FIRST RECORD OF THE NEST ORIENTATION OF *Apis dorsata* IN RELATION TO CELL TOWERS

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Abstract:

This study is aimed to study the nest orientation of *Apis dorsata* in relation to cell tower in the Kariavattom panchayat of Thiruvananthapuram district, Kerala. The distributions and orientation of nests were observed around 5 km of cell tower using a survey method . Results showed that 60 nests (40 active nests, 20 abandoned combs) of *A. dorsata* were found. Tree species used as nesting sites were *Ficus* sp.(Moraceae), *Adenanthera* sp.(Fabaceae), *Spondias pinnata* (Anacardiaceae), *Artocarpus sericoarpus* (Moraceae), *Alstonia scholaris* (Apocynaceae), *Knema cinerea* (Myristicaceae) and *Litsea mappacea* (Lauraceae).The nests in trees were found in 3-11 meters (5 nests), 11-25 meters (20 nests), and 20 – 35 meters on buildings (35 nests).Maximum nets on building was noted on the top of Greenfield International Stadium (30 nests) . Most of the bee nests were oriented towards South east direction and minimum towards south west direction on buildings and trees. In the South east direction maximum bee hive orientation was noted both on trees and buildings where radiation exposure from cell towers was minimum (0.20 w/m2) whereas in the South west direction minimum bee hive orientation was recorded where the radiation exposure was maximum (9.20w/m2).

Keywords: Nest orientation, *A.dorsata* , cell tower, building.

Introduction

Apis dorsata construct nests on varieties of nesting structures that provide suitable habitat for leading successful life (Deodikar et al. 1977; Reddy and Reddy, 1993). Neupane (2004) found that greater preference of *A.dorsata* colonies towards strong-cemented water tanks and residential buildings for nesting. These colonies are often found in aggregations on a suitable nesting structure and their numbers vary from a few colonies to many

hundreds colonies (Kumar and Reddy, 2003; Nagaraja andRajagopal, 2009). *A. dorsata* build nests by orienting towards suitable compass directions. They are found to orient their nests in large numbers towards North-South axis by minimizing the exposure to strong wind and bright sunlight (Reddy 1983). The present study aims to study the nest orientation of *A.dorsata* in relation to cell towers . The forest may be especially reliant on animal pollinators, such as honey bee because they are needed for long distance movement of pollen among spatially separated conspecific trees that are often self-incompatible or dioecious (Bawa 1990; Corlett 2004; Suwannapong et al. 2011). Rapid development of telecommunication devices has caused enhancement of human interference with nature so that undesirable impacts were noticed on biological, physical and ecological systems. To combat the need of mobile connection large number of mobile towers is installed in urban and rural areas. The electromagnetic radiation emitted from the mobile towers, transmission lines and power lines induces undesirable impact on living beings in a multiple ways causing pollution known as electromagnetic smog.

Materials and Methods

Observation of nest orientation of A.dorsata was carried out from April 2019 to March 2020 in Kariavattom village (8.5678° N, 76.8908° E) and it is an area of Trivandrum city the capital of Kerala where Greenfield International stadium , the largest international stadium of Kerala is situated . The vegetation is of mixed type dominated by acasia plants . Other vegetation includes trees, shrubs, climbers,creepers etc,. Interestingly, this region was abundant with buildings and trees as major nesting structures. Five mobile tower were installed in this village. These studies used survey and interview method (Bookhout 1996; Tongco 2007). The live and abandoned combs found were then recorded and the information about the existence of the nests in that location was also collected (Neupane *et al*.2013). The position of the trees and nesting site was measured by using GPS *Garmin map 62s.* Nesting site preference of *Apis dorsata* was described by descriptive analysis. The distribution and orientation of nests was visualized using ArcGIS 10.2 program. (http://www.esri.com/landing pages/software/arcgis/arcgis-desktop-student-trial). EMF (Electromotive field) power density was measured with the help of RF Power density meter and direction of area with magnetic pocket compass. The nest height from ground level (m) was measured by using hagameter. characteristic, slope and direction of branching, as well as the protected and unprotected nest of honey bee by using binoculars and compass. The physical conditions around the nest observed were the type of habitat, water distance from the nest, relative humidity (%) and temperature (o C) by using termohygrometer, wind speed (km/h) using anemometer, and light intensity

(lux) by using lux meter. Monthly average data of rainfall, humidity, and wind speed were collected from Meteriological Department.

Results

The comb of *Apis dorsata* is more or less semicircular. The width of the *Apis dorsata* comb was 98.5 ± 26.2 cm (n = 158), and the height was 45.8 ± 11.4 cm (n = 146). Results showed that 60 nests (40 active nests, 20 abandoned combs) of *A. dorsata* were found. Tree species used as nesting sites were *Ficus* sp.(Moraceae), *Adenanthera* sp.(Fabaceae), *Spondias pinnata* (Anacardiaceae), *Artocarpus sericoarpus* (Moraceae), *Alstonia scholaris* (Apocynaceae), *Knema cinerea* (Myristicaceae) and *Litsea mappacea* (Lauraceae). The nests in trees were found in 3-11 meters (5 nests), 11-25 meters (20 nests), and 20 – 35 meters on buildings (35 nests). Maximum nests on building was noted on the top curved sloppy surface of Greenfield International Stadium (30 nests) . Most of the bee nests were oriented towards South east direction and minimum towards south west direction on buildings and trees . In the present study, the orientation of *A. dorsata* nests on different nesting structures was recorded towards all compass directions. But they showed fluctuation in their numbers towards each direction. Generally selection of these nesting structures will be attributed to greater protection of colonies against pests, predators, bright sunlight and even winds pressure. But in the present study it was shown that nest orientation was in accordance with intensity of Electro magnetic radiations from cell towers. Maximum nest orientation towards southeast direction was due to less radiation exposure (0.2 watt/m^2) whereas high radiation exposure (8.1watts/ m^2) was noted where nest construction was less. The abandoned bee hives were mostly found within 50 – 300 meters around the tower where radiation exposure was maximum (9.2 watts/m^2) (Table-1). The trees are the primary nesting structures of giant honeybees due to cool and pleasant environment for bee nests along with sufficient shade and moderate amounts of sunlight for normal colony activities (Reddy and Reddy, 1993). But in the present study A.dorsata selected buildings for maximum nest construction for availing radiation shielding from cell towers. 90 percent nests was noted 500 meter to 2 Km away from cell towers could be due to less radiation exposure.

Conclusions

During the present study a total of 60 nests (40active nests, 20 abandoned combs) of *A. dorsata* were found. The nests in trees were found in 3-11 meters (5 nests), 11-25 meters (20 nests), and 20 – 35 meters on buildings (35 nests).Maximum nests on building was noted on the curved sloppy surface of top of Greenfield International Stadium (30 nests) . Most of the bee nests were oriented towards South east direction and minimum towards south west direction on buildings and trees. In the South east direction maximum bee hive orientation was noted both on trees and buildings where radiation exposure from cell towers was minimum (0.20 w/m2) whereas in the South west direction minimum bee hive orientation was recorded where the radiation exposure was maximum (9.20w/m2). In the East west, North south, North east and North west directions radiation exposure varied from 5 to 6 w/m2 where bee hive was ranged from 3 to 4 numbers. The abandoned hives were mostly around 50 -300 meters around the cell towers where radiation exposure range was extreme (9.2 w/m2).

All mobile phone towers emit microwave radiations, which is in the radiofrequency radiation (RFR) ,a part of the spectrum of electromagnetic waves. Though radiofrequency radiation , is a source of non ionizing radiation, these radiations together with ionizing radiation make up the electromagnetic spectrum. Radio frequency of the electromagnetic waves ranged from 100 kilo hertz (KHz) to 300 Giga hertz (GHz). Radio frequency radiation is a source of thermal energy and in adequate doses, has all the known effects of heating on biological systems . Sharing of towers by different companies should not be encouraged otherwise the magnitude of radiation would be increased . Frequencies of different mobile tower companies is represented in Table 2. Independent monitoring of radiation levels and overall health of the community and nature surrounding towers is necessary to identify hazards early.

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Table.1 Nest orientation of *Apis dorsata* colonies on different nesting structures

Directions	**Number of bee colonies on**		
	Buildings	**Trees**	**Radiation Level (watts/m2)**
East-West	4.00	3.00	5.00
North-South	3.00	3.00	6.00
North-East	4.00	4.00	5.00
North-West	4.00	4.00	5.20
South-East	18.00	10.00	0.20
South-West	2.00	1.00	9.20

Table 2: Different frequency bands in India for mobile technology 2G, 3G and 4G

S.No.	Mobile Technology in India	Frequency Bands in India	Major Operators

1	GSM (2G)	900 MHz, 1800 MHz	Airtel, Idea, Vodafone, Aircel, BSNL
2	CDMA	850 MHz	Reliance, BSNL, Tata
3	WCDMA (3G)	2100 MHz, 900 MHz	Airtel, Idea, Vodafonr
4	WiMAX	2300 MHz	BSNL
5	4G LTE (4G)	1800 MHz	Aitel, Idea, Vodafone, Jio
		850 MHz	Jio
		2300 MHz	Airtel, Idea, Vodafone, Jio
		2500 MHz	BSNL, Idea, Vodafone