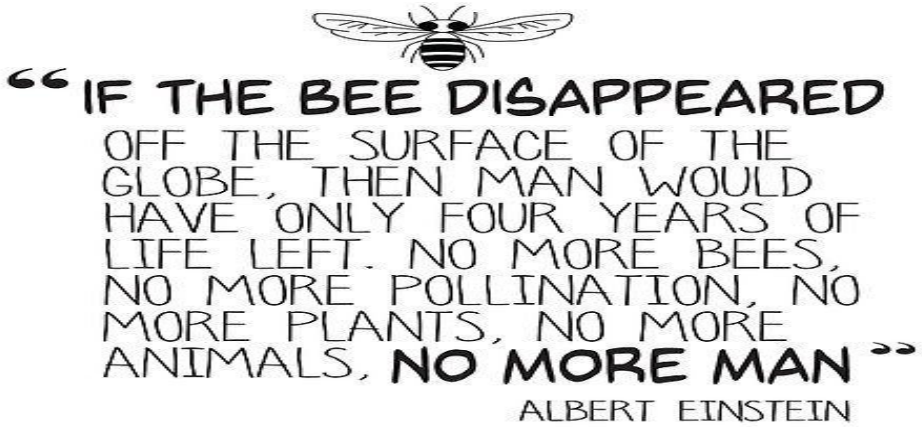
Conclusion:

A range of benefits, such as food and fibre, plant-derived medications, ornamentals and other aesthetics, genetic diversity, and ecosystem resilience, are dependent upon pollination, which is a crucial input in crop production to boost crop quantity and quality. Due to their dependable floral characteristics and foraging habits, bees are the most significant pollinators for agricultural crops that are animal-pollinated globally. However, only a small percentage of managed bee species pollinate the world's crops; the majority are pollinated by solitary bees and other wild animals.

In order to ensure global food security, bee pollination must be improved in addition to environmental balance. For particular medicinal plants and international crops, bees perform a crucial function that has a big impact on both quantity and quality. Researchers should concentrate their efforts on examining the effects that bees have on crop quality, as this should yield more in-depth information about how bees might change the chemistry of particular crops.

Henceforth, we consider "Honey bees are the Super-pollinators.



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