

Impact Of Hive Placement on Pollination and Fruit Set in Mango (*Mangifera Indica*) By *Apis Cerana Indica*

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Abstract—Pollination is a critical factor influencing fruit set and yield in mango. The present study was conducted in a mango orchard at Saoner Tahsil, Nagpur District, Maharashtra, to evaluate the effect of distance from a honeybee hive on mango fruit set. A healthy colony of *Apis cerana indica* was introduced into the orchard during the peak flowering period. Fruit set was recorded at five distances from the hive, namely 5 m, 50 m, 100 m, 150 m, and 300 m. The results revealed a distinct decline in fruit set with increasing distance from the hive. The highest fruit set was observed near the hive at 5 m (102 fruits), whereas the lowest fruit set was recorded at the farthest distance of 300 m (58 fruits). These findings clearly indicate that proximity to *Apis cerana indica* hives significantly enhances pollination efficiency. Strategic placement of honeybee hives within mango orchards can therefore play a vital role in improving pollination and boosting overall mango productivity

Index Terms—*Apis cerana indica*, mango, hive placement, fruit set, pollination

I. INTRODUCTION

Mango (*Mangifera indica* L.) is one of the most important fruit crops of India and contributes significantly to the horticultural economy. Despite profuse flowering, mango often exhibits poor fruit set and high flower drop, which reduces productivity. One of the major biological factors responsible for low yield in mango is inadequate pollination (Free, 1993). Mango flowers depend on insect-mediated cross-pollination for successful fertilization and fruit development, and honeybees are considered efficient pollinators due to their active foraging behaviour and flower constancy (Klein et al., 2007).

Among the honeybee species found in India, *Apis*

cerana indica is a native species well adapted to local agro-climatic conditions. Managed pollination using honeybee colonies has been reported to improve fruit set and yield in orchard crops, but the success of such practices depends strongly on hive placement and distance effects within the orchard (Partap and Verma, 1994; Vasanthakumar et al., Year). Therefore, the present study was undertaken to evaluate the impact of hive placement of *A. cerana indica* on pollination efficiency and fruit set in a mango orchard located at Saoner Tahsil, Nagpur District, Maharashtra.

II. MATERIALS AND METHODS

The investigation was conducted in a mango orchard situated at Saoner Tahsil, Nagpur District, Maharashtra. The selected orchard covered about one acre and contained nearly 700 mango trees maintained under routine orchard management. The field work was carried out during the natural flowering period, mainly from mid-November to early January, when blooming was at its peak and bee activity could be recorded properly.

A managed colony of the Indian honeybee, *Apis cerana indica*, was used for the study. The colony was queen-right and had six frames strength with sufficient sealed brood and stored honey, ensuring regular foraging during the observation period. To avoid disturbance and allow the bees to settle, the hive was shifted and placed in the orchard during night time. The colony was positioned on a metal stand, and ant pans were provided so that ants and other crawling insects would not interfere with the hive performance. To examine the effect of distance from the colony, five observation points were fixed at 5 m, 50 m, 100 m, 150

m and 300 m from the hive. Bee visitation was assessed through direct field counting. At each distance point, five inflorescences were selected randomly and observed continuously for 10 minutes. The number of *A. cerana indica* workers visiting the inflorescences during this period was counted and expressed as bees per five inflorescences per ten minutes.

Fruit set was recorded distance-wise to study how pollination effectiveness varied across the orchard. Fruit retention was noted at the time of harvest, around 150 days after flowering. In addition, the number of withered or deformed fruits was recorded at peanut stage, approximately 120 days after flowering, to understand early fruit loss. Fruit yield-related observations were also taken by weighing mature fruits to obtain average fruit weight. Yield per tree was calculated using the standard relationship among fruit number, panicle count and fruit weight, and was expressed in kilograms using the formula:

$$\text{Fruit yield per tree (kg)} = (\text{Mean number of fruits per panicle} \times \text{Mean number of panicles per tree} \times \text{Mean individual fruit weight (g)}) / 1000.$$

All observations were compiled treatment-wise and compared to identify the trend across distances. Statistical interpretation was carried out using one-way ANOVA wherever required, and correlation analysis was used to relate bee visitation with fruit set and yield.

III. RESULTS

Visitation frequency of *Apis cerana indica* at different distances

The activity of *Apis cerana indica* on mango inflorescences varied clearly with distance from the hive. Bees were most frequently seen near the colony, and their movement reduced steadily as the observation points shifted away from the hive. At 5 m distance, the visitation frequency reached the highest value (12.6 bees/5 inflorescences/10 min). With increasing distance, the number of visiting bees declined, and the lowest visitation was recorded at 300 m (4.6 bees/5 inflorescences/10 min). This pattern suggests that the foraging intensity of *A. cerana indica* remained concentrated around the hive location.

Table 1. Visitation frequency of *Apis cerana indica* at different distances

Distance (m)	Bees / 5 inflorescences / 10 min
5	12.6
50	10.8
100	8.9
150	7.1
300	4.6

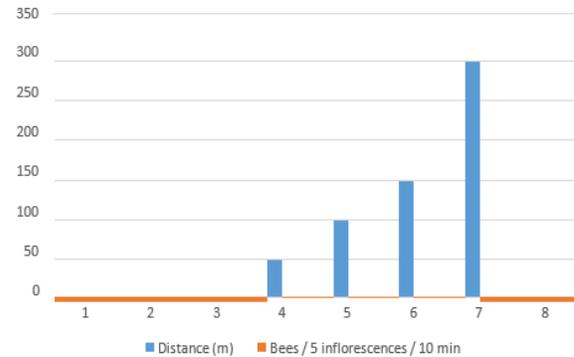


Fig 1. Visitation frequency of *Apis cerana indica* at different distances.

Effect of hive distance on fruit set

Fruit set followed a similar distance-wise trend as bee visitation. Higher fruit set was observed in trees located near the colony, while fewer fruits were formed in the distant parts of the orchard. The maximum fruit set was recorded at 5 m distance (102 fruits). A small reduction was noticed at 50 m (97 fruits), followed by a sharper decline at 100 m (80 fruits) and 150 m (69 fruits). The lowest fruit set was recorded at 300 m (58 fruits). These results indicate that orchard zones receiving more bee visits showed better fruit set, whereas areas far from the hive received less pollination benefit.

Table 2. Fruit set recorded at different distances from the hive.

Distance (m)	Fruit set (Number of fruits)
5	102
50	97
100	80
150	69
300	58

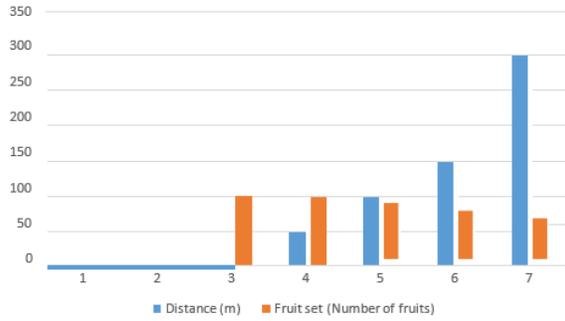


Fig 2. Fruit yield per tree at different distances from hive.

Yield and yield parameters at different distances

The yield and yield-related characteristics also showed noticeable variation with distance from the hive. Retained fruits per panicle were higher in the trees closer to the colony, and the values gradually reduced towards the farthest distance. At the same time, the number of deformed or poorly developed fruits showed an increasing tendency in the distant treatments. This suggests that improved pollination near the hive supported better fruit development and retention.

Average fruit weight showed only small fluctuations among the distances, but overall fruit yield per tree decreased as the distance increased. The highest yield was estimated at 5 m distance (19.8 kg/tree), whereas the lowest yield was recorded at 300 m distance (10.5 kg/tree). The decline in yield across distances reflects the combined effect of lower bee visitation and reduced fruit retention.

Table 3. Yield and yield parameters of mango at various distances from *A. cerana indica* hive

Distance(m)	Retained fruits/panicle	Deformed fruits	Avg fruit weight (g)	Fruit yield (kg/tree)
5	1.40	2.3	285.4	19.8
50	1.10	2.7	295.6	15.2
100	0.90	3.4	278.9	12.6
150	0.80	3.9	305.2	11.4
300	0.70	4.3	300.1	10.5

IV. DISCUSSION

The present study confirms that *Apis cerana indica* acts as an efficient pollinator of mango and that hive

placement strongly influences pollination outcomes. Higher fruit set near the hive may be due to increased bee visitation and improved pollen transfer efficiency (Free, 1993). Similar distance-related trends in pollination benefits have been reported in orchard pollination studies (Partap and Verma, 1994; Vasanthakumar et al., Year). The results of this study highlight that strategic placement of honeybee colonies is important for ensuring better pollination and improved yield under orchard conditions.

V. CONCLUSION

The study concludes that fruit set and yield parameters in mango decline with increasing distance from the *Apis cerana indica* hive. Maximum fruit set was recorded near the hive, suggesting that proper colony placement can enhance pollination efficiency and productivity. Managed pollination using *A. cerana indica* can be recommended as a sustainable practice for mango orchard systems.

REFERENCES

- [1] Free, J.B. (1993). *Insect Pollination of Crops*. Academic Press, London.
- [2] Klein, A.M., et al. (2007). Importance of pollinators in changing landscapes for world crops. *Proceedings of the Royal Society B*, 274: 303–313.
- [3] Partap, U. and Verma, L.R. (1994). Pollination of fruit crops by honeybees. *Journal of Apicultural Research*, 33: 1–10.
- [4] Vasanthakumar, S., Aruna, R. and Srinivasan, M.R. (Year). Pollination efficiency of Indian honey bees, *Apis cerana indica* (Fabricius) in mango orchard. *Conference paper*, India.