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Study On Nesting Characteristics and Biology of Stingless Bee (*Trigona iridipennis* Smith.)

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Abstract: *Cavities in old walls were most common nesting sites of Trigona iridipennis in Bengaluru region. Most of colonies had a resinous entrance tube. Inside the colony, food pots and brood cells were arranged separately. Food pots were larger than brood cells and were sealed as and when filled. Brood cells were compactly arranged and were mass provisioned with regurgitated brood food. Egg and larval cells were brown colored, while pupal cells were cream colored. Queen cells were larger than worker cells. Total period required from oviposition to adult emergence was 53.30 days comprising 5.75, 12.70, 35.30 days for egg, larvae and pupal stages, respectively. Length of this period was 2.53 times more than that of A. cerana. Marked adults of T. iridipennis had a life span ranging between 80-87 days.*

I. Introduction

Stingless bees/ dammer bees are the smallest of honey producing bees. They are highly social insects like honeybees living in permanent colonies, nesting in dark places like cavities in tree trunks, empty logs, cracks and crevices in old walls etc., unlike other honeybees of the genus *Apis*, they construct numerous elliptical cells for storing pollen and honey by using a special material "cerumen" made of wax, resin, propolis and mud. Stingless bee colonies are perennial and usually consist of hundreds or thousands of workers (Wille, 1983). They can be domesticated in hives like Indian bee *Apis cerena* Fab. and European bee *Apis mellifera* L.

Beekeeping with stingless bees is called melliponiculture, which has been practiced for many centuries in various parts of Latin America, where these bees are considered as very valuable domestic species. They differ from *Apis* species in biology and nesting characteristics. The process of feeding of larvae in stingless bee is very different from that of honeybees of genus *Apis.* System of larval feeding in stingless bees is called mass provisioning, where as in *Apis* spp., larvae fed progressively with royal jelly and bee bread during their growth and development (Heard, 1999). The information on nesting characteristics and biology of stingless bees is very much limited. Hence, research on nesting characteristics and biology of stingless bee has been carried out at Regional Research Station, UAS, GKVK, Bengaluru.

II. Materials And Methods

Nesting characteristics of stingless bee was studied by locating fifteen nests in cavities of old walls. They were internally examined by breaking the wall. Dimensions and structural peculiarities of nest cavities and the measurements of various nest components viz., brood cells, pollen pots, honey pots and entrance tube were recorded. Distance between the nests and their density in known area were also recorded.

The biology was studied by maintaining three stingless bee colonies in a glass topped wooden boxes having 24.5 x 18.0 X16.0cm in size. Observations were made from oviposition to adult emergence in case of workers and duration of egg period, larval period and pupal period were recorded. The Egg period was determined by observing changes in uncapped cells from oviposition to egg hatching. For this purpose, marked brood cells were dissected everyday at the rate of one cell per day and observed till egg hatched. The larval period was determined by again dissecting marked brood cells at intervals and also by observing exhaustion of brood food and changes in color of brood cells from brown to creamish white giving a transparent look which indicates completion of larval period. The pupal period was determined similarly from spinning of cocoon by matured larva till adult emergence.The adult life and their activity was studied by marking worker bee immediately after emergence and its activity was observed until death.

III. Results And Discussion

Natural nesting sites of *T. iridipennis* were hallows of tree trunks, old wall cavities, old pipes and termite mounds. These bees prefer closed structure for nesting and they never nest in open as *A. dorsata* or *A. florea*. *T. iridipennis* is adapted to nest in very narrow spaces, as the brood cells are in cluster which can be accommodated well in narrow cavities and they are not arranged as horizontal combs like in *Apis* spp. Nest

aggregation was found to be common in old wall cavities than in tree cavities. About 6 colonies were found inside a stone wall at one location. Starr and Sakagami (1987) observed 84 colonies of *T. fuscobalteata* and *T. sapiens* Cockerell. in bamboo cavities of 0.7-3.0 liter volume. The congregation of more number of nests in a site may be due to good nesting sites for long duration and short swarming distance (Inoue and Salmah, 1984).

Nest cavity diameter of stingless bees ranged from 210-375mm with an average of 260mm (Table 1). The entrance tube in colonies of old wall cavities ranged between 6-18 mm in length with an average of 12mm and 3-14 mm in width with an average of 9mm. The external entrance tube length of *T. gribodoi* ranged between 6-25mm (Pooly and Michaner, 1969). It may be as long as 1m in *T. pectaralis* and continued inside the nest cavity along the inner wall of entrance cavity (Wille, 1983).

Out of total colonies studied, eighty (80) per cent of colonies are having nest with external tunnel. The internal tunnel length ranges between 65-90mm with an average of 85 mm. similar findings were made by Pooley and Michener, 1969. The brood cells height and width of studied colonies ranges from 2.1-2.7mm and 1.7-2.0mm with an average of 2.5 and 2.0mm respectively. Similarly, pollen pot height and width ranges from 5.1-5.9mm and 4.2-5.5mm with an average of 5.5 and 4.9mm, honey pot height and width ranges from 6.5-7.8mm and 5.2-6.1 mm with an average of 6.5 and 5.8mm respectively. The food storage of colonies was divided into pollen zone and honey zone, pollen zone was usually more than honey zone, which indicated the surplus availability of pollen in the study area. The pollen parts were closed when they were full, where as in genus *Apis* pollen cells never closed. New parts were built adjacent to them and some time they intermingled. Similar observations made by Dollin 1996. The food parts of studied colonies resembled bunch of grapes and contained honey and pollen parts. Honey is stored in cerumen pots, where as in genus *Apis* honey is stored in hexagonal cells made up of wax, after ripening they seal as in genus *Apis.* Nesting density of observed colonies ranges from 25cm -9m.

Table 1: Nest characteristics of *Trigona iridipennis* Smith. in wall cavities (Mean of 15 nests)

Sl. No.	Nest characteristics	Dimensions (mm)	
		Range	Average
01	Cavity diameter	210-375	260
02	Entrance length	6-18	12
03	Entrance width	3-14	9
04	Nests with external tunnel	80 %	
05	Internal tunnel length	65-90	85
06	Brood cell height	2.1- 2.7	2.5
07	Brood cell width	1.7-2.0	2.0
08	Pollen pot height	5.1-5.9	5.5
09	Pollen pot width	4.2-5.5	4.9
10	Honey pot height	6.5-7.8	6.5
11	Honey pot width	5.2-6.1	5.8
12	Nesting density	25 cm -9m	

The cell construction, provisioning, oviposition and total development period from oviposition to adult emergence ie., egg period, larval period, pupal period and their growth in terms of length and breadth were studied and results are presented in table 2 and 3.

Queen plays an important role in regulating cell construction and discharge of larval food by workers. There was no egg laying by workers even in the absence of queen, where the cell construction ceased and the colony diminished day by day. Wunderink and Sommeijer (1996) observed the same in *Trigona nigrapurpurea*. The brood cells of different stages were distinct color. Newly constructed cells are brownish, which become straw colored with the advancement of age. The worker constructed the uniform globular brood cells connected to each other by pillar like connections in batches of 4 to 6, whereas, in *Apis* species have vertical, single or multiple parallel combs either exposed to light or in dark enclosures with regular hexagonal cells. Single stingless bee worker constructed and completed one cell in 2.0-2.5 hours. The queen inspected the brood cells during construction. After completion, 6-8 attendant workers were involved in filling up of each cell with special honey and pollen food mixture which was regurgitated from their crop. The queen moved over such cells fluttering her wings in a rhythmic manner and inspected the cells. Later she deposited an egg at the centre of larval food, either in vertical or slanting position. Then, with few seconds one of the worker started closing the cell with cerumen and finished it within two or three minutes. The average time required to finish this operation was two minutes and sixteen seconds. The findings of study were almost similar with findings of Kshirsagar and Chauhan (1977). The entire process of building a brood cell, providing larval food and laying an egg is called provisioning and oviposition process (POP).

The eggs were smooth, cylindrical and transparent measuring 1.2 to 1.37mm in length with a mean of 1.33mm and width 0.4 to 0.48 mm with a mean of 0.44mm. The egg hatched in 5.5-6 days with an average of 5.75 days. The larvae creamy white, apodus and 'C' shaped. The length and width of larvae on 3rd, 7th and 12th days old was measured and found increased with advancement of age of larvae. The larval duration ranged

between 11.0 to 13.5 days with a mean of 12.7 days. In stingless bees there was no physical contact between larvae and adult bees since the cell was closed after egg laying. Whereas in case of genus *Apis*, the cell containing egg was left open and larvae was fed progressively with royal jelly and bee bread during its growth. The system of larval feeding incase of stingless bee was called mass provisioning, which resembles the system used by solitary bees. The pupal cells looked transparent as the brood food exhausted on the removal of cerumen after pupation in the brood cell. The pupae were exerate type measuring 4.5-4.75mm length with a mean of 4.63mm and width of 2.9-3.1mm with a mean of 3mm. The pupal period occupied 33-38days with an average of 35.3 days. The total period of development from egg to adult took with a mean of 53.3 days. Immediately after emergence, the creamish to ash colored young adults started grooming their body and turned darker after eight days. There after they started removing the waste materials, dead bees, cell construction, provisioning and guarding at the entrance after 20-25 days and started foraging when they were 35-40 days old. The marked bee was observed and was found dead in about 80-87 days usually inside the nest itself. The dead bees were discarded by the bees of 20-25 days age. The results of the study on egg, larval and pupal period were differ with the findings of Wittamann *et al*. (1991) and Salmah *et al*. (1996) on *T. itama*, the variation might be due to difference in the species and geographical variations.

Table 2: Biology of stingless bee, *Trigona iridipennis*

Sl. No.	Date of egg laying	Developmental period in days				
		Egg	Larvae	Pupae	Total mean	Date of adult emergence
01	Jan 13th	5.5-6	11-12	33-34	50.75	Mar 3rd
02	Jan 18th	5.5-6	11-12	33-34	50.75	Mar 8th
03	April 17th	5.5-6	12-13	35-36	53.75	June 10th
04	May 3rd	5.5-6	12-13.5	36-38	55.50	June 28th
05	May 7th	5.5-6	12-13.5	36-38	55.50	July 3rd
	Range	5.5-6	11-13.5	33-38	-	-
	Mean	5.75	12.70	35.30	53.30	-

Table 3: Dimension of developmental stages of *Trigona iridipennis*

Different stages	Dimensions (mm)			
	Length (Range)	Average length	Width (Range)	Average width
Egg	1.20-1.37	1.33	0.40-0.48	0.44
Larvae 3rd days old	3.39-3.47	3.43	1.37-1.61	1.48
7th days old	5.00-5.16	5.08	1.94-2.08	2.01
12th days old	5.48-5.57	5.23	2.10-2.50	2.30
Pupae	4.50-4.75	4.63	2.90-3.10	3.00

IV. Conclusion

Information on different nesting sites, nesting characteristics and biology of stingless bee will be more helpful to design suitable bee hives and to conserve the natural nesting sites for their utilization in the pollination of various crops.

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