

## Study on nesting parameters of dwarf honey bee, *Apis florea* F. in arid zone of W.B, India

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### Abstract

Nesting biology of *Apis florea* F. (1973) was investigated in different arid zones of West Bengal, India. 20 natural colonies of *A. florea* were thoroughly studied during February 2022 to January 2023. *A. florea* builds small, single, open, areal nest, 1 ft to 19ft 4 in (mean=7.42±5.18 ft) above the ground. The present study investigated that *A. florea* builds their colony much higher in number in and around human habitations. Only 7 colonies were found in live or dry tree branches. The nests are of different shapes and sizes. Mentioned colonies were various in colour like creamy white, brownish etc. Length of the hive ranges from 8.4 cm to 51 cm (mean=27.43±14.68 cm) and the width of the hive range from 6.1 cm to 38 cm (mean=19.9±9.90 cm). Different nesting parameters viz. location, dimension of the cell of queen, drone, worker etc. have also been noted.

**Keywords:** Nesting behaviour, *Apis florea*, Arid zones of W.B

### Introduction

The dwarf honeybee, *Apis florea* (Fabricius, 1787) is a small eusocial hymenopteran bee species in the genus *Apis*. These wild bees construct an areal, single, exposed nest (Sarma *et al.*, 2002).<sup>[13]</sup> It is distributed from China to Thailand, and also found in India, Sri Lanka, Pakistan, Oman, Iran etc. (Wongsiri *et al.*, 1997; Hepburn and Hepburn, 2005)<sup>[5, 17]</sup>. In India, the biology, behavior and economic importance of *A. florea* have been reported by Soman and Chawda (1996)<sup>[14]</sup>. Different nesting parameters and comb dimensions of *A. florea* have been studied by Khan *et al.*, (2002)<sup>[6]</sup> in India. In Nepal Thapa and Wongsiri (1996)<sup>[16]</sup> have noted the pollination behavior of *A. florea*. Information on nesting plants of dwarf honeybee was also reported under tropical conditions of Karnataka.

This small sized bee species are highly valuable for pollination efficacy in crops (Oldroyd *et al.*, 2000)<sup>[11]</sup>. *A. florea* is a neglected bee species to the local people for their low production of honey and do not usually rare in controlled condition. Limited studies have been done on *A. florea* in India and no sufficient information is available from arid zones of West Bengal. Hence the present investigations were conducted to record some useful information on the same.

### Material and Methods

The present investigations were performed in different arid zone of West Bengal, like Purulia, Birbhum. Arid zones are mainly characterized by high temperature and low humidity in day time and comparatively cold in night. Annual rainfall of arid zones is less than 25 cm. Twenty hives of *A. florea* were thoroughly studied and recorded during February 2022 to January 2023. Colonies as well as its nesting sites or nesting trees were studied by naked eyes and binocular (specification: Nikon action 8x40 CF). The nesting plants were identified by photographic pictures taken by Nikon digital camera- D5600, 18-55 mm, 10X optical zoom, and with the help of local people as well as plant taxonomist. The height of nesting site from ground was recorded with the help of measuring rod. Nesting parameters (length, width and thickness of hive, dimension of queen, drone and

worker cell etc.) were measured by using scale and vernier caliper. The recorded data from data sheet were compiled and various statistical appropriate tools were used for analysis.

### Result and Discussion

The present study reported that *A. florea* construct their nest at a height 1ft to 19.33ft above the ground (Table: 1). In this study, it is found that 65% of colonies were found below 10 ft height from ground and 30% colonies were found at height between 10 ft to 15 ft and only 5% colonies were observed above 15ft.

The present investigation recorded a wide diversity in the hive dimensions. Length of the comb (horizontal dimension) ranges from 8.4cm to 51cm and width of comb (vertical dimension) ranges from 6.1cm to 38cm. The mean comb length was 27.43±14.68 cm and mean comb width was 19.9±9.90 cm (Fig: 2a).

A wide variation of comb shape was recorded like, almost round (40%), elongated (30%), heart shaped (15%), irregular (5%), rectangular (5%), oval (5%). The honey storage cells are located at the upper most region of the hive where it is attached to the substrate. Below the honey cells pollen cells (Fig: 2b) are observed and below the pollen cell numerous brood cells are observed (Fig: 1). Queen cells are cylindrical in shape, located at the bottom most region of hive protruding vertically and above the queen cell large number of drone cells are noted (Fig: 2a). Size of the worker cells (both depth and diameter) is slightly lower than drone cells and the cells are hexagonal and horizontal. The mean diameter and depth of worker cell were 3.39±0.65mm and 9.05±1.24mm respectively. The mean diameter and depth of drone cell were 4.48±0.36mm and 13.62±1.16mm respectively. Similarly, the mean diameter and depth of queen cells were 5.08±0.24mm and 13.60±1.46mm respectively.

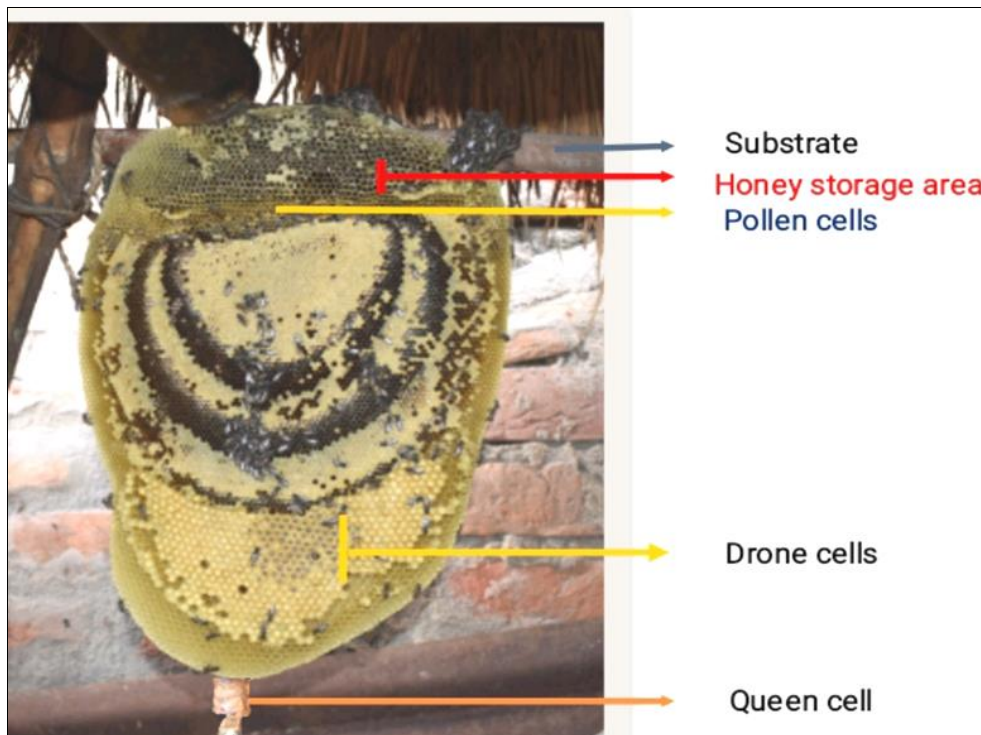
2 to 10 queen cells per colony are found among studied colonies, but the queen cells are absent in newly settled colonies (Fig: 2a). The mean number of queen cells was 07±2.67. Number of queen cells indicates the number of

swarming as well as the age of the colony. The present study recorded a wide variety in the hive direction. Maximum numbers (45%) of colonies were observed in E-W direction followed by NW-SE (35%), NE-SW (15%) and N-S (5 %) (Fig: 4)(Table: 2). Comb colour varies from creamy white to brownish. 40% colonies were brownish in colour and 60% hives were Creamy White colour. Hive colour also depicts health and age of hive.

Maximum numbers of colonies were observed in human settlement areas (Fig: 3a, b). Total 20 beehives were observed and out of 20 colonies, only 6 colonies were on branches of different plant species like *Carissa sp*, *Mangifera sp*, *Heritiera sp*, *Tamarindus sp* etc. and rest colonies were hanging from carnish or balcony of human houses (Fig: 3). The supportive branches were 1.5 to 6 cm in diameter.

**Table 1:** Nesting parameters of *Apis florea* in arid zone of W.B, India

Sl. No.	Parameters	Range	Mean	SD
1.	Height of nest from ground (ft)	1 - 19.33	7.42	5.18
2.	Length of comb (cm)	8.4 - 51	27.43	14.68
3.	Width of comb(cm)	6.1 – 38	19.9	9.90
4.	Thickness of honey storage area (cm)	3.4 – 11.5	7.52	2.26
5.	Thickness of worker cell area (mm)	10.1 – 31.4	20.42	6.50
6.	Thickness of drone cell area (mm)	21.2 – 37.4	28.87	4.63
7.	Diameter of worker cell (mm)	2.5 – 4.8	3.39	0.65
8.	Depth of worker cell (mm)	6.9 – 11.1	9.05	1.24
9.	Diameter of drone cell (mm)	4.1 – 5.3	4.48	0.36
10.	Depth of drone cell (mm)	12.4 – 16.1	13.62	1.16
11.	Diameter of queen cell(mm)	4.7 – 5.5	5.08	0.24
12.	Depth of queen cell(mm)	12.2 – 15.9	13.60	1.46
13.	Number of queen cell	2 – 10	07	2.67



**Fig 1:** Hive architecture of dwarf honeybee *Apis florea*

**Table 2:** Nesting features of *Apis florea* in arid zone of W.B, India

Sl. No.	Character	Description
1.	Shape of hive	40% almost round, 30% elongated, 15% heart shaped, 5% irregular, 5% rectangular, 5% oval
2.	Colour of comb	40% Brownish, 60% Creamy White
3.	Direction of the open vertical face of the combs	45% E-W, 35% NW-SE, 15% NE-SW, 5 % N-S
4.	Location of honey cell	Top region of the hive
5.	Location of drone cell	Above queen cell
6.	Location of queen cell	Bottom of the hive
7.	Location of worker cell	Middle, Below the Pollen cell
8.	Location of pollen cell	Below the honey cell



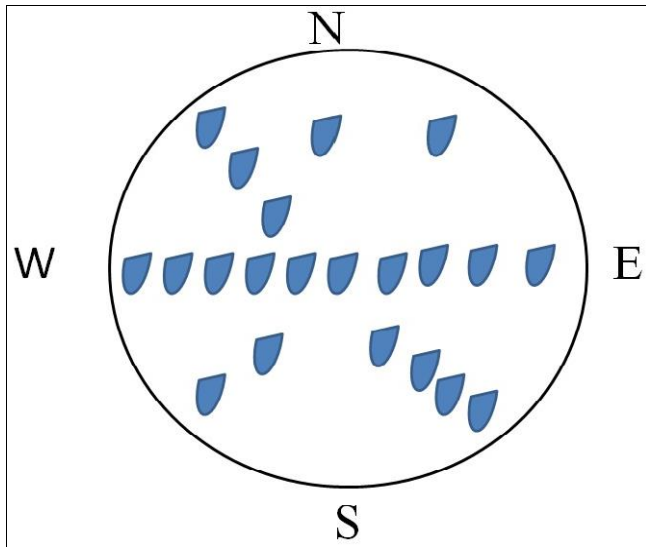
Fig 2: a) Measurement of a hive of *Apis florea*; b) Pollen stored in hive of *Apis florea*

Ruttner (1985) [12] reported that the most outstanding traits of *A. florea* is to survive in very hot and dry climatic condition. Whitecombe (1984) mentioned that *A. florea* build their nest between 2 m and 7 m (mean=3.28 m) from the ground level in Oman. Mossadegh (1990) [9] noted that *A. florea* construct their colonies between 0.3 m to 14 m from the ground level in Thailand. Khan *et al.* (2002) [6] observed maximum number of colonies from 2m to 3m above the ground in Hissar and nests were found upto 5m height from ground. Kshirsagar *et al.* (1983) [7] also studied in Hissar on the nest of same species and mentioned those nests were found between 2 m to 10 m height from the ground. Narayanaswamy and Basavarajappa (2013) [10] reported that *Apis florea* didn't prefer to build their nest in higher elevations which support the present observation. They also reported that supportive branches used by *Apis florea* colonies were thin to medium sized (1 to 4 in diameter).

Khan *et al.*, (2002) [6] and Malathi (2005) [8] noted that *A. florea* build their nest in all directions. 4 directions of orientation of *A. florea* colonies (NS, EW, NE-SW, NW-SE) was reported by Shwetha *et al.* (2020) [15] in Mysore. Narayanaswamy and Basavarajappa (2013) [10] reported that NE-SW orientation of nest were dominant than other. The honey storage area above the supportive substrate is known as 'crown' of hive. Worker bees use it as dancing floor where they perform different communicative performance (Dyer, 1985; Wongsiri, 2006, Abrol, 2020) [2]. Queen cells are also found in the centre of the comb by the modification of worker cells for emergency purpose (Kshirsagar *et al.*, 1983) [7]. Akratanakul (1977) [1] observed 22 colonies and found 3 to 13 queen cells per colony which is also corroborated by the present study. Ghatge (1949) [4] have also reported 15 to 20 queen cells per colony.



Fig 3: a) Hie of *Apis florea* hanging from balcony; b) Hive of *Apis florea* hanging from carnish



**Fig 4:** Direction of the open vertical face of the combs

### Conclusion

The red dwarf honeybee (*Apis florea*) colonies are found in arid zones of West Bengal, India. The honey of *A. florea* has excellent medicinal as well as nutritional property. It is also an excellent local pollinator of crops varieties. Due to their low production of honey it has less attention to local people and beekeepers. Foraging range of *A. florea* is very narrow and they usually collect nectars and pollens from neighboring plants. Since, the studied bee predominantly prefers human settlements as their nesting sites. The awareness of rural people should be taken care of considering this fact from the point of conservation of this useful wild bee.

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### Conflict of interest

There was no conflict of interest.

### References

1. Akatanakul P. The natural history of the dwarf honeybee (*Apis florea*) in Thailand. Ph. D Thesis. (Cornell University, Ithaca, New York), 1977.
2. Dyer FC. Mechanism of dance orientation in the Asian honey bee, *Apis Florea*. J. Comp. Physiol. A Neuroethol. Sens. Neural Behav. Physiol,1985:157:183-198.
3. Free JB. Biology and Behaviour of the Honeybee *Apis Florea*, and Possibilities for Beekeeping. Bee World,1981:62(2):46-59.
4. Ghatge A. Some research work on *Apis Florea*. Indian Bee J,1949:11(1/2):5-6.
5. Hepburn R, Hepburn C. Bibliography of *Apis florea*. Apidologie,2005:36:377-378.
6. Khan MS, Kaushik HD, Rohilla HR. Nesting parameters and comb dimensions of the dwarf honeybee, *Apis Florea* F. at Hisar, India. Indian Bee J,2002:64:12-19.

7. Kshirsagar KK, Muvel KS, Mittal MC, Phadke RP. Unusual nesting choice by dwarf honeybee, *Apis Florea* Fab. Indian Bee J,1983:60(4):217-218.
8. Malathi K. Bioecology of little bee, *A. florea* F. M. Sc thesis, university of agricultural science, Bangalore, 2005.
9. Mossadegh MS. Nesting behaviour of *Apis Florea* F. (Hymenoptera: Apidae) in Khuzestan, Iran. Proceedings of the 11<sup>th</sup> International Conference IUSI, New Delhi,1990, 669-670.
10. Narayanaswamy R, Basavarajappa S. Nesting attributes of dwarf bee, *Apis florea* F. under urban ecosystem of Manasagangotri campus, Mysore, India. European Journal of Zoological Research,2013:2(6):6-15.
11. Oldroyd BP, Osborne KE, Mardan M. Colony relatedness in aggregations of *Apis dorsata* Fabricius (Hymenoptera: Apidae). Insectes Soc,2000:47:94-95.
12. Ruttner F. Graded geographic variability in honey bees and environment. Pszczelnicze zeszyty naukowe,1985:29:81-92.
13. Sarma SM, Fuchs S, Werber C, Tautz J. Worker piping triggers hissing for coordinated colony defense in the dwarf honeybee *Apis florea*. Zoology,2002:105:215-223.
14. Soman AG, Chawda SS. A contribution to the biology and behavior of the dwarf bee, *A. florea* F. and its economic importance in Kutch, Gujarat, India. Indian Bee J,1996:58:81-88.
15. Shwetha BV, Bhat NS, Neethu T. Nesting behaviour, structure and architecture of *Apis Florea*. The future role of dwarf honeybees in natural and agricultural systems,2020:1:95-105.
16. Thapa R, Wongsiri S. Toxicity of Azadirachta derivatives and synthetic pesticides on oil seed rape to *Apis cerana* (Hymenoptera: Apidae) biopesticides toxicity, safety, development and proper use. In: Proc. Inter. Symp. Biopest. Phitsanulok, Thailand, 1996, 82-86.
17. Wongsiri S, Lekprayoon C, Thapa R, Thirakupt K, Rinder TE, Sylvester HA, et al. Comparative biology of *Apis andreniformis* and *Apis florea* in Thailand. Bee World,1997:78:23-35.