MATERIALS AND METHODS
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The present study involves intensive and extensive observations on nesting behaviour of wild honeybees at field conditions. Consequently, the success of the study depends on the occurrence and distribution of nest sites, presence of sufficient number of colonies throughout the study period, and accessibility of natural nest sites for observation and recording of data.

2.1 Study area

On the basis of information available on the distribution of *Apis* species in the plains and also in the light of recent studies on nesting behaviour, the area consisting of Bangalore and its surrounding areas has been selected for the study of comb building activity of Indian honeybees.

The study area, Bangalore urban and rural, is situated at 12° 58’ to 13° 05’ North latitude and 77° 35’ to 77° 40’ East longitude with an elevation of about 928m. It has an area of about 898 sq.km. The average annual rainfall is about 80 cm and the temperature
varied from $15^\circ$ to $37.4^\circ$ C. Though study area is generally considered as a plain area, it has many parks and gardens. The flora of Bangalore is diversified and rich in cultivated plants, hedge plants, plantation crops, agricultural crops & food crops (Ramaswamy and Razi, 1973).

2.2 Classification of honeybee

The honeybee belongs to Class : Insecta; Order : Hymenoptera; Super family : Apoidea; Family : Apinae; Genus : Apis. It consists of three species namely *Apis dorsata* Fabricius, *Apis florea* Fabricius and *Apis cerana* Fabricius. Of the three indigenous species only *Apis cerana* has been domesticated.

2.3 Survey of nest sites of honeybee

The study area includes both urban and rural areas. The nests of the respective species of honeybee were classified based on the taxonomic characters as well as nest size. A total number of 121 nest sites of all the species found in the study area was recorded. Of the 121 nest sites 45 were of *A. dorsata*, 66 of *A. florea*, and 10 that of *A. cerana*. 
Of the three indigenous species only *A. cerana* has been fully domesticated, whereas the other two species, *A. dorsata* and *A. florea* still exist as wild species.

2.4 Classification of nest sites

The structures of any geographical area where honeybees build their nest are classified as nest site. Any objects whose place either inside or outside, surface or beneath are used for the building of nests of honeybees were also called nest site. Depending on the number of nests, a nest site may be classified as single, double and multiple colony nest site. Accordingly the nests of *A. dorsata* were classified as single, double and multiple colony nest site. In the study area 16 single, 13 double and 16 multiple colony nest sites were identified. On the contrary, the other two species of honeybees *A. florea* and *A. cerana* exists as single colony in a nest site. Obviously the nests of *A. florea* and *A. cerana* were not classified as single, double and multiple colony nest sites.

2.5 Nature of nest support and classification

The part of nest site used for building the nest is referred as nest support. The nests were classified as arboreal and terrestrial based on the type of support on which nests were found. Nests found on trees and plants were referred to as arboreal and those found on supports like buildings, bridges, water tank, rocks and
stadiums were classified as terrestrial nests. A total of 121 nest sites including 73 arboreal, 48 terrestrial were recorded in the study area. Of the 73 arboreal, 10 were *A. dorsata*, 61 *A. florea*, and 2 *A. cerana*. Terrestrial nest sites includes 35 *A. dorsata*, 5 of *A. florea* and 8 *A. cerana*.

2.6 Determination of height of nests

The height of a nest from the ground level was determined by the help of Measuring Tape when the height of the nest is below 3 meters. Height of the nest found above 3 meters from the ground level was determined by the help of Theodolite (Deodikar *et al*., 1977). Similarly, the height of nest site from the ground level was also recorded. Only the height of nests of *A. dorsata* and *A. florea* was recorded. Though the *A. cerana* also exists naturally, but the number of their natural nest sites are too small in number. Obviously, the height of nests of *A. cerana* could not be determined. Further, the nests of *A. cerana* are often hidden and not visible for observations without breaking the nest support.

2.7 Determination of nest shape and symmetry

The shape of 673 fully grown *A. dorsata* nests and 81 fully grown nests of *A. florea* were determined by visual observation and classified into 9 and 6 categories respectively. The nests were grouped into symmetrical and asymmetrical.
2.8 Determination of nest orientation

The direction of nest in relation to North-South bearing was determined with the help of compass and other accessories as used by Deodikar et al., (1977). Direction of colonies of A. dorsata and A. florea was determined. Most nests of A. cerana were not visible for determining their orientation. A total of 792 nests including 711 nests of A. dorsata and 81 nests of A. Florea were recorded in the study area.

2.9 Determination of nest density

Total number of live nests present in a nest site at any given time is referred as nest density. The number of live colonies in five multiple colony nest sites were recorded monthly and presented as monthly nest density of each nest site for three years. The nest density of A. dorsata was only recorded as the other wild species A. florea occurs as a single colony.

2.10 Determination of nest dimension

Nest dimensions including width, height and thickness were recorded by Measuring Scale for nests at lower level and by Theodolite (Deodikar et al., 1977), for nests at higher level from the ground. Horizontal length at the centre of the nest is taken as nest width, while the vertical length at the centre of the nest from the tip
of the nest to top of the nest is taken as height of the nest. The
distance between the front and back side of the comb was
measured as thickness. The dimensions of 250 nests of *A. dorsata*,
50 of *A. florea*, and 10 of *A. cerana* were determined.

2.11 Determination of cell dimension

The cells found at or near the attachment of the comb are
referred as support / honey cells. The cells in which pollen and
honey stored are essentially that of worker cells.

The cell wall thickness and the diameter of supporting,
worker and drone cells were determined with the help of travelling
microscope (Hepburn, 1983). The cell depth was determined by the
help of graduated pipette (Deodikar et al., 1977). The cell dimension
of 50 combs of each species were determined. The cell dimension
of queen cells could not be determined because of non availability
and non feasibility.

2.12 Determination of cell count

The number of cells per unit area of the comb is referred as
cell count. The number of supporting and worker cells per square
decimeter area of the comb was determined in 50 combs of each of
all the three species. Also the length of 10 linear cells of supporting,
worker and drone cells of 50 combs of each species was
determined. The number of cells per square decimeter area for drone cells was not determined because they are scattered.

2.13 Determination of Comb growth

Comb growth of the three species of honeybees was recorded in relation to comb width and comb height with the help of Theodolite (Deodikar et al., 1977). The data were collected periodically at regular intervals.

Comb growth of Apis dorsata was recorded fortnightly at 5 arboreal and 5 terrestrial nest sites in different places. Comb growth at different heights from the ground level was recorded at selected test nest sites. The growth of the comb built on remnant and non-remnant support in selected test nest sites are also recorded. Similarly comb growth of A. florea was recorded at 5 arboreal and 1 terrestrial nest site every 15 days. Also comb growth of A. cerana was recorded in 10 hives every 5 days.

Suitable statistics i.e., Z test, Chi square test and Co-efficient of variance are employed in the analysis of data and the inferences drawn are shown in the appropriate tables.