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Nesting Behaviour of Rock Bee, *Apis dorsata* F.: Preference of Nesting Structure and Nest Supports*

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Abstract : Studies on the preference of nesting structures and nest supports in each type of nesting sites by rock bee, *Apis dorsata* F. was carried out during 1994-95 and 1995-96. Accordingly, the results indicated that the rock bees prefer to nest more on terrestrial sites (84.11%) as compared arboreal nesting sites (15.89%). Further, though rock bees preferred to nest on all types of nest supports, maximum colonies selected horizontal (88.50%) and slanting (48.00%), respectively on terrestrial and arboreal nesting sites to construct their nests. In addition, number of colonies increased on each nest supports with increase in size (width or diameter) of nest support. However, the minimum size required to nest was 5 cm width and 4 cm diameter on terrestrial and arboreal nesting sites, respectively.

Introduction

The rock bee, *Apis dorsata* F. normally construct the nest on tall buildings, rocks and trees at greater height from ground level. But, in any particular area the partitioning of nesting structure (Preference of nesting structure) for nesting by the rock bees is unknown. Though, few studies have been carried out by various authors *viz.*, Chakrabarti and Chaudhari (1972), Reddy (1983 and 1988), Ahmad and Abbas (1985), Reddy and Reddy (1987 and 1993) and Starr *et al.* (1987) from different places, no systematic work is being done in this area earlier. Further, on any nesting structure the rock bees select the nest supports with different angles as well as size which is rather interesting to know its variations on different types of nest supports on different nesting sites. In this regard, no work is done in this area but few patchy reports are available elsewhere from other parts of the world as reported by Mors and Laigo (1969), Chakrabarti and Chaudhuri (1972), Muthappa (1979), Ahmad and Abbas (1985), Starr *et al.* (1987), Reddy (1988) and Reddy and Reddy (1989). The preference of nesting structure, type of nest supports and its size may vary at different locations. Therefore, the present investigations were undertaken.

Material and Methods

Rock bees construct their nests on various structures like tall trees, buildings, rocks, etc. To know their preference for nesting, observations were recorded on 11 terrestrial and 10 arboreal sites with regard to number of colonies (live and deserted) at weekly intervals. Later, the data were totaled for a month on each nesting site. Further, total colonies from respective terrestrial and arboreal nesting sites were averaged from two year data. The monthly mean and per cent colonies were worked out by pooling two year data to infer on the site preference by rock bees for nesting. The data were subjected to the students 't' test for statistical analysis.

Nest support is a place at which rock bees prefer to nest on each nesting structure based on its angle with respect to the ground level and

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its width or diameter as the case may be. On 21 nesting sites (terrestrial and arboreal), the width of the nesting support on terrestrial sites and diameter of the branch or twig on arboreal sites was recorded for 250 colonies. Further, the nature of nest support *viz.*, horizontal, highly slanting, slanting and slightly slanting was recorded along with number of colonies on each type. Later, based on the two years observations the average number of colonies on each type of nest support and its size was found out. The mean and per cent colonies on each type of nest support (both terrestrial and arboreal) was also calculated.

Results and Discussion

The studies on preference of nesting structures for construction of their nests by the rock bees revealed that, rock bees preferred to settle more on terrestrial nesting structure as conmared to arboreal nesting structures. The monthly average number of colonies ranged from 77.00 to 487.50 with the over all mean of 240.79 on terrestrial nesting structures as against 17.50 to 75.50 with the mean of 41.54 on arboreal nesting structures during different months of the year. Accordingly, the per cent colonies preferring the different types of nesting structures was also high on terrestrial nesting structures which ranged from 76.39 to 89.87 as against 10.13 to 23.61 with the mean of 84.11 and 15.89, respectively on terrestrial and arboreal nesting structures. Further, it was revealed through students 't' test that the selection of terrestrial nesting structures by rock bees was significantly (240.79) high as compared to selection of arboreal nesting structures (41.54) for nesting (Table 1).

Table 1. Preference of nesting structure by *A. dorsata* F. (Average of two years)

Months	Average no. of colonis on different nesting structures						
	Total		Average		Grand	Percentage	
	Terrestrial	Arboreal	Terrestrial	Arboreal	total	Terrestrial	Arboreal
Aug.	396.00	64.00	198.00	32.00	230.00	86.00	14.00
Sep.	621.00	70.00	310.50	35.00	345.00	89.87	10.13
Oct.	868.00	122.00	434.00	61.00	495.00	87.68	12.32
Nov.	906.00	151.00	453.00	75.50	528.50	85.71	14.29
Dec.	974.00	139.00	487.50	69.50	556.50	87.51	12.49
Jan.	392.00	70.00	196.00	35.00	231.00	84.85	15.15
Feb.	154.00	35.00	77.00	17.50	94.50	81.48	18.52
Mar.	242.00	51.00	121.00	25.50	146.50	82.59	17.41
Apr.	394.00	90.00	197.00	45.00	242.00	81.40	18.60
May	330.00	102.00	165.00	51.00	216.00	76.39	23.61
Jun.	234.00	54.00	117.00	27.00	144.00	81.25	18.75
Jul.	268.00	49.00	134.00	24.50	158.50	84.54	15.46
Total	5779.00	997.00	2889.50	498.50	2831.50	-	-
Mean	481.58	83.08	240.79	41.54	235.96	84.11	15.89
S.Em±	-	-	41.49	5.45	-	-	-

The terrestrial nesting sites on an average recorded significantly higher number of (140.79) colonies as compared to arboreal nesting sites which recorded less (41.54) colonies in a year and resulted in 84.11 and 15.89 per cent colonies on respective nesting sites. Further, it revealed that the preference of terrestrial nesting sites by rock bees to construct their nests was mainly due to the greater protection from wind, slashing or torrential rains and sun light as compared to the arboreal nesting sites. The present findings are in agreement with the earlier findings from Reddy (1983 & 1988) and Sattigi *et al.* (1996). Further, the present findings are in disagreement with the findings of Ahmad and Abbas (1985) from Andaman and Nicobar Islands which may be due to differences in ecological niche as they have recorded only in forest area with less buildings as compared to present study area which comprised more or less equal opportunity for bees to select either terrestrial (buildings) or arboreal (trees) as their nesting sites . Similarly, the earlier reports from Reddy *et al.* (1986) and Reddy and Reddy (1987 and 1993) also contradicted present findings as they reported that the rock bees in and around Bangalore preferred to nest more on arboreal nesting sites as compared to terrestrial nesting sites. But, it is difficult to draw the conclusion because some reports from same area and authors (Reddy 1983 & 1988) are in conformity with the present findings. However, it may be inferred that the variation in the findings of same authors may be due to the variation in weather during different years of observations coupled with availability of bee flora. Since, Dharwad falls under transition zone with more number of rainy days in a year, rock bees might have preferred terrestrial nesting sites which gave more assured protection as against arboreal nesting sites.

It is clear from the data that the rock bees construct their nests on all types of nesting supports viz., horizontal, highly slanting (almost vertical), slanting and slightly slanting. On terrestrial nesting supports maximum colonies (88.50%) were noticed on horizontal nest support followed by slanting (6.50%) and slightly slanting (4.50%) out of 200 colonies studied. Least number of colonies were noticed on highly slanting nest support. On the contrary, maximum (48.00%) colonies were recorded on slanting nest supports followed by horizontal (26.00%) and slightly slanting (22.00%) out of 50 colonies observed on arboreal nesting sites. In addition, it was least (4%) on highly slanting nest supports. On an average, irrespective of terrestrial or arboreal nesting sites the maximum of 76.00 per cent colonies were recorded on horizontal nest supports followed by 14.80 per cent on slanting and 8.00 per cent on slightly slanting nest supports. The least (1.20%) per cent of colonies were noticed on highly slanting nest supports (Table 2).

The rock bees in nature construct their nests on various types of nest supports such as horizontal, highly slanting, slanting and slightly slanting based on the availability of nest support in a particular nesting structure. Among the above said types. the horizontal nest support was preferred by maximum colonies on terrestrial nesting sites and very few colonies selected the highly slanting (almost vertical) nest supports. This is because, in terrestrial nesting sites most of the building extensions which act as nest supports are horizontal and they are more convenient to establish the nest. Very few colonies could construct their sites on slanting, slightly slanting and highly slanting nest supports on terrestrial nesting sites because such supports on terrestrial nesting sites are very rare and are available only where the nesting structures are either globular or spherical in

Table 2. Preference of nest supports by *A. dorsata* F. (Average of two years)

Nesting site type	No. of combs on different nest supports								Total
	Horizontal (180°)		Highly slanting 60-90°)		Slanting (45-60°)		Slightly slanting (<45°)		
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	
Terrestrial	177	88.50	01	00.50	13	06.50	09	04.50	200
Arboreal	013	26.00	02	04.00	24	48.00	11	22.00	050
Total	190	76.00	03	01.20	37	14.80	20	08.00	250
Mean	95.00	-	1.50	-	18.50	-	10.00	-	-

shape like water tanks, towers and shrines. The present findings are in conformity with the findings of Ahmad and Abbas (1985) and Reddy (1988) who also opined that the rock bees preferred to construct their nests mainly on horizontal nest supports followed by slanting nest supports.

In arboreal nesting sites, the rock bees constructed their combs on all types of nest supports. However, more number of colonies preferred slanting supports followed by horizontal nest supports. The least preferred nest support was highly slanting as in case of terrestrial nesting sites. The slanting nest support was most preferred in arboreal nesting sites because majority of branches (nest supports) will be slanting either upward or downward and rarely they will be in horizontal position. The result of the present study are in line with the findings of Morse and Laigo (1969), Chakrabarti and Chadhuri (1972), Morse (1983), Ahmad and Abbas (1985) and Reddy (1988). On the contrary, though the findings of Reddy and Reddy (1989) are in conformity with the present findings for all aspects, but differs with regard to the construction of combs on vertical (highly slanting) nest supports (branches) in trees. Accordingly, rock bees will never construct their combs on highly slanting nest supports. On the other hand Morse (1983) also reported that the rock bee do construct their combs on vertical (highly slanting) nest supports which is in conformity with the present findings. This variation may be due to the fact that the arboreal nesting sites (trees) selected by them must have had sufficient branches of either horizontal, slanting or slightly slanting nature. In such cases, the rock bees may not prefer the vertical nest supports due to the availability of most comfortable nest supports in large numbers. Over all, from the present findings it is evident that on terrestrial nesting sites, most preferred nest support was horizontal as against slanting in case of arboreal nesting sites.

The studies on size of nest support indicated that the rock bees need minimum of five cm width to construct their nests on terrestrial nest supports and there is no limit for maximum size. As the width of the nest support range increased from 0 to 30.10 cm and above, the mean number of colonies also increased from 1 to 69 indicating the direct relation between width of the nest support and number of colonies settled. This is also reflected in terms of per cent colonies (0.50 to 34.50%) settled at different width of the nest supports. But, as the width of the nest support decreased, the number of colonies also decreased as the zero to five cm width range recorded only single colony (Table 3). Similarly, on arboreal nest supports, same

Table 3. Selection of different sizes of the nest supports by *A. dorsata* F. (Average of two years)

Width/Diameter of net support (cm)	Type of nest supports			
	Terrestrial		Arboreal	
	No. of colonies	Percentage	No. of colonies	Percentage
00-05	1.00	00.50	02.00	04.00
05.1-10	9.00	04.50	04.00	08.00
10.1-15	21.00	10.50	05.00	10.00
15.1-20	23.00	11.50	05.00	10.00
20.1-25	34.00	17.00	07.00	14.00
25.1-30	43.00	21.50	08.00	16.00
30.1 & above	*69.00*	*34.50*	*19.00*	*38.00*
Total	200.00	-	50.00	-

trend was noticed wherein the diameter of the nest support ranged from 0-5 to 30.10 cm and above with maximum colonies at highest range. However, at zero to five cm range only two colonies were recorded out of which one colony was noticed on the nest support with four cm diameter. Here also, the number of colonies increased from 2.00 to 19.00 as the diameter of the nest support increased from 0 to 30.10 cm and above which reflected in corresponding increase in per cent colonies from 4.00 to 38.00 (Table 3).

In an attempt to find out the maximum and minimum size (width or diameter) of nest support required to construct the comb by rock bees, the results indicated that the minimum width of the nest support required on terrestrial nesting sites was five centimeter below which no colonies were constructed. Further, as the size of the nest support increased, the number of colonies also increased. This is due to the sufficient space and comfort that bees get and will have no problem of congestion or over crowding. The studies in this line are totally lacking, hence no comparison could be made.

On arboreal nesting sites, same trend was noticed wherein, the number of colonies on any nest support increased with increase in the size of the nest support. The minimum diameter of the nest support required for nesting was four centimeter. This is because, as the size of the nest support (branches) increases the bees get sufficient support and stability to their nest. If the size is small, such nest supports will have less space for the basement of comb and likely to be disturbed by heavy breeze leading to damage to the nest or it may be uncomfortable for bees to stay on such supports. The present findings are in conformity with the findings of Reddy and reddy (1989) who reported that the minimum diameter of the branch (nest support) required to construct the comb is six centimeter which is numerically slightly higher but it would not make much difference in terms of diameter. On the

other hand, the findings of Morse and Laigo (1969) and Chakrabarti and Chaudhuri (1972) contradict the present findings as they have reported that the minimum diameter required to construct the comb by rock bees is 12 cm. This variation may be due to the fact that, above studies were made in thick forest area where the rock bee colony size will be quite bigger as compared to colony size in transitional or semi-forest area and bigger colonies need more stable support than the small or normal size colonies of rock bees which were commonly found in present studies.

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