



FLORAL HANDLING BY *APIS CERANA INDICA* F. IN SUNFLOWER

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ABSTRACT

The foraging activity of *Apis cerana indica* F with specific to their floral handling time on sunflower has been investigated at MSSSoA, Centurion University of Technology and Management in Gajapati district of Odisha in two cropping seasons. Floral handling time was to be maximum during mid flowering stages and the least during late flowering. The mean time spent on flowers was higher during 10:00-11:00 AM in the second season whereas it was during 01:00-02:00 PM in the first season.

Key words: Indian honey bees, *Apis cerana indica*, floral handling time, seasonal variations, time spent, sunflower, beekeeping, apiculture, Gajapati District, Odisha

The Indian honey bee *Apis cerana indica* (F), is a subspecies of the Eastern honey bee (*Apis cerana*) present in India. These bees serve an important role in pollination by transporting pollen from male to female sections of flowers, contributing to the ecosystem's biodiversity, and aiding agriculture by facilitating the reproduction of numerous plant species. Honey bees are regarded as the best pollinators since they not only pollinate but also store honey that people can use. The economic, ecological, and ornamental benefits of the sunflower *Helianthus annuus* (L) make it an important oilseed crop. It is a diploid from the Asteraceae family. Sunflowers feature bright, colourful flowers that produce a lot of nectar and pollen, which attract pollinators such as bees and butterflies. Insect pollination contributes 9.5% of the total economic value of agricultural production used directly for human food according to Gallai et al. (2009). Sunflower's inflorescence, made up of several small flowers arranged in a broad disc, provides a plentiful landing spot for pollinators. In addition, their movements between capitula are always indiscriminate which enhanced pollen movement according to Toit et al. (1992). There are no evidences on the Indian honey bee floral handling time on sunflower in Odisha condition. As a result, an investigation has been done on the floral handling time of Indian honey bee, *Apis cerana indica* F, associated with sunflower.

MATERIALS AND METHODS

The present study was carried out in two growing

seasons of sunflower, with initial one (September-December, 2021) and the following one (January-April, 2022) in the Experimental Station of Entomology, which is situated in the upland region of the Experimental Research Field, M S Swaminathan School of Agriculture, Paralakhemundi (District: Gajapati), Centurion University of Technology and Management, Odisha. The tactics listed below have been employed to maintain a close eye on population, abundance, and foraging activities. Data has been collected on floral handling time carried out by *A. c. indica* through visual observation during 2021-23. Observations were taken from ten locations for 5 min following fixed plot survey in selected experimental sites every ten days during different time period of a day i.e. 07:00 to 08:00 AM, 10:00 to 11:00 AM, 01:00 to 02:00 PM and 04:00 to 05:00 PM. Time spent by *A. c. indica* in sec as observed was taken flower in 1 capitulum. These data were analyzed following standard statistical methods (SPSS).

RESULTS AND DISCUSSION

The present study revealed that the activity of *A. c. indica* started at 10% flowering stage and the activity continued till late flowering stage. Results revealed that sunflower is visited by 15 pollinators apart from *A. c. indica*; These were rock bees *Apis dorsata* (F), stingless bee *Tetragonula iridipennis* (Smith), two species of leaf cutter bees i.e. *Xylocopa latipes* (Drury) and *Xylocopa aestuans* (L), two species of wasps i.e. *Vespa orientalis* (L) and *Vespa tropica* (L), tawny coster *Acraea terpsicore* (L), common crow *Euploea core*

(Cramer), grey pansy *Junonia atlites* (L), blue glassy tiger *Idiopsis vulgaris* (Butler), plain tiger *Danaus chrysippus* (L), Lemon pansy *Junonia lemonias* (L), Lemon emigrant *Catopsilia pomona* (F), cucumber moth *Diaphania indica* (Sauners) and *Amegilla zonata* (L). Similarly, Thakur et al. (2023), Nayak et al. (2021), Yasmeen et al. (2021), Bhowmik and Bhadra (2015), Hussain et al. (2015), Rasheed et al. (2015), Krishna et al. (2014), Goswami et al. (2013), Jadhav et al. (2011), Panda et al. (1991) and Satyanarayan and Seetharam (1982) observed *A. c. indica* as an effective foraging pollinator on sunflower.

Inference drawn from first season revealed that mean time spent by *A. c. indica* among cropping periods was the maximum with 51.0 sec/ capitulum at 66 DAS followed by 76 DAS (37.05 sec/ capitulum) and 56 DAS (29.48 sec/ capitulum), 46 DAS (13.5 sec/ capitulum) and was least on 86 DAS with a minimum of 5.80 sec/ capitulum. In the second season, mean time spent by *A. c. indica* was the maximum with 53.53 sec/ capitulum at 69 DAS followed by 79 DAS (43.33 sec/ capitulum) and 59 DAS (33.35 sec/ capitulum), 49 DAS (15.08 sec/ capitulum) and was least on 89 DAS with a minimum of 6.55 sec/ capitulum (Table 1).

The first season study revealed that mean time spent by *A. c. indica* was maximum during 01:00-02:00 PM (46.40 sec/ capitulum) followed by 10:00-11:00 AM (38.06 sec/ capitulum), 07:00-08:00 AM (24.10 sec/ capitulum); and was least during 04:00-05:00 PM (0.70 sec/ capitulum). There was little difference during the second season *i.e.* mean time spent by *A. c. indica* was maximum during 10:00-11:00 AM (52.78 sec/

capitulum) followed by 01:00-02:00 PM (42.28 sec/ capitulum), 07:00-08:00 AM (24.50 sec/ capitulum) and was least during 04:00-05:00 PM (1.90 sec/ capitulum) (Table 1). The overall maximum floral handling time of *A. c. indica* was found in the second season on 69 DAS (53.53 sec/ capitulum). The results from the two season shows that maximum floral handling time of *A. c. indica* was maximum during 01:00-02:00 PM (46.40 sec/ capitulum) in the first season whereas it was maximum during 10:00-11:00 AM (52.78 sec/ capitulum) (Fig. 1).

Yasmeen et al. (2021) revealed that the time spent by Indian honey bee was found to be 6.07 sec in sunflower heads. Mehmood et al. (2018) recorded that *A. mellifera* spent 60.97, 74.46, 62.12 sec/ flower during 09:00, 13:00 and 17:00 hr compared to *X. fenestrate* (66.65, 68.19, 67.79 sec) with significant variation in their stay time. These species are showing similar trend in floral time handling behaviour as that of *A. c. indica*. Thus, a large variety of insect species belonging to Hymenoptera are particularly attracted to sunflower capitulum, with the primary Indian honey bee, *Apis cerana indica* being the dominant. The results show that domesticating *A. c. indica* from January to April is more effective than September to December in the sunflower habitat, as foraging activity is highest during the second season.

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Table 1. Time spent on flower (in seconds) by *A. cerana indica*

| First season | | | | | |
|------------------------------|----------------|----------------|----------------|---------------|---------------|
| 46 DAS | 56 DAS | 66 DAS | 76 DAS | 86 DAS | Mean± SD |
| 13.15 | 29.48 | 51.10 | 37.05 | 5.80 | 27.32 ± 18.23 |
| Second season | | | | | |
| 49 DAS | 59 DAS | 69 DAS | 79 DAS | 89 DAS | Mean± SD |
| 15.08 | 33.35 | 53.53 | 43.33 | 6.55 | 30.37 ± 19.46 |
| During time periods of a day | | | | | |
| First season | | | | | |
| 07:00-08:00 AM | 10:00-11:00 AM | 01:00-02:00 PM | 04:00-05:00 PM | Mean± SD | |
| 24.10 | 38.06 | 46.40 | 0.70 | 27.32 ± 19.99 | |
| Second season | | | | | |
| 07:00-08:00 AM | 10:00-11:00 AM | 01:00-02:00 PM | 04:00-05:00 PM | Mean± SD | |
| 24.50 | 52.78 | 42.28 | 1.90 | 30.37 ± 22.28 | |

DAS- days after sowing; SD= standard deviation

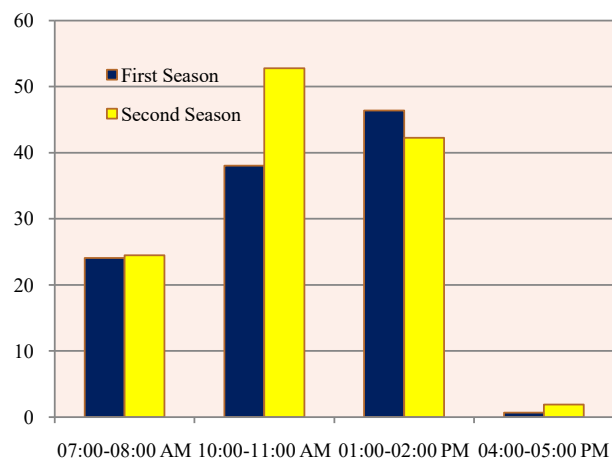


Fig. 1. *Apis cerana indica* F. floral handling time over a day and two seasons

AUTHOR CONTRIBUTION STATEMENT

DP, CRS and SB conceived and designed research. DP conducted experiments. DP and CRS analyzed data. DP wrote the manuscript. CRS and SB reviewed the manuscript and approved the final manuscript.

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CONFLICT OF INTEREST

No conflict of interest.

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