ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Assessment of comparative foraging activity in queen right and queen less colony of stingless bee, Tetragonula iridipennis Smith (Hymenoptera: Apidae)

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Manuscript Info

Manuscript History:

Received: 14 May 2015
Final Accepted: 19 June 2015
Published Online: July 2015

Key words:

Apis spp., Foraging, *Tetragonula iridipennis*

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Abstract

Stingless bees are good pollinator in tropical and sub-tropical regions in India and known to pollinate various plants of economic importance and generally better used in planned pollination. Foraging performance by bees is a clear indicator of functioning and strength in colony. A various circumstances affect the normal foraging activity by bees. The queenless ness in the bee colony may be one of those reasons which alter the normal foraging activity in respect to foraging activity in a normal queen right bee colony. The present study was done with the aim to know how the absence of queen in a colony of stingless bee *Tetragonula iridipennis* Smith affects its foraging activity and to find out a comparative conclusion between foraging activity in a queen less and a queen right colony of *T. iridipennis*. The study revealed some important differences in foragging jobs in both types of colonies. Number of outgoing forager bees and resin collector bees were remain almost similar in queen right (61.149 and 2.893 bees per 5 min) and queenless colony(62.744 and 3.618 bees per 5 min), respectively, but pollen collector bees were found to be more active in queen less colony (20.560 bees per 5min) then in queen right colony (1.814 bees per 5 min), respectively, and the activity of cleaner bees and nectar collecting bees were more in queen right colony (5.367 and 61.39 bees per 5 min) than in queen less colony (2.569 and 44.957 bees per 5 min), respectively.

INTRODUCTION

Foraging activity in bees is a routine and essential task for survival of colony, although no foraging activity was observed during cloudy or rainy days. Foraging activity also decreases to greater extent in months of Nov-Feb in northen parts of India. Like *Apis* species pollen and nectar are the essential food for stingless bees. In case of stingless bees, strength, development and quantity of honey stored in a colony are highly dependent on the collection of nectar and pollen by the worker bees. Information on the foraging behavior of stingless bees will be of much use for meliponiculture (rearing of stingless bees) and in management of stingless bees and thus better to be utilized in planned pollination also. **Free *et al.* (1985)** reported colonies with virgin queens forage as much as those with mated queens but collected less pollen in *Apis mellifera* colonies. **Nagamistu *et al*. (2002)** reported more pollen-carrying activity in the early morning, when 50% of returning bees carried pollen. **Managanvi *et al.* (2009)** reported peak activity of outgoing and incoming forager bees of *Trigona laeviceps* at 11am i.e. 44.4 bees/5min and 43.8bees/5min, respectively. Maximum pollen collector bees were observed at 10 am i.e. 19.6 bees/5min and maximum nectar collector bees at 12 pm i.e. 25.8 bees/5min.

The study conducted at Vellayani (Kerala) revealed that the peak foraging activity of *Trigona iridipennis* was during July with maximum foraging bees. Lowest foraging activity was observed during the month of December and January. The number of incoming foragers with pollen was more during July, August and October

and less during December and January **(Devanesan *et al.*, 2002)**. **Premila *et al.* (2007*)*** also observed maximum number of pollen foragers in the morning hours and nectar foragers at midday. Resin collection remained throughout the day. The incoming foragers were observed to collect more pollen than nectar. The average number of incoming foragers with pollen was 17.9 bees/5min compared with nectar collectors (11.5 bees/5min) during the first peak at 12.00 h. The average number of pollen and nectar foragers were 13.9 bees/5min and 10.8 bees/5min, respectively, during the second peak at 15.00 h. Flight activity was highly influenced by light intensity, which resulted in the reduction of activity in the evening **(Devanesan *et al.*, 2002)**. **Patnaik and Prasad (2006)** reported that the number of incoming pollen foragers of *Trigona iridipennis* ranged from 0.07 to 2.92/min, while that of non-pollen foragers varied from 0.34 to 6.94/min. **Saravanan and Alagar (2007)** observed the foraging activity of stingless bee *Trigona iridipennis* Smith for four months from two colonies hived and maintained in TNAU, Coimbatore and reported that Pollen foraging attained the peak mainly during morning hours. However, nectar and resin collection was evenly distributed throughout the day. Collection of nectar and pollen accounted for more than 90% of flights. The workers performed relatively more number of flights for collection of nectar rather than pollen and resin.

All these studies on foraging activity of *Trigona iridipennis* (=*Tetragonula iridipennis*) relates to queenright colonies and no report seems to be available for foraging activity of a queenless colony of this species. In present study efforts have been made to compare foraging activity in a queen right colony with that in a colony with queenless condition.

MATERIAL AND METHODS

The present study was conducted in Apiary, Department of Entomology, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand (India) for studying differences in foraging activity in one queen less and one queen right hived colonies of *Tetragonula iridipennis.* The observations on activity of forager bees (incoming + outgoing) were recorded vediographically for 5 minutes thrice a day at 4 hour intervals at 8:00AM, 12:00PM and 4:00PM, respectively daily for 47 days (24 May- 9July, 2014). Readings were taken for 47 days because it is the time taken by *T. iridipennis* to complete one brood cycle in northern region of India **(Velmurgan, 2011)**. The number of outgoing and incoming bees was counted carefully. Among outgoing bees, the bees with debris, dead brood or the dead adult bees were the cleaner bees and counted separately. Among incoming foragers, numbers of pollen and nectar forager bees were counted. In case of pollen foragers, pollen load could be observed clearly on metathoracic leg which is equipped with pollen basket. The resin collector bees were identified on the basis of resin drop seen on metathoracic leg. Incoming foragers without pollen load and resin drops were considered as nectar forager bees. However, the number of nectar forager bees was calculated by deducting the number of cleaner bees, that after throwing away the undesirable material near the hive, these bees were observed to enter the hive without any reward.

RESSULT AND DISCUSSION

Foraging activity of queen right colony

The results for foraging activity in queen right and queen less colonies were presented in table 1. The average number of outgoing forager bees was maximum at 4 pm (77.12 bees/5min or 42.04%) followed by 12 pm (55.95 bees/5min or 30.51%) and 8 am (50.36 bees/5min or 27.45%), respectively. The average number of cleaner bees was maximum at 12 pm (6.26 bees/5min or 38.92%) followed by 8 am (5.83 bees/5min or 36.23%) and 4pm (4 bees/5min or 24.84%), respectively. The incoming pollen collecting bees were maximum and almost similar at 8 am (2.067 bees/5min or 37.97%) and 4 pm (2 bees/5min or 36.75%), while minimum at 12 pm (1.375 bees/5min or 26.65%). The incoming nectar collecting bees was maximum at 4 pm (75.14 bees/5min or 40.8%) followed by 12 pm (57.23 bees/5min or 31.07%) and 8am (51.78 bees/5min or 28.11%), respectively. The number of resin collecting bees was maximum at 8 am (3.59 bees/5min or 38.91%) followed by 12 pm (2.75 bees/5min or 29.76%) and 4 pm (2.34 bees/5min or 31.32%), respectively.

Irrespective of the day hours, mean number of outgoing forager bees were 61.14 bees/5min and mean number of cleaner bees were 5.36 bees/5 min. Similarly the number of pollen, nectar and resin collector bees were 1.81 bees/5min, 61.39 bees/5min and 2.89 bees/5min, respectively **(Table-1)**.

Foraging activity of queen less colony

The number of outgoing forager bees per 5 min was maximum at 12 pm (67.95 bees/5min or 36.1%) followed by 4 pm (64.25 bees/5min or 34.13%) and 8 am (56.02 bees/5min or 29.46%), respectively. The number of outgoing cleaner bees was maximum at 12 pm (2.80 bees/5min or 36.43%) followed by 8 am (2.47 bees/5min or 32.11%) and 4 pm (2.42 bees/5min or 31.46%), respectively. The number of incoming pollen collecting bees was maximum at 12 pm (25.25 bees/5min or 58.85%) followed by 8 am (19.51 bees/5min or 33.46%) and 4 pm (13.06 bees/5min or 22.68%), respectively. The number of incoming nectar bees was maximum at 12 pm (48.14 bees/5min or 35.69%) followed by 4 pm (46.06 bees/5min or 34.15%) and 8 am (40.65 bees/5min or 30.14%), respectively.

The number of incoming resin collecting bees was maximum at 12 pm (4.82 bees/5min 44.48%) followed by 4 pm (3.39 bees/5min or 31.22%) and 8 am (2.63 bees/5min or 24.28%), respectively.

Irrespective of the day hours, the mean number of outgoing forager bees were 62.74 bees/5min and the mean number of cleaner bees were 2.56 bees/min. Similarly the mean number of pollen, nectar and resin collecting bees were 19.27bees/5min, 44.95 bees/5min and 3.61 bees/5min, respectively **(Table-1)**.

Table 1: Comparative foraging activity in queen right and queen less colony during different day hours in one brood cycle

Day hour	Queen right colony										Queen less colony									
	Number of Outgoing Bees/5 min				Number of Incoming Bees/5 min						Number of Outgoing Bees/5 min				Number of Incoming Bees/5 min					
	Forager Bees		Cleaner Bees		Pollen		Nectar		Resin		Forager Bees		Cleaner Bees		Pollen		Nectar		Resin	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
8 am*	50.36	27.45	5.83	36.23	2.06	37.97	51.78	28.11	3.59	38.91	56.02	29.76	2.47	32.11	19.27	33.46	40.65	30.14	2.63	24.28
12 pm*	55.95	30.51	6.26	38.92	1.37	25.65	57.23	31.07	2.75	29.76	67.95	36.1	2.80	36.42	25.25	53.85	48.14	35.69	4.82	44.48
4 pm*	77.12	42.04	4	24.84	2	36.75	75.14	40.8	2.89	31.32	64.25	34.13	2.42	31.46	13.06	22.68	46.06	34.15	3.39	31.22
Mean**	**61.14**	**46.88**	**5.36**	**3.15**	**1.81**	**0.62**	**61.39**	**47.07**	**2.89**	**2.25**	**62.74**	**47.66**	**2.56**	**1.79**	**20.56**	**13.78**	**44.95**	**34.15**	**3.61**	**2.59**
SEM	**2.84**		**0.52**		**0.19**		**62.26**		**0.28**		**2.29**		**0.22**		**1.65**		**1.90**		**0.26**	
CD 5%	**7.96**		**1.46**		**0.55**		**4.94**		**0.78**		**6.44**		**0.62**		**4.64**		**5.35**		**0.74**	

*Mean of 47 values; ** Mean of 141 values (47 days × 3 hours)

SUMMARY AND CONCLUSION

Comparative foraging activity of one queen right and one queen less colony of *T. iridipennis* were observed daily for on brood cycle (46-47 days). In a general view, there was no significant difference in number of outgoing forager bees and resin collector bees between queen right and queenless colony, however, the activity of pollen collector bees was more in queen less colony than queen right colony. On the other hand, activity of cleaner bees and nectar collecting bees were more in queen right colony than queen less colony. The peak time for various activities in queen right colony was different for different activities than in queen less colony (pollen and resin collection at 8 am, cleaning at 12 pm and nectar collection at 4 pm) where it was same (12 pm) for all these activities. This indicated that presence of queen in a colony stimulated the worker bees to initiate their indoor and outdoor duties in morning with more efficiency.

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