

Influence of foraging rate and speed of *Apis* species (Hymenoptera) on *Brassica campestris* var. sarson

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Abstract

Foraging rate and speed of three species of *Apis cerana*, *A. mellifera* and *A. dorsata* were studied in the fields of sarson at Pallimore and Hiranagar at three different hours of the day viz., 0900, 1200 and 1500 hours in order to determine the number of flowers visited per bee at a particular time. At both Pallimore and Hiranagar, *A. dorsata* spent significantly more time than *A. cerana* and *A. mellifera* at 0900 hours, whereas no significant ($P > 0.05$) differences were observed between the three *Apis* species at 1200 and 1500 hours of the day. However number of flowers visited/bee/minute by *A. mellifera* were significantly ($P < 0.05$) more than *A. dorsata* and *A. cerana* at 0900 and 1200 hours at Pallimore but no such significant differences ($P > 0.05$) were observed at 1500 hours of the day. Similarly at Hiranagar, *A. mellifera* visits significant ($P < 0.05$) number of flowers/minute at 1200 hours than *A. dorsata* and *A. cerana*, whereas at 0900 and 1500 hours no such significant differences were observed ($P > 0.05$).

Keywords: *Apis cerana*, *Apis mellifera*, *Apis dorsata*, *Brassica campestris*, Foraging.

Introduction

Insects are of prime significance in pollination of agricultural and horticultural crops. These insects belong to order Hymenoptera, Diptera, Lepidoptera, Coleoptera and Thysanoptera (Michener, 1974). Among hymenoptera, honeybees are considered as the most efficient pollinators of cultivated crops because of their floral fidelity (Wells and Wells, 1983 and Waser, 1986), potential for long working hours (Sihag, 1990), presence of pollen baskets, maintainability of high population, micromanipulation of flowers and adaptability to different climatic conditions (Verma and Partap, 1993).

Materials and Methods

Time spent per flower and number of flowers visited per minute were taken as the indicators of foraging rate and speed respectively. Time spent by a worker bee of *A. cerana* and *A. mellifera* on sarson flower and number of flowers visited per minute was recorded with the help of a stop watch having an accuracy of one tenth (1/

10th) of a second. These observations were taken thrice a day at 0900, 1200 and 1500 hours and were repeated for a week in each field under good climatic conditions.

Results and Discussion

Three species of *Apis* were monitored for their foraging rate and speed at three different hours of the day i.e. 0900, 1200 and 1500 hours at both the fields as shown in Table 1 and Figures 1, 2, 3 & 4. It reveals that *Apis cerana* and *A. mellifera* coincide in their foraging rate and speed at 0900, 1200 and 1500 hours i.e. there is no difference in their foraging rate and speed. For *A. dorsata* the foraging rate and speed remains the same at 1200 and 1500 hours but at 0900 hours *A. dorsata* spent more time than *A. cerana* and *A. mellifera*. This may be due to large body size of *A. dorsata* and also due to partial opening of the flowers in the morning hours.

These results are in agreement with Verma and Partap (1993) who noted no significant differences in the time spent and number of flowers

Table -1: Time spent per flower per bee (seconds) and number of flowers visited per bee/minute on sarson bloom at Pallimore and Hiranagar, district Kathua.

Fields	Parameters	0900 hr			1200 hr			1500 hr		
		A.c.	A.m.	A.d.	A.c.	A.m.	A.d.	A.c.	A.m.	A.d.
Pallimore	X±S.E	2.44±0.27	2.82±0.22	4.21±0.34	2.34±0.26	2.36±0.23	2.87±0.15	2.18±0.12	2.36±0.17	2.47±0.15
	C.V.	29.51	20.57	21.19	29.06	25.55	14.04	14.68	19.49	15.79
	X±S.E	11.57±0.32	12.91±0.84	10.20±0.26	12.48±0.44	13.31±0.33	11.31±0.37	13.00±0.43	13.68±0.37	12.11±0.63
	C.V.	7.17	17.12	6.86	9.29±	6.54	8.66	8.77	7.09	0.63
Hiranagar	X±S.E	2.92±0.23	3.19±0.26	3.58±0.20	2.38±0.07	2.65±0.22	2.86±0.18	1.81±0.09	2.67±0.09	2.53±0.24
	C.V.	20.89	21.63	14.80	7.98	21.88	16.78	13.26	9.74	24.90
	X±S.E	10.91±0.14	11.57±0.17	10.34±0.17	11.40±0.09	13.09±0.29	11.46±0.14	12.06±0.16	12.63±0.39	12.40±0.23
	C.V.	3.30	3.80	4.45	2.02	5.80	3.14	3.40	8.15	4.92

A.c = *A. cerana*; A.m = *A. mellifera*; A.d = *A. dorsata*.
 X±S.E = Mean ± standard error about mean of 70 observations; C.V.= Coefficient of variation;
 (a) At Pallimore and Hiranagar, $A.dorsata > A.mellifera > A.cerana$ at 0900 hours ($P < 0.01$) whereas, differences were insignificant at 1200 and 1500 hours ($P > 0.05$).
 (b) At Pallimore, $A. mellifera > A.cerana > A.dorsata$ at 0900 and 1200 hrs ($P < 0.05$); whereas, insignificant at 0900 hours ($P > 0.05$); At Hiranagar, $A. mellifera > A.dorsata > A.cerana$ at 1200 hours ($P < 0.01$); whereas, insignificant at 0900 and 1500 hours ($P > 0.05$).

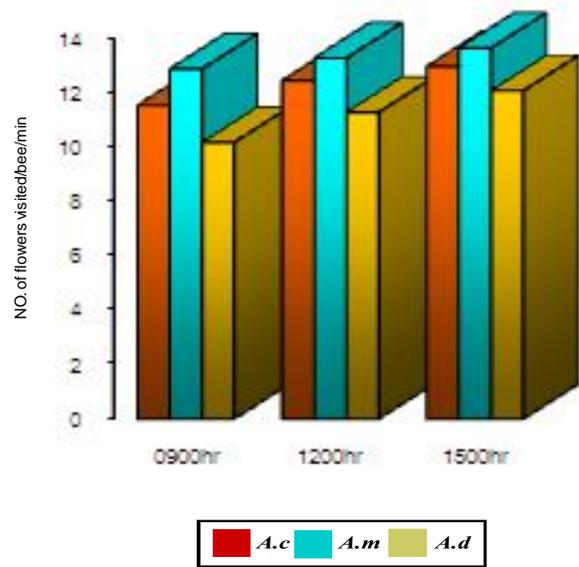
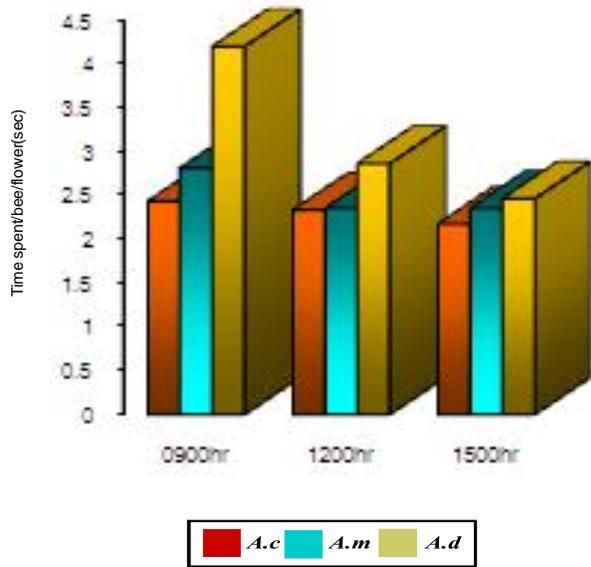


Fig.1: Variations in time spent/bee/flower(sec) by *Apis cerana*, *A.mellifera* and *A.dorsata* at different hours of the day on sarson crop at Pallimore, Kathua.

Fig.2: Variations in number of flowers visited/bee/min. by *Apis cerana*, *A.mellifera* and *A.dorsata* at different hours of the day on sarson crop at Pallimore, Kathua.

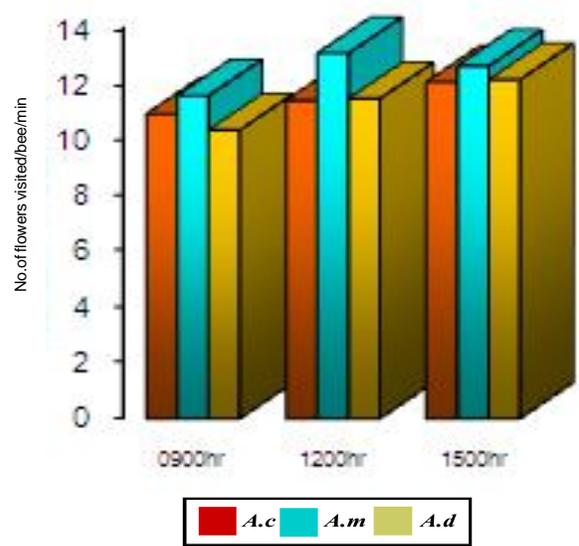
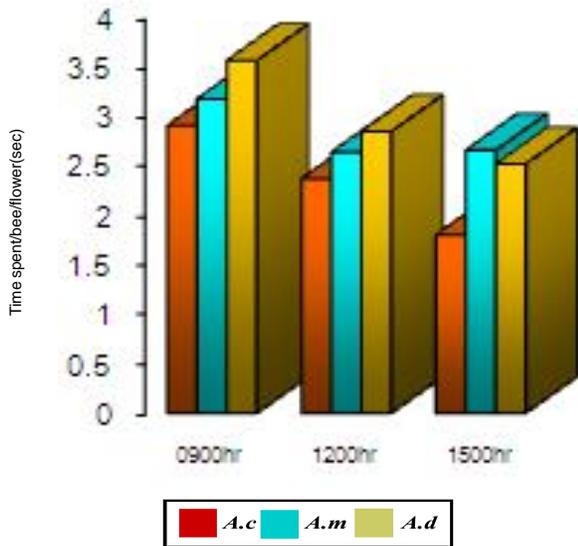


Fig.3: Variations in time spent/bee/flower(sec) by *Apis cerana*, *A.mellifera* and *A.dorsata* at different hours of the day on sarson crop at Hiranagar, Kathua.

Fig.4: Variations in number of flowers visited/bee/min. by *Apis cerana*, *A.mellifera* and *A.dorsata* at different hours of the day on sarson crop at Hiranagar, Kathua.

visited by *A. cerana* and *A. mellifera* on mustard bloom. Murrell and Nash (1981) also reported that *A. cerana* spent less time per floret than *A. florea*, whereas *Apis dorsata* was intermediate in its foraging speed (mean 4.5 sec/floret). Time spent and number of flowers visited by *A. cerana indica* was reported as 4.61 ± 0.13 sec/flower and 13.3 flowers/min by Adlakha & Dhaliwal (1979).

The variations in foraging rate and speed of *A. cerana*, *A. mellifera*, *A. dorsata* and *A. florea* may be due to different amounts of nectar and pollen present in various flowers as time spent per flower depends upon the amount of nectar present and morphology of flower (Pyke *et al.*, 1977).

Conclusion

It has been concluded that by placing both the colonies of bees (*A. cerana* and *A. mellifera*) and nesting of *A. dorsata* near by the fields of *Brassica campestris* increases the number of flowers visited per bee at a particular time, hence increases the pollination and enhances the yield.

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References

- Adlakha, R.L. and Dhaliwal, H.S. 1979. Insect pollination of seed cauliflower (*Brassica oleracea* var. *botrytis*) with particular reference to the role of honey bees. Indian Bee Journal 41: 13-16.
- Kakar, K.L. 1981. Foraging behaviour of insect pollinators of cauliflower bloom. Indian Journal of Ecology 8(1): 126-130.
- Kumar, L. 1998. Foraging ecology and behaviour of *Apis cerana* F. and *A. mellifera* L. in pollinating apple and cherry flowers. Ph.D. thesis. Himachal Pradesh University, Shimla, India.
- Michener, C.D. 1974. The Social Behaviour of Bees. Cambridge, Massachusetts: Harvard University, Press.
- Mohr, N.A. and Jay, S.C. 1988. Nectar and pollen collecting behaviour of honeybees on canola (*Brassica campestris* L. and *Brassica napus* L.). Journal of Apiculture Research 27(2): 131-136.
- Murrell, D.C. and Nash, W.T. 1981. Nectar secretion by toria (*Brassica campestris* L. var. toria) and foraging behaviour of three *Apis* species on toria in Bangladesh. Journal of Apiculture Research 20(1): 34-38.
- Pyke, G.H., Pulliam, H.R. and Charnov, E.L. 1977. Optimal foraging a selective review of theory and tests. The Quarterly Review of Biology 52: 137-154.
- Sharma, S.K. and Singh, J.R. 1999. Pollinating efficiency of *Apis dorsata* F. and *Apis florea* F. on carrot (*Daucus carota* L.). Indian Bee Journal 61(1-4): 75-78.
- Sihag, R.C. 1990. Seasonal management of honeybee (*Apis mellifera* L.) colonies in Haryana (India). Indian Bee Journal 52 (1-4): 51-56.
- Verma, L.R. and Partap, U. 1993. The Asian Hive Bee, *Apis cerana*, as a Pollinator in Vegetable Seed Production (An Awareness Handbook). Nepal: International Centre for Integrated Mountain Development (ICIMOD), Kathmandu.
- Waser, N.M. 1986. Flower constancy: definition, cause and measurement. American Naturalist 127(5): 593-603.
- Wells, H. and Wells, P.H. 1983. Honeybee foraging: optimal diet, minimal uncertainty or individual constancy behaviour. Journal of Animal Ecology 52: 829-836.