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# Significance of Honeybee in Crop Pollination

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One of the most crucial processes for maintaining and preserving biodiversity and life on Earth is pollination. The transfer of pollen from male to female sex organs is called pollination. Pollination is an important step in the reproduction of seed plants, the transfer of pollen grains (male gametes) to the plant carpel, the structure that contains the ovule (female gamete). Approximately 90% of flowering plants require pollination by insects and other arthropods (Haq *et al*., 2016). Insect pollination is necessary for the growth of over 80% of fruits, vegetables, and other crops worldwide. The failure of cucurbit fruit set often results from inadequate pollination, which is directly related to low numbers of fertilized ovules. It is essential that fruit-producing cucurbit flowers (pistillate or hermaphrodite) receive adequate amounts of pollen for the pollination process to proceed, which will lead to successful fruit set and development. Pollination, pollen tube growth, and the eventual fertilization of ovules are responsible for the release of natural plant growth regulators (often referred to as plant hormones or phytohormones) that directly influence both cucurbit fruit set and production of fruit tissue and consequently fruit development.

The most significant insect pollinator is the bee. Insect pollination is necessary for the growth of over 80% of fruits, vegetables, and other crops worldwide. The most significant insect pollinator is the bee. Many different types of animals, mostly insects, provide pollination, which is an essential environmental service. The orders of bees, flies, butterflies, moths, wasps, beetles, and other insects contain the majority of pollination species. The three orders of insects that serve as pollinators are Hymenoptera, Lepidoptera, and Diptera. The most popular and easily managed pollinator for commercial cucurbit crops globally is the honeybee. .The principal flower-visiting insects are from the orders Hymenoptera and Diptera for the following reasons. Approximately 73% of the world's cultivated crops are dependent on pollination, of which 56.5% are pollinated by bees, 19% by flies, 6.5% by bats, 5% by wasps, 5% by beetles, 4% by birds, and 4% by butterflies and moths. Pollinators provide key of ecosystem services to both natural and agro-ecosystems. Positive relationships between the richness and abundance of floral resources and pollinator diversity and activity have been found at the landscape level (Klein *et al*. 2003). Honeybee pollination is so important because pollination is needed for plants to reproduce, and so many plants depends on bees. When a bee collects nectar and pollen from the stamens the male reproductive organ of the flower sticks to the hairs of her body. When she visits the next flower, some of the pollen is rubbed off into the stigma, or tip of the pistil. The female reproductive organ of the flower. When this happens, fertilization is possible and a fruit, carrying seeds can develop. Plant rely on bees and other insects to reproduce and so they have adapted, over time, to become more attractive to them. A flower's scent can have appeal to bees, and its bright

colors may lure the bees. Honeybees are considered as the most effective and ideal pollinators.

## Honeybee Species and Their Role in Pollination

Honeybees are the main pollinators in most of the cross pollinated crops particularly in seed spices. A large number of species of honeybees have been conserved and utilized for their services for pollination of various crops in the world. In the Asia, there are ten species of honeybees are to be considered and could be exploited for pollination in different agro-climatic conditions. These species are rock bee, *Apis dorsata* Fab., Indian bee, *Apis cerana indica* Fab., little bee, *Apis florea* Fab., European bee, *Apis mellifera* Lin. (introduced from native Europe for commercial beekeeping); dammer bee, *Trigona irridipennis* (sting less bee); *Apis laboriosa* Smith (the largest bee species in the world was confirmed from high altitudes of Himalayan range); red bee, *Apis koschevnikovi* Enderlein; *Apis andreniformis* Smith (world's smallest bee species, naturally available in southeast Asia); Malaysian bee, *Apis nuluensis* Lin., and black bee, *Apis nigrocinta* Smith are the native of Sulawasi Island and Indonesia.

***Apis dorsata* Fab.**

*Apis dorsata*, (the rock bee or giant bee) is a native of Asia, found in foot hills of Himalayas and northern regions of the country (Thomas *et al*., 2002). The Sunderban forests in West Bengal are rich in Apis dorsata, the organic honey from these forests are of great demand today. It is ferocious in nature and has almost black coloured abdomen. It is found mainly in the open branches of trees, along the sides of steep rocks in the forest and comparatively high places of isolated unused buildings. Each colony consists of a single comb. A colony normally comprises of one queen, thousands of workers (female sterile bees) and several hundreds of drone (male bees) in all the species of honeybees.

***Apis florea* F.**

It is commonly known as little bee because of small size, golden in colour and quiet by nature. The species is common in central part of India and also occurs in arid and desert region of extreme climates, and also in plains and forests. Large quantity of Apis florea honey is collected from the Kutch area of Gujarat (Soman and Chawda, 1996). Single colony have single comb, construct openly on branches of small trees, bushes, hedges, sunshade of building, caves, empty cases, etc. Honey production capacity is very less, about half a kilo of honey per year from a productive colony but the quality of honey is very good. Honey production capacity is very less, about half a kilo of honey per year from a productive colony but the quality of honey is very good. It has not been domesticate as commercial beekeeping due to low yield of honey but play a foremost duty in pollination in seed spices crops like ajwain, cumin, dill, fennel, coriander etc.

***Apis mellifera* L.**

Bees of *A. mellifera* are medium sized, golden colour and quiet in nature. They are less prone to swarming, absconding and each colony has many combs and prefers darkness. In India, *A. mellifera* has been imported initially to agricultural plains of Punjab in 1960 and has become popular among commercial beekeepers because of good beekeeping source or bee plants, migratory habits and higher honey yield. *A. mellifera* gradually spread to Himachal Pradesh, Bihar, Uttar Pradesh, West Bengal (Agrawal, 2014) and recently in Kerala, Karnataka and Maharashtra. Since *A. mellifera* beekeeping need sound financial support it is difficult for the poor farmers to afford.

***Apis cerana indica* Fab.**

*Apis cerana* is supposed to native of India or some parts of Asia. Twelve subspecies of *A. cerana* are scientifically identified till now. Bees are medium sized (larger than *Apis florae* but smaller than *A. dorsata* and *A. mellifera*), golden colour and comparatively quiet in nature. They make multiple parallel combs on trees, cavities and sunshade of buildings etc. preferably in dry and dark places. They have less migratory habit and easy to domesticate. The species is being cultivated in domestic way throughout the country. It is very prominent at higher altitude area of the country on coriander, buckwheat and many fruit trees.

**Trigona irridepennis**

*Trigona* sp. (dammar bee) is common in all parts of the country and remains long periods in the same abode. It is a very small bee and collects nectar from small flowers. Since the quantity of honey produced is small, these bees are not commercially used. It is a very important insect pollinator in many crops, and their honey has repute in folk medicine.

## Impact of bee pollination on yield and quality

Beekeeping has positive ecological consequences. Bees visit plants for searching food in the form of nectar and pollen. In this process of pollen collection, bees visit the number of flowers as resulted pollination of horti agricultural crops and wild plants. It increases yield in terms of seed yield and also improves the quality of seeds/fruits and vegetable. Bee pollination also increases oil contents of seeds in seed spices, sunflower and mustard. In India, the total area under bee pollination dependent crops is around 50 million hectares and one hundred and fifty million colonies are needed to meet this height at the rate of 3 colonies/hectare. At present, there are only 1.2 million colonies existing in the country, hence, there is a wide scope for expansion of beekeeping for pollination in cross pollinated crops.

The pinkish-white flowers of coriander (*Coriandrum sativum* L.) bloom in compound umbels throughout the January–March season. Insects frequent the flowers, which also yield a good amount of pollen and nectar. The main pollinators are honey bees, and bee pollination can raise yields by 187.3% when bee-Q (bee attractant) is used and by 122.2% when pollination is not performed (Chaudhary and Singh, 2007). Furthermore, the pollination of eggplant (*Solanum melongena* Linn) by *Melipona fasciculata* Smith in greenhouses increased fruit set by 29.5% and increased fruit quality (measured as fruit weight) compared with self-pollination (Nunes-Silva *et al*., 2013).

## Conclusion

Pollination is an ecosystem services and honeybee are a valuable pollinator. It has a great adapted capacity, as it is found almost everywhere in diverse climatic condition. Honeybee pollination improves the yield of various oilseed crop, vegetables crop and fruit crop. However, use of pesticides application affect the integration of bee keeping and crops. The application of pesticides during the flowering period of target crops should be avoided and ensures the protection of honeybee health. Farmers should use ecofriendly pesticides or organic pesticides derived from plant extract and IPM practice should be promoted for control of pest in their agriculture field.

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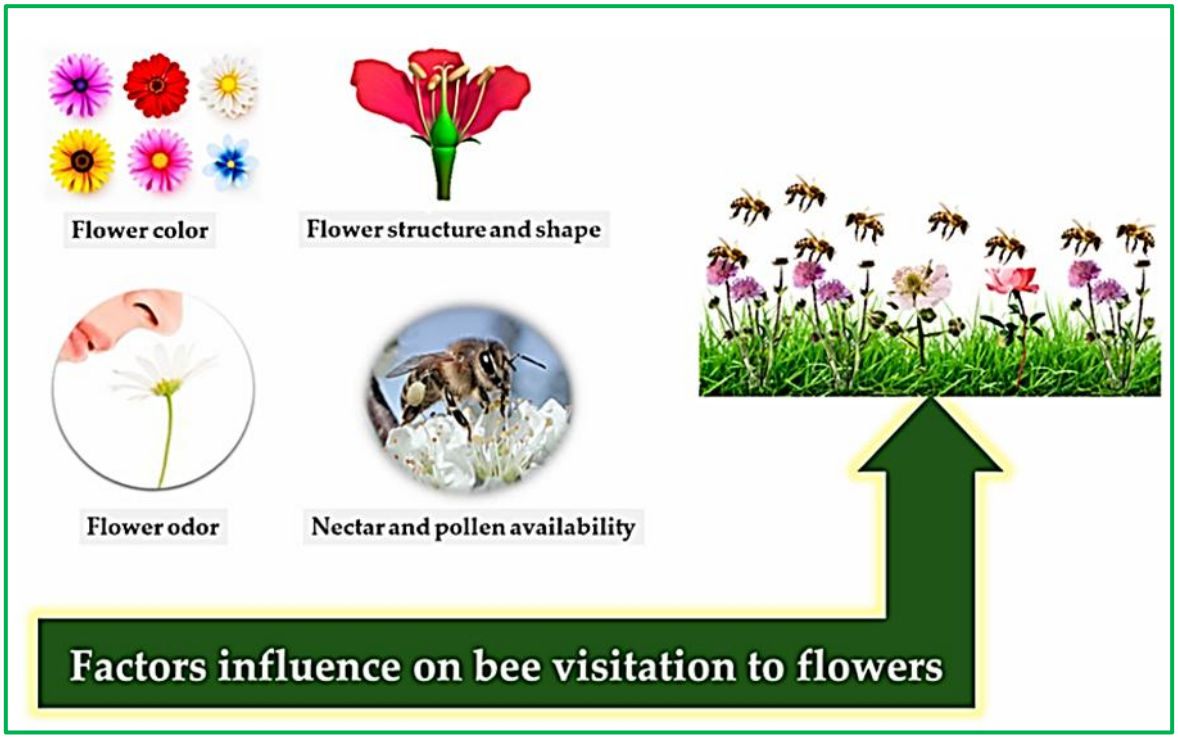
Flower color
Flower structure and shape
Flower odor
Nectar and pollen availability
Factors influence on bee visitation to flowers


Apis melifera
Apis cerena
Apis florea
Apis dorsata