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Honeybees: Importance in agriculture and the significance of bee conservation

SAKSHAM CHOUDHARY, VANDANA PETWAL, CHANDAN KUMAR

PLANTICA IARD Dehradun
Correspondence Email : sakshamchoudhary214@gmail.com

Introduction

Pollination is the process in which the pollen grains are transferred from the anther to the stigma. The pollens are transferred with the help of a medium known as vectors. The vectors can be both biotic and abiotic. Abiotic factors include water and wind. Biotic factors include animals, birds, and insects like bees, butterflies, ants, beetles, etc. Animals are the most important and major pollinators for most of the plants in the wild as well as cultivated crops. Insect pollination is the most critical method of pollination in the ecosystem. During evolution, the plants and pollinators developed specific relations to perform.

Among all these pollinators, animals are the most important pollinators around the globe. Nearly 85% to 87.5% of the total pollination is performed by animals globally.

Insect pollination is the most critical method of pollination in the ecosystem. During evolution, the plants and pollinators developed specific relations to perform pollination. Approximately 67% of the cultivated crops are insect pollinated. The genome sequencing of honeybees has been completely recorded that it is found that India has been gifted with the greatest diversity in case of honeybees.

Indian subcontinent has been found to be the origin of genus *Apis* and were then spread around the globe evolving into other species including *Apis mellifera, Apis dorsata, Apis bombyx, Apis cerana, Apis florea,* etc. *Apis mellifera,* most commonly known as Western or European honeybee was among the first honeybee species to be domesticated in Egypt. Ancient Egyptians had religious sentiments with the honeybees. In a ritual, the Egyptian priests used the specialized tools to put honey in the mouth of statue of a mummy as the believed the bee was the incarnation of spirits of the dead person.

Ancient Egyptians also believed that bees were incarnated by the tears of the Sun god- Ra. When the tears of the Sun god fall from the sky touch the desert sand, they give birth to honeybees that functions on plants and trees to produce wax and honey.

Importance of honeybees

1. Yield Increase : There is a never-ending demand for food products due to exponentially increasing human population and climate change. But due to decrease in agricultural land, the one of the few environmentally friendly options available is proper and effective pollination to improve the quality and quantity of yield. As honeybees are one of the most important pollinators, their role is crucial in yield production. Honeybees can be exploited to increase the pollination in crop fields.

2. Products and byproducts: Honeybees can also be termed as natural engineers and master chemists. Besides from performing pollination, they also produce other valuable products. The products collected from beehives contain high

economic value. The products collected are honey, beeswax, propolis, royal jelly, and bee venom.

Crop	Yield Increase (%)
Rapeseed	12.8-139.3
Mustard	128.1-159.8
Sunflower	48.2-155.0
Sesame	22.0-33.0
Castor	30.6
Soybean	18.1
Linseed	1.7-40.0

Source: P. Duraimurugan and A. Vishnuvardhan Reddy, ICAR, Indian Institute of oilseeds Research, Rajendernagar, Hyderabad.

(i) Honey. Honey is a direct product that is produced by honeybees as their food resource and is stored in hives. Honey is used by food source and a natural sweetener. It also contains high nutritional value and taste with many health and other benefits. Honey is also used in cosmetics and other skincare products. It also contains many medical properties including antibacterial, antioxidant effects etc. also because of being a chemically stable product, the shelf life of honey is also very long. The viability of honey is also prolonged due to its natural acidity and low moisture content. The oldest honey ever found was inside the tomb of Ancient Egyptian King Tutankhamun and the honey inside the jar is still in edible condition. The jar has been dated from 3500 BC.

(ii) Beeswax : Beeswax is a product that is produced by honeybees to build their combs. It is used as the structural framework and building material for honeycombs by the honeybees. Beeswax contains a high economic value and wide range of uses. It is used to make candles and is used in cosmetic industries as a hardening agent and emulsifier. Other than this, it is also used for fragrance in soaps, lip balm and perfumes. It is also used to polish wooden boards and kitchen tables as it is food grade. In addition, bees wax also contain medicinal properties. It helps to lower the cholesterol levels and prevents infections.it also contains antimicrobial and anti-inflammatory properties. It is also used in baby rash creams caused due to diapers.

(iii) Propolis : Propolis, also known as bee glue is a resin that is produced by honeybees. It is used by bees for construction of beehives and repairing of cracks and holes. Propolis also have medical properties like healing of wounds, cuts, bruises, burns, acne etc.

(iv) Royal jelly: Royal jelly is milk like secretion that is excreted by the bees. It is used to feed the larval stage of bees for 3 days in case of workers and drones for their development. It also contains medicinal properties like hay fever, pancreatitis, liver diseases, skin problems and high cholesterol situations. It is also helpful for its antiaging effects and boosting of immune system. It is also effective against tumors.

(v) Bee venom : Bees being the tiny gardeners, also contain stingers that release bee venom to defend themselves and the hives from the predators. Bee venom is a colorless and acidic substance that causes inflammation and severe pain. Bee venom is not toxic in nature but it makes our immune system hyper responsive and

as a result, our immune system produces more antibodies against it. The blood vessels are also dilated due to the release of histamines by the immune system. Bee venom also used in treatment of arthritis, Parkinson, nerve pain. It is also shown effectiveness against cancer cells and antiviral activity.

Consequences of bee decline

As according to recent studies, the population of honeybees has been recorded to decline at a serious rate. This decline may result in reduced pollination rate that will further affect the flora. As a result, there might be a decline in number of cross-pollinated species. This can cause a huge impact on biodiversity as it can result in co-extinction for many other plants, insects, birds, animals, microorganisms etc. that depend on these plants. This might cause a drastic impact either directly or indirectly to the environment and might be fatal for ecosystem. Decline in honeybee population may cause a major impact on apiculture market in India. The total market value for apiculture in 2023 was nearly around ₹25760.9 Million. This can result in shortage of honeybee products like honey, bees wax, bee venom, propolis and royal jelly.

Decline in honeybee population may also cause negative economic impacts on yield as well. The reducing honeybee population might result in decrease in yield in cross pollinated crops. This can further result in shortage of food supply and cause food instability as a large number of crops cultivated for human use depend on honeybees for cultivation.

Causes of decline

Habitat loss : The natural habitat of honeybees has been affected by agriculture, mining and anthropogenic activities. As agriculture provides flora for some insects like bees, butterflies etc. some species are mostly habitat specific and hence are losing their sites for foraging, overwintering, and nesting that can be fatal for their survival. Many pollinators are adversely affected by anthropogenic activities like deforestation, construction, change in agricultural pattern etc.

Climate change : Bees are the insect species that are found mostly all over the world except for Antarctica. This means that honeybees are at some extent adaptable to most climatic conditions. But due to harsh climate change, change in temperature, and sea levels, honeybees are getting affected and resulting in more fatality rates and population decline. This factor is not only affecting honeybees but other pollinators too.

Emerging diseases and predators : Climate change does not necessarily kill the honeybees but it surely weakens the honeybees and their hives. This makes the colony more vulnerable to parasites and diseases. Parasites like Nausema cause intestinal problems in the hive if left untreated. Predators like wasps, wax moths, and termites also attack beehives when the colonies are weakened. These parasites and predators cause high fatality for the colonies resulting in a decreased number of honeybees.

Pesticides and Insecticides : Pesticides are the chemicals that are used to get rid of unwanted pests from the fields. These pesticides might be narrow-ranged or wide-ranged. The wide range of pesticides may affect the pollinators resulting in the death of pollinators while foraging. But when bees are affected by contact pesticides, it might be fatal for the whole colony including the queen and larvae.

The major symptom of pesticide poisoning in beehives is large numbers of dead honeybees in front of the hive or inside the apiary. Another symptom is the sudden loss of the honeybee population which further results in a weakened bee colony making the colony more vulnerable to pests and diseases.

Strategies for bee conservation

Reforestation : Reforestation means the reclamation and conservation of forest lost due to natural or anthropogenic causes. It helps to revive nature in the way it is supposed to be and provides natural habitats to all other organisms. Forests are one of the most important sources for bees' survival as they provide every requirement for their habitat like pollens, nesting sites, shade in summer, etc. Forests are home to many plant species that bloom at different times, providing pollen resources at different times of the year.

Floral restoration : Restoration of flowers is one of the most important factors in honeybee conservation. It is helpful to create a bee-friendly environment by fulfilling the requirement for pollens for honeybees. Floral restoration aims at planting a wide variety of plants like herbs, shrubs, and trees that bloom at different times of the year to secure a continuous supply of pollen for honey production.

Nest-site restoration: Nest-site restoration aims to create and maintain a habitat that is preferred by different species of honeybees. A proper nest site contains good soil, a nearby water reservoir, a shady nesting place, a nearby pollen source, nearby forests, and a natural habitat while also providing artificial feeding facilities, etc.

Natural / Organic farming: Natural/Organic farming is the farming method in which there is a focus on minimal use of chemical fertilizers and pesticides. It is an environmentally friendly approach to agriculture and also helps in reducing pesticide poisoning which is one of the major causes of bee decline. It ensures a chemically safe environment for honeybees which further results in better quality of honeybee products like honey, etc.

References

1. J. Olerton, R. Winfree (2011), How many plants are pollinated by animals? Oikos 120: 321-326
2. Meena Thakur, Bees as pollinators- Biodiversity and conservation, International Journal of Agricultural Sciences and Soil Science (ISSN:2251-0044) vol.2(1) pp. 001-007 January 2012
3. Rachael Winfree (2010), The conservation and restoration for wild bees, Ann. N.Y. Acad. Sci. ISSN 0077-8923
4. The Sacred Bee: Ancient Egypt — Planet Bee Foundation
5. The World's Oldest Jar Of Honey Is From 3500 BC (tastingtable.com)
6. How Climate Change Is Affecting Bees - Ecrotek Beekeeping Supplies Australia
7. Indian Apiculture Industry Report, Trends and Forecast 2024-2032 (imarcgroup.com)