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Effects of honeybee pollination on seed in different crops

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Abstract

“Transferring pollen from the male anther of a flower to the female stigma” is known as pollination. Honey bees carries the “pollen on the outside of the anther and carries it to the stigma”. Sometimes, the pollen grains only are needed to “transfer the stigma of the same flower or another flower on the same plant” and thus honey bee pollination occurs. Hand pollination can also be named as mechanical method in which manually pollination is done, it can be done by rubbing pollen from anthers of the parent flower on the stigma and that flower is again covered to avoid contamination by other insects. Here, we have compared the hand pollination with honey bee pollination via caged method and as a result we get to know that by bee pollination there is a huge difference in the yield.

Keywords: Honeybees, bee pollination, hand pollination, sunflower, mustard, cardamom, alfalfa

1. Introduction

Honeybees are noted for their wax-based perennial colony nests, enormous ‘colonies’, and surplus honey production and storage, making the hives a valued forage target for many animals, including honey badgers, bears, and human hunter-gatherers. Only eight surviving honeybee species are recognized, with a total of 43 subspecies, even though traditionally 7 to 11 species were found. Honeybees are only a minor subset of the over 20,000 bee species known. Honeybees play a vital role in increment in the production of a crop yields.

The western honeybee (*Apis mellifera*) is generally preferred species for honey production and crop pollination. The eastern honey bee (*Apis cerana*), which lives throughout South, Southeast, and East Asia, is the only other domesticated bee. True honey bees are “only members of the genus *Apis*”, but other types of bees make and store honey and have been kept by humans for this reason. Beeswax is also used in the manufacture of ‘candles, soap, lip balms, and various cosmetics, as a lubricant, and in the lost wax process of mould-making’. Honey bees are considered to be one of the best pollinating agents as their body is designed in such a manner with small hair like structures that when it sits on a flower the anther gets stuck to its body and is transmitted from one flower to another in any crop.

1.1 Honeybee, different sex and castes

There are two sexes of honeybees, “male and female”, as well as two castes “queen and workers”, both female. Workers, who do not reach sexual maturity, and queens, who are larger than workers, are the two female castes. Males, or drones, are larger than workers and only appear in early summer. The workers and queen have stingers, but the same is not found in drones. Queen honeybee keep sperm in a structure called the spermatheca, which allows them to control egg fertilization. As a result, queens can lay either “unfertilized or fertilized eggs”. “Unfertilized eggs become drones”, but the fertilized eggs become females, which might be workers or virgin queens.

The purpose of this study was to assess the efficiency of pollination using honeybees (*Apis mellifera*) on different hybrid seed production under different types of pollinations. There are three ways of pollination: in cages with honeybees, by hand pollination (in cages) pollination without honeybees were utilized in all feasible combinations of crosses between two male and three female parents. Pollination kinds, male parents, and female parents were constructed as experiment components in a split-split plot of randomized full block.

Here, we have tried to compile a few crops and the effect of pollination on them. The crops that we took are as follows- Sunflower, Mustard, Cardamom, Alfalfa.

2. Sunflower

Helianthus annuus (common sunflower) is a big annual forb in the genus *Helianthus*. It is widely cultivated for its tasty oily seeds. Besides from being used to make cooking oil, it is also utilized as cattle feed (as a meal or a silage plant), bird food, in some industrial applications, and as an ornamental in personal gardens. *H. annuus* is a densely branching perennial with several flower heads. The domestic sunflower, on the other hand, frequently has single big inflorescence (flower head) atop an unbranched stem. The scientific name *Helianthus annuus* is derived from the Greek Helios 'sun' and anthos 'flower,' while the Latin epithet annuus means 'annual'. Stamm and Shuster (1989)^[21] detected “in the presence of bees, seed set was 70-80% in male-fertile sunflower plants”. Rao *et al.* in 1995^[18] reported “seed set was higher on insect- pollinated male fertile plants (76.4%) than on hand -pollinated male fertile plants (16.9%)”. Earlier studies suggested that “more seed is set when honey bees forage on sunflowers” (Parker, 1981; Pavia *et al.*, 2002)^[24, 15].

2.1 Mustard

Mustard is a “condiment” prepared from the seeds of the mustard plant (*Sinapis alba*, white/yellow mustard; *Brassica juncea*, brown mustard; or *Brassica nigra*, black mustard). To make a paste or sauce ranging in colour from bright yellow to dark brown, whole, ground, cracked, or crushed mustard seeds are blended with water, vinegar, lemon juice, wine, or other liquids, salt, and often other flavorings and spices. The seed itself has a powerful, aromatic, and somewhat harsh taste. “Mustard condiments range in flavor from sweet to spicy. Animal pollinators are thought to be contribute in 15 up to 30% in global food production” (Mc Gregor 1976; Roubik 1995)^[9, 19] and “bees are one of the most important pollinating taxa” (Delaplane & Mayer 2000)^[7]. “Insect pollination leads to earlier cessation of flowering, and more synchronous pod and seed ripening, thereby possibly increasing the weight of seed harvest” (Westcott & Nelson 2001)^[22].

2.2 Cardamom

Cardamom is a spice derived from the seeds of numerous plants in the *Elettaria* and *Amomum* genera of the Zingiberaceae family. Both species are indigenous to the Indian subcontinent and Indonesia. They are distinguished by their little seed pods, which are triangular in cross section and spindle-shaped, with a thin, papery outer shell and small, black seeds; *Elettaria* pods are light green and smaller, while *Amomum* pods are larger and darker in colour. “Flowers of cardamom are bisexual and require cross pollination” (McGregor 1976; Belavadi *et al.* 1993; Siddappaji & Channabasvanna 1983; Chandran *et al.* 1983)^[9, 25, 20, 5]. “Many flower visitors have been reported to be associated with cardamom. Among them, honeybees (Indian hive bee, *Apis cerana indica* F. and rock bee, *A.dorsata* F.) are the most prominent, contributing over 98% of the total visitors” (Belavadi & Parvathi 1993; Parvathi *et al.* 1993)^[25, 14]. “An increase of about 217-486% in yield has been reported in plants having access to bee visits compared to those with no insect visits” (Chandran *et al.* 1983)^[5].

2.3 Alfalfa

Alfalfa (*Medicago sativa*), usually known as lucerne, is a perennial flowering plant in the Fabaceae legume family.

Many countries throughout the world cultivate it as a significant forage crop. It is utilized as a “green manure and cover crop”, as well as for “grazing, hay, and silage”. The word alfalfa is a Spanish adaptation of the Arabic word alfafaa, which derives from the Old Persian compound *aspasti-, which means horse nourishment. It is one of the most important forage crops and is cross-pollinated because of self-incompatibility. There are so many research that proved the role of bee pollination has increased the yield of seed in alfalfa. Taber *et al.*, 1990 found that alfalfa seed was very high by the addition of bumble bee in California. Besides this, Pharis and Unrau, 1953^[16]; Ozbek, 1979^[23]; Nedlenic *et al.*, 1997^[10] found in research that the pollination increases the seed yield to a great amount.

3. Conclusion

From the above discussion, it can be assumed that the foraging activity of honey bee species can be helpful in so many crops and it has a great potential to increase the quality as well as quantity of yield in any crop.

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