

Foraging Behavior of Different Honeybee Species under Natural Condition in Chitwan, Nepal

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Abstract: An experiment was conducted to know the foraging behavior of different honeybee species in rapeseed flower under natural conditions in Chitwan, Nepal during 2012-2013. This experiment shows that higher numbers of flowers were visited by *Apis cerana* F. as compared to *Apis mellifera* L. and *Apis dorsata* F. under natural condition at the same time of the day. *Apis cerana* F. visited 16.5 and 26.0 flowers and *Apis mellifera* L. visited 12.33 and 21.67 flowers, whereas *Apis dorsata* F. visited 9.33 and 15.83 flowers at 10:00 am and 2:00 pm of the day respectively. The peak foraging hours for all three bee species were recorded around 12:00 noon to 14:00 pm. Similarly, number per meter square of all three bee species were recorded more at 2:00 pm and least at 10:00 am. Among the three species of honeybees, *Apis mellifera* L. were recorded more number per meter square at 2:00 pm and 12:00 pm where as *Apis cerana* F. were recorded more at 10:00 am and 4:00 pm. It shows that *Apis cerana* F. visited higher number of flowers and was more efficient pollinator as compared to *Apis mellifera* L. and *Apis dorsata* F.

Keywords: *Apis mellifera* L., *A. cerana* F. and *A. dorsata* F., Foraging behavior, Natural condition

1. Introduction

Nepal is small mountainous country with geographical and ecological variation containing rich biodiversity. It contains suitable climatic condition for beekeeping with availability of bee flora throughout the year. It is reported that three important honeybee species, little honeybee (*Apis florea* F.), rock bee (*Apis dorsata* F.) and Asian bee (*Apis cerana* F.) were commonly found in Nepal [1] and largest honeybee (*Apis laboriosa* F.) is also found in the mountain region of Nepal whereas European bee (*Apis mellifera* L.) was introduced in Nepal in 1994 [2]. They are naturally important pollinators of plants throughout their natural range. The main significance of honeybees and beekeeping is pollination, whereas the hive products are secondary value [3]. Scientific evidence confirms that bee pollination also improves the yield and quality of crops, such as fruits, vegetable seeds, spices, oilseeds and forage crops [4]. For better pollination and productivity of crops, the proper methods of utilizing pollinators are important, which are specific for honeybees, other bees and other insects [5].

The foraging efficiency of honeybees is directly effect to the crop production and productivity and it depends on the availability of bee forage, conditions of the colony and foraging range of worker bees. Hence, the knowledge on bee behaviour and foraging activity and their interactions with different plant species are pre-requisite to frame on strategy for effective crop pollination and bee hive productions for different agro-ecological regions. Similarly,

the number of bees per meter square in field gives the density of honeybee and availability of pollinators. Therefore, this study attempts to compare foraging activities of the different species of honeybees (*Apis cerana* F., *Apis mellifera* L., and *Apis dorsata* F.) in rapeseed under natural condition of subtropical climate in inner terai, Chitwan, Nepal.

2. Material and Method

An experiment was conducted at Jutpani VDC, Chitwan district Nepal during October 2012 to February 2013 to know the foraging behaviour of different honeybee species under natural condition. The 3 m x 5 m (15 m²) size of plots were formed and separated by 0.5m distance between plots and 1m between replications. Rapeseed variety Pragati was sown on 03 November 2012 with all the agronomical practices followed. The seeds were sown at 3-4 cm depth of soil @ 6 kg / ha in well prepared field maintaining 20 cm x 5 cm spacing between row to row and plant to plant, respectively. Flower number visited per minute and number of bees in per meters area per minute of *Apis cerana* F., *Apis mellifera* L. and *Apis dorsata* F. under natural condition were recorded. These records were taken four times at 10:00 am, 12:00 noon, 2:00 pm and 4:00 pm of the day at different rapeseed flowering stages. Comparative analysis was performed on foraging activities of the honeybee species using MSTAT software package.

3. Result and Discussion

Figure 1 and Table 1 clearly shows that higher number of flowers were visited by *Apis cerana* F. as compared to *Apis mellifera* L. and *Apis dorsata* F. on

rapeseed flower under natural condition at the same time of the day. *Apis cerana* F. visited 16.5, 26.0, 17.83 flowers and *Apis mellifera* L. visited 12.33, 21.67, 14.83 flowers, whereas *Apis dorsata* F. visited 9.33, 15.83, 11.5 flowers at 10:00 am, 2:00 pm and 4:00 pm of the day, respectively. It shows that *Apis cerana* F. visited higher number of flowers as compare to other two species of honeybee and it is more efficient pollinators in natural condition. Similar result was also presented on rapeseed as *Apis cerana* F. visited 18.0, 19.8 and 14.2 flowers, and *Apis mellifera* L. visited 14.2, 15.4 and 14.5 flower at 9:00, 12:00 and 15:00, respectively [6]. In another experiments, it was reported that *Apis cerana* F. foraged higher number of broccoli flowers as 12.11 flowers per minute as compared to *Apis mellifera* L. as 10.89 flowers per minute under natural conditions [7]. Similarly, the peak foraging hours for all three bee species were recorded around 12:00 noon to 14:00 pm. the highest numbers of flowers were visited at 2:00 pm followed by 12:00 noon and 4:00 pm while the least numbers were visited at 10:00 am by all three species. Similar result was presented by an experiment as peak foraging behavior for *Apis cerana* F. was recorded between 11:00 to 13:00 hrs and then steady decline which abruptly decreased between 17:00 to 18:00 hrs where as in the case of *Apis mellifera* L. the increase was steady and reached its peak between 13:00 hrs to 15:00 hrs [8].

Table 1. Comparative foraging behavior of *Apis cerana* F., *Apis mellifera* L. and *Apis dorsata* F. on rapeseed under natural condition in Jutpani VDC Chitwan, 2012/013*

Parameter		<i>Apis cerana</i>	<i>Apis mellifera</i>	<i>Apis dorsata</i>
Flower visited per minute	10:00 am	16.5b	12.33c	9.333c
	12:00 noon	21.67ab	19.33ab	13.33ab
	2:00 pm	26.00a	21.67a	15.83a
	4:00 pm	17.83b	14.83bc	11.5bc

* Means followed by the same letter in each column are not significantly different by DMRT at ≤ 0.05 percent level.

Similarly, Figure 2 and Table 2 shows under natural condition, more number per meter square of all three bee species were recorded at 2:00 pm and least at 10:00 am. The more *Apis mellifera* L. per meter were observed at 2:00 pm (6.333 bees) and least at 10:00 am (1.667 bees). Similarly, *Apis cerana* F. were recorded more at 2:00 pm (4.167 bees) and the least numbers at 10:00 am (1.833 bees). The number of *Apis dorsata* F. per meter square was not significantly different at different time of the day but the result was as similar with other two species more numbers were recorded at 2: 00 pm and least at 10:00 am. Similar result were presented as more number of bees recorded at 12:00 noon as compared to 9:00 am and 15:00 pm as 9.0, 8.1 and 6.3 and 13.5 number of bees visited per m²/ 5 min [6]. Higher number of *Apis mellifera* L. colonies kept by farmers resulted in higher number of *Apis mellifera* L. number per meter square whereas destruction of suitable hibernating places, unavailability of pollen and nectar source, more human intervention and miss use and over use of chemical pesticide resulted decrease population of honeybee in nature. It is

reported that low pollinator abundance and diversity have started appearing in different area of world [9]. It was reported that after the heavy use of chemical pesticides and many colonies destroyed in Chitwan [10] [11].

Among the three species of honeybees, *Apis mellifera* L. were recorded more number per meter square at 2:00 pm and 12:00 pm where as *Apis cerana* F. were recorded more at 10:00 am and 4:00 pm. Whereas *Apis dorsata* F. were recorded least in all over the day hours as compare to *A. cerana* F. and *A. mellifera* L. This result clears that under slightly unfavorable environmental condition the activity of *Apis mellifera* L. is decreases whereas but *Apis cerana* F. does not. It shows that *Apis cerana* F. can forage flower even slightly unfavorable environmental condition. In a study it showed that the number of bees per m ranged between 4.0-12.0 and 2.6-10.2 in the case of *Apis mellifera* L. and *Apis cerana* F. respectively [12]. Similar result were reported as more number of *Apis mellifera* L. at noon and least at 9:00 am and 15:00 pm as compared to *Apis cerana* F. in Chitwan condition [6].

Table 2. Number per meter square of *Apis cerana* F., *Apis mellifera* L. and *Apis dorsata* F. on rapeseed under natural condition in Jutpani VDC, Chitwan 2012/013*

Parameter		<i>Apis cerana</i>	<i>Apis mellifera</i>	<i>Apis dorsata</i>
Number per meter square	10:00 am	1.833b	1.667b	0.17
	12:00 pm	3.500ab	5.000a	0.50
	2:00 pm	4.167a	6.333a	1.0
	4:00 pm	2.000b	1.833b	0.67

* Means followed by the same letter in each column are not significantly different by DMRT at ≤ 0.05 percent level.

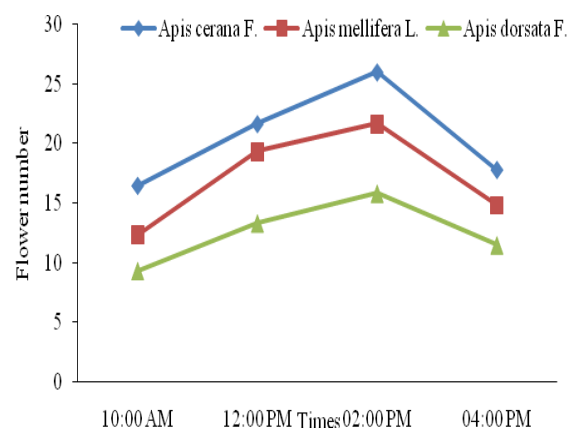


Figure 1. Number of flowers visited per minute by *Apis cerana* F., *Apis mellifera* L. and *Apis dorsata* F. under natural condition in Jutpani VDC, Chitwan 2012/013.

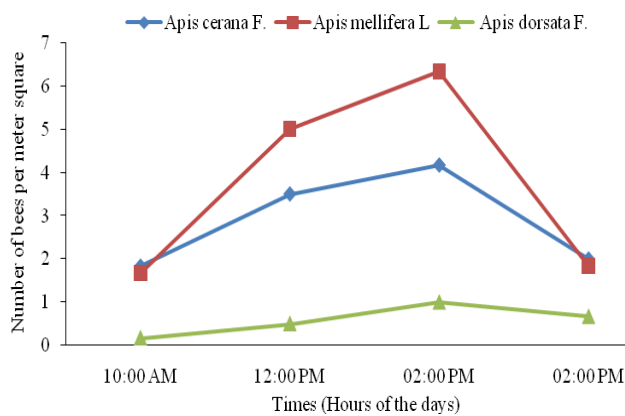


Figure 2. Number of *Apis cerana* F., *Apis mellifera* L. and *Apis dorsata* F. per meter square area at different times of the day under natural condition in Jutpani VDC, Chitwan 2012/013.

4. Conclusion

It is concluded that *Apis cerana* F. visited higher number of flower as compared to *Apis mellifera* L. and *Apis dorsata* F. in natural condition. The peak foraging hours for all three bee species were recorded around 12:00 noon to 14:00 pm. The population of *Apis dorsata* F. and *Apis cerana* F. is less as compare to *Apis mellifera* L. due to the disturbance of natural habitat. Hence, *Apis cerana* F. is efficient pollinators as compared to *Apis mellifera* L. and *Apis dorsata* F. and honeybee friendly cultivation practices for the conservation of honeybee on the natural habitat is recommended.

References

- [1] D. P. Abrol, "Foraging behavior of *Apis mellifera* L. and *Apis cerana* F. as determined by the energetic of nectar production in different cultivars of *Brassica campestris* var. *toria*," *Journal of Apicultural Science*, 51 (2): 19-24, 2007.
- [2] F. R. Devkota, R. B. Thapa, "Foraging preference of *Apis cerana* F. and *Apis mellifera* L. to broccoli under caged and open conditions in Chitwan," *Institute of Agriculture and Animal Science*, 26: 167-168, 2005.
- [3] G. C Dhakal. "A comparative study of *Apis cerana* F. and *Apis mellifera* L. on pollination of *Brassica campestris* Var. *toria* and *Fagopyrum esculentum* M. at Rampur, Chitwan," M. Sc. In Entomology Thesis TU. IAAS Rampur, Chitwan, Nepal. 76 p, 1982.
- [4] N. C. Joshi and P. C. Joshi, "Foraging behavior of *Apis* spp. on apple flowers in a subtropical environment," *New York Science Journal* 3(3): 71-76, 2010.
- [5] G. P. Kafle, "Salient features of beekeeping in Nepal," *In: L. R. Verma (ed.) Honeybees in Mountain Agriculture*. Oxford and IBH Publication Company, New Delhi, India. pp. 155-162, 1992.
- [6] M. Kasina, M. Kraemer, C. Martius and D. Wittmann, "Diversity and activity density of bees visiting crop

flowers in Kakamega, western Kenya" *Journal of Apicultural Research* 48 (2): 134-139, 2009.

- [7] MoAC, "Directorate of Industrial Entomology department," Government of Nepal Ministry of Agriculture and Co-operatives, Kathmandu. Nepal, 2008.
- [8] U. Partap, T. Partap, "Managed crop pollination. The missing dimension of mountain crop productivity," Discussion paper series No. MFS 97/1, ICIMOD, Kathmandu, Nepal. 26 p, 1997.
- [9] K. C. Sharma, Current experiences and practices in pesticide use in the Bagmati zone. ADPI series #9. ICIMOD, Kathmandu, Nepal, 1994.
- [10] R. C. Sihag, "Management of bees for pollination," *In: M. Matska, L. R. Verma, S. Wongsiri, K. K. Shrestha and U. Partap (eds.). Asian Bees and Beekeeping-Progress of Research and Development*. Proceeding of Fourth Asian Apicultural Association International Conference, Kathmandu. March 23-28, 1998. Oxford and IBH Publication Company Private Limited, India. 283 p, 2000.
- [11] R. B. Thapa, "Environmental impacts from Nepal's use of chemical pesticides," Consultancy report submitted to WWF Nepal. APROSC, Kathmandu, Nepal, 1994.
- [11] L. R. Verma, "Beekeeping in integrated mountain development: economic and scientific perspectives," ICIMOD senior fellowship Series, No. 4 Oxford and IBH Publishing Company. Private. Limited, New Delhi, India. 387 p, 1990.

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