Effect of supplementary feeding on *Apis cerana* F colony development at Katrain in Kullu valley of Himachal Pradesh

NIRUPAMA SHARMA, JK GUPTA and HARISH SHARMA

Department of Entomology and Apiculture
Dr YS Parmar University of Horticulture and Forestry
Nauni, Solan 173230 Himachal Pradesh, India
Email for correspondence: nirupamasharma999@gmail.com

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ABSTRACT

The experiment was conducted to work out the optimum schedule for supplementary feedings at Katrain, district Kullu, Himachal Pradesh situated at an altitude of 1473 m amsl. Irrespective of different dates of observations the average colony population was 12970 bees in colonies fed with sugar and pollen. These colonies also had maximum brood area of 1635 cm^2. Irrespective of the dates of observation the colonies given different types of supplementary feedings were statistically at par with each other with respect to honey stores and the amount of pollen collected by colonies fed on sugar and pollen was 298.3 cm^2. The study revealed that there was no need of giving supplementary feedings in the form of pollen and sugar during July to August in Katrain area as sufficient bee flora is available to the colonies during this period in the region.

Keywords: Low temperatures; insufficient bee flora; reduced bee activities; supplementary feeding

INTRODUCTION

Apis cerana is a part of natural heritage of mountain communities. It is an excellent pollinator of mountain crops and helps in maintenance of biodiversity. Indigenous methods of keeping bee colonies in log and wall hives are still common in Himachal Pradesh. In this Himalayan region bee colonies require special care particularly in the winter and monsoon seasons. In these seasons bee activities are reduced to a minimum due to the low outside environmental temperature particularly during January and February and the prolonged wet conditions during July-August. Consequently there are problems of inadequate food reserves, queenlessness, reduced fecundity and diseases. As a result of this *A cerana* colonies often abscond or desert the hives (Verma 1990). Provision of adequate food stores in terms of honey and pollen during the monsoon and winter seasons is therefore essential. Woyke (1976) found that supplementary pollen feeding also reduced absconding in *A cerana*.

This experiment was conducted to work out optimum schedule for supplementary feedings. It may thus be possible to start economical beekeeping with *A cerana* on small scale at farmers'/orchardists' level who cannot afford commercial beekeeping with *A mellifera* by adopting migration during winter months. This will definitely boost even horticulture production in the state. No systematic studies have been undertaken in Himachal Pradesh on these aspects hence the experiment was conducted with the objective to find out optimum schedule for supplementary feedings.

Various substances and formulae for pollen substitutes (Bhupen 1943) and pollen supplements have been tried as feeds for *A cerana*. Beekeepers in hills of Uttar Pradesh use wheat pancakes and jaggery. Similarly substitutes like pea flour, gram flour, soybean flour and skimmed milk powder have been used for feeding *A cerana*. Except the last two others were not useful as pollen substitutes. Sharma (1951) reported that buckwheat flour prepared in the form of half-

cooked sweetened pancake was the best among the cereals tried on *A cerana* in Himachal Pradesh for bee colonies. Shah and Shah (1979) found that soft patties made out of one part of sun-dried pollen mixed with half its weight of sugar, three parts of expeller-processed soybean flour and two parts of 2:1 sugar-water syrup was readily accepted by *A cerana* bees in Srinagar (Jammu and Kashmir). Brood rearing started early in these colonies and pollen income and honey production in spring flow were 1.5 times higher than in colonies without supplement feeding.

MATERIAL and METHODS

The experiment was conducted at the apiary of Regional Horticultural Research Sub-Station (YSPUHF), Katrain, dist Kullu, Himachal Pradesh situated at 32.1°N and 77.2°E longitude with altitude of 1473 m amsl.

Four groups, each having 3 *A cerana* colonies were selected from the available stock. These groups of colonies were given four types of feedings viz sugar feeding (SF) [two kg sugar (50% sugar syrup) fed to the colonies in four installments at 4-day interval during July], pollen feeding (PF) (pollen fed in the form of patties prepared by kneading stored pollen in sugar syrup; each colony fed with 350 g of patty wrapped in butter paper with perforations; the pollen collected from multiple plant sources), sugar and pollen feedings (SPF) (both sugar and pollen feedings as described above given to the colonies) and control (no feeding) (nothing fed to the colonies).

Initial performance of the colonies was recorded in the second week of July before giving various types of feedings. After the start of experiment the performance of the colonies was recorded for two brood cycles viz first and last week of August which was later compared. All the colonies were replaced with the new queens in the previous swarming season ie during the months of March and April. The data were statistically analyzed as per RBD using log transformations (Gomez and Gomez 1984). The other statistical tests viz t-test, standard error, coefficient of variation and correlation were also worked out.

To estimate the number of bees per frame, photographs of the combs covered with bees from three different colonies were taken. The number of bees on one side of the frame was counted from the photographs. This number of bees was multiplied by the factor '2' for getting total number of bees on both sides of the frame. Average count of three frames gave the number of bees per frame. Population of a colony was expressed in terms of number of bees (calculated by multiplying the average number of bees on a frame with the number of frames covered by bees).

RESULTS and DISCUSSION

Effects of supplementary feedings on the colonies of *A cerana* for two brood cycles are presented in Tables 1 and 2.

Effect of supplementary feedings on bee population in the colony

The data recorded on different types of supplementary feedings given to the colonies and presented in Table 1 reveal that irrespective of different dates of observations the average colony population was 12970 bees in colonies fed with sugar and pollen (SPF). The population in colonies fed with sugar (SF), pollen (PF) and control averaged 11570, 9096 and 12570 bees per colony respectively. Irrespective of type of feeding the bee population was statistically similar during the two brood cycles varying between 11130 to 11880 bees/colony. The colonies given SPF had more bee population on all the dates of observations and minimum in colonies given PF. In the control colonies the bee population was almost equivalent to that found in SPF treatment by second brood cycle.

The low bee population in pollen-fed colonies could be attributed to the fact that these colonies were having minimum brood rearing activity as compared to the colonies subjected to other treatments (SF, SPF and control colonies).

Effect of supplementary feedings on brood rearing

Data on effect of supplementary feedings on brood rearing (Table 2) reveal that irrespective of dates of observations SPF colonies had maximum brood area of 1635 cm^2 followed by 1431 cm^2 in control (difference being non-significant). However brood rearing was significantly lesser in SF (981.9 cm^2) and PF (923.6 cm^2) treatments. The average brood area irrespective of types of feeding was 1208 cm^2 on 19 July and 1052 cm^2 on 8 August. The brood increased significantly to 1468 cm^2 by 28 August. Colonies given SPF treatment had more brood during both the brood cycles as compared to other feedings and the control.

Table 1. Effect of supplementary feedings on the bee population in *A cerana* colonies at Katrain, Kullu, Himachal Pradesh

Treatment	Colony population (number of bees)			
	II week of July	I brood cycle	II brood cycle	Mean
Sugar feeding	11370 (4.38)	11970 (4.07)	11370 (4.05)	11570 (4.17)
Pollen feeding	9469 (3.95)	9208 (3.95)	8609 (3.92)	9096 (3.94)
Sugar and pollen feeding	11370 (4.06)	13770 (4.14)	13770 (4.14)	12970 (4.11)
Control	11970 (4.07)	12570 (4.10)	13170 (4.12)	12570 (4.10)
Mean	11130 (4.11)	11880 (4.06)	11730 (4.06)	

Figures in parentheses indicate log transformed values

$CD_{0.05}$

Supplementary feeding	0.18
Date	NS
Supplementary feeding x Date	0.31

Table 2. Effect of supplementary feedings on *A cerana* colonies at Katrain, Kullu

Supplementary feeding	19 July	I brood cycle	II brood cycle	Mean
Brood area (cm^2/colony)				
Sugar feeding	1062.0	583.3	1300.0	981.9
Pollen feeding	1021.0	891.7	858.3	923.6
Sugar + pollen feeding	1146.0	1665.0	2094.0	1635.0
Control	1604.0	1069.0	1621.0	1431.0
Mean	1208.0	1052.0	1468.0	
Honey stores (g/colony)				
Sugar feeding	750.0	1467.0	1342.0	1186.0
Pollen feeding	1417.0	1200.0	669.3	1095.0
Sugar + pollen feeding	1183.0	2283.0	1771.0	1746.0
Control	1800.0	1533.0	925.7	1420.0
Mean	1287.0	1621.0	1177.0	
Pollen stores (cm^2/colony)				
Sugar feeding	2.70	268.70	325.00	198.80
Pollen feeding	9.70	112.50	56.25	59.48
Sugar + pollen feeding	1.11	489.60	404.20	298.30
Control	16.77	420.80	208.30	215.30
Mean	7.57	322.90	248.40	

$CD_{0.05}$

	Brood area	Honey stores	Pollen stores
Supplementary feeding	413.90	NS	98.70
Date	358.48	NS	85.46
Supplementary feeding x Date	716.90	NS	170.92

Effect of supplementary feedings on honey stores

The results revealed that irrespective of the dates of observation the colonies given different types of supplementary feedings were statistically at par with each other with respect to honey stores (Table 2). Even on different dates of observations irrespective of types of feeding the amount of honey stored in colonies did not differ.

Effect of supplementary feedings on pollen store

Irrespective of dates of observations the amount of pollen collected by colonies fed on SPF was 298.3 cm^2 (Table 2) which was statistically identical with control and SF. However significantly lesser (59.48 cm^2) pollen stores were found in colonies fed on PF. The pollen stores irrespective of types of feeding were significantly less on 19 July (7.57 cm^2)

which increased significantly to 322.9 cm^2 on 8 August and no further significant increase was observed by 28 August when colonies had on an average 248.4 cm^2 of pollen area.

CONCLUSION

In Katrain area of Kullu valley, Himachal Pradesh there was second honey flow during autumn and for building the colony strength to avail autumn flow three different types of supplementary feedings were tried in present study viz sugar feeding, pollen feeding, sugar and pollen feeding and compared with the control (no feeding). It was observed that the average bee population, brood area and food stores in *A cerana* were more when fed with both sugar and pollen (SPF) as compared to other feeding (PF, SF) treatments. But when the performance of SPF colonies was compared with the control there were no significant differences between these two groups. These results thus point out that there is no need of giving additional supplementary feedings in the form of pollen and sugar during July to August in Katrain area of Kullu valley, Himachal Pradesh as sufficient bee flora is available to the colonies in nature during this period.

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