



COMPARATIVE STUDY ON BROOD REARING EFFICIENCY OF *APIS CERANA* F. UNDER DIFFERENT ENVIRONMENTAL CONDITIONS OF JAMMU AND KASHMIR AND TAMIL NADU INDIA

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ABSTRACT

Brood rearing efficiency of *Apis cerana* was studied in terms of egg laying rate. The maximum brood rearing efficiency was found at Srinagar (J&K) as compared to Coimbatore (T.N). The brood rearing efficiency ranged between 00.00 to 94.10 with an average of 46.98 ± 20.17 to 52.99 ± 18.83 at Srinagar (J&K) as compared to Coimbatore (T.N) ranged between 0.00 to 91.13 with an average of 28.76 ± 7.24 to 45.47 ± 11.86 . Humidity, High Temperature, rainfall shows negative correlation with brood rearing efficiency, and positive correlation with Pollen storage and bright sunlight hours.

Key words: *Apis cerana*, Brood Rearing Efficiency, Srinagar, Tamil Nadu.

INTRODUCTION

For successful managing and rearing of honey bees it is imperative to adapt beekeeping measures to colony development. Under temperate conditions, the colony brood rearing cycle is characterized by complete cessation of brood rearing in the late fall and reduction of colony size during the winter [1]. Limited brood rearing may be initiated already during winter months and brood rearing leading to colony expansion is often initiated already before nectar and pollen become available [2]. In temperate climates, honey bee colonies are characterized by a summer population of short-lived bees (summer bees) and a winter population of long-lived bees (winter-, or diutinus bees) [3,4]. After emerging as adults, summer bees first perform tasks in the nest such as nursing brood [5]. About 2–3 weeks later, they go through a distinct behavioral transition to begin foraging for nectar and pollen in the field. Nectar (carbohydrate) and pollen (protein) are resources for colony growth, reproduction and survival [6]. Colonies rear some hundreds to a few thousand males, tens to hundreds of thousands of female workers, and zero to tens of queens.

The state of the brood plays an important role in the honeybees' pollen foraging and storage strategy. Honeybee larvae are especially dependent on proteins,

because they gain mass very quickly [7]. The nursing of brood is usually carried out by a group of young adult "nurse bees" [8] which feed the larvae with a product of the hypo pharyngeal and mandibular glands called jelly [9,10] and sometimes feed them honey and pollen directly [11]. Both the behavioural patterns of these feeding episodes [12] and the composition of the larval food [13] change as a larva ages. Additional factors determining the nursing a larva receives are the total number of nurses, their level of activity, the age and the sex of the larva and the current hunger status of the larva [14].

Bad weather or bad pollen supply in the foraging area can soon bring a colony into a situation where there is not enough pollen available for all pollen consumers. One reason for this is the usually small amount of stored pollen (compared to the amount of honey stores) in a honeybee colony. If such periods of pollen shortage occur repeatedly, the effects can still be measured some generations later [15]. But even under conditions of very poor pollen supply, the bees somehow manage to continue nursing brood at a level that (in most cases) enables the colony to survive [16], whereas without any available pollen, bees can raise brood only for a very short time [17]. Dietz and Stephenson [18] showed that

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only colonies that have access to a certain amount of fresh pollen are able to perform successful brood rearing. The Aim of this study is to determine the brood rearing efficiency of *Apis cerana* under two different environmental conditions.

MATERIAL AND METHODS

Marking of egg in the cells

To mark the cells, one centimeter wide plastic strip, shall be firmly between the top and bottom bars of the experimental brood frame. Row numbers of cells shall be written on the strip. Brood frames prepared in this manner shall be placed in the centre of brood nest of the experimental colonies for egg laying by the queen. On the next day, marked frame shall be removed and cells containing eggs shall be counted and marked (recording row number and cell number) for the presence of eggs.

Brood rearing efficiency

For determining brood rearing efficiency of each colony, eggs in the frames shall be marked as described under 3.2.1. Observations on the number of eggs hatched, number of larvae sealed and number of adults emerging from the sealed cells shall be recorded. Brood rearing efficiency shall be determined for six colonies during March – August, 2012 at Srinagar (J&K) and for six colonies during March-August, 2013 at Coimbatore (T.N) respectively. Time taken by a worker bee to develop from egg to the adult stage was recorded. Emergence of adults on egg basis shall be also calculated.

RESULTS AND DISCUSSION

BROOD REARING EFFICIENCY

The data collected on brood rearing efficiency at

Srinagar and Coimbatore are presented in Table 1 and 2.

Brood Rearing Efficiency of *A. cerana* colonies at Srinagar

Observations recorded during March-August, 2012 indicated that the egg hatch in 6 different colonies ranged between 12.42 to 72.48 per cent with an average value of 47.16 ± 12.36 per cent (table 1 & Fig 1). The number of larvae sealed in different colonies ranged between 0 to 94.10 per cent. Three colonies viz. SRG-2, SRG-4 and SRG-5 had high level of larval sealing (94.10, 92.26 and 93.16 %). On the average, larval sealing was to the level of 52.99 ± 18.83 per cent. Adult emergence from the sealed brood ranged between 0 to 100 per cent with an average value of 46.98 ± 20.17 per cent. There was no adult emergence in three colonies (SRG-1, SRG-3 and SRG-6) If adult emergence is calculated on egg basis, it was 56.82, 57.86 and 58.32 per cent (with an average value of 57.66 per cent) in SGR-4, SGR-5 and SRG-2 respectively

Brood rearing efficiency of *A. cerana* colonies at Coimbatore

Observations recorded during March-August, 2013 indicated that the egg hatch in the four colonies ranged between 12.64 to 74.49 per cent with an average value of 41.70 ± 10.26 per cent (table 2 & Fig 2). The larval sealing 13.40 to 91.13 per cent with an average value of 45.47 ± 11.86 per cent. Adult emergence from the sealed brood ranged between 0 to 87.43 per cent. Four colonies (COM-1, COM-2, COM-5 and Com-6) has no adult emergence. Per cent adult emergence on egg basis in these two colonies (COM-4 and COM-3) was between 56.14 to 59.13 per cent with an average value of 57.63 per cent.

Table 1. Brood rearing efficiency of *A.cerana* colonies at Srinagar (J&K) during March-August, 2012.

Colony number	Egg hatch (%)	Larvae sealed (%)	Adult emergence from sealed brood (%)	Per cent adult emergence on egg basis
SGR-1	32.35	12.36	0.00	-
SGR-2	72.48	94.10	86.72	58.32
SGR-3	33.12	26.09	0.00	-
SGR-4	65.14	92.26	95.16	56.82
-5	67.49	93.16	100.00	57.86
SGR-6	12.42	0.00	0.00	-
Mean	47.16	52.99	46.98	57.66
SE(±)	12.36	18.83	20.17	

Table 2. Brood rearing efficiency of *A.cerana* colonies at Coimbatore (T.N) during March-August 2013

Colony number	Egg hatch (%)	Larvae sealed (%)	Adult emergence from sealed brood (%)	Per cent adult emergence on egg basis
COM-1	33.20	13.40	0.00	-
COM -2	33.12	28.10	0.00	-
COM -3	74.49	91.13	87.43	59.13
COM -4	68.64	90.60	85.16	56.14
COM -5	28.14	26.09	0.00	-
COM -6	12.64	23.53	0.00	-
Mean	41.70	45.47	28.76	57.63
SE(±)	10.26	11.86	7.24	

Fig 1. Brood rearing efficiency of *A.cerana* colonies at Srinagar (J&K) during March-August, 2012

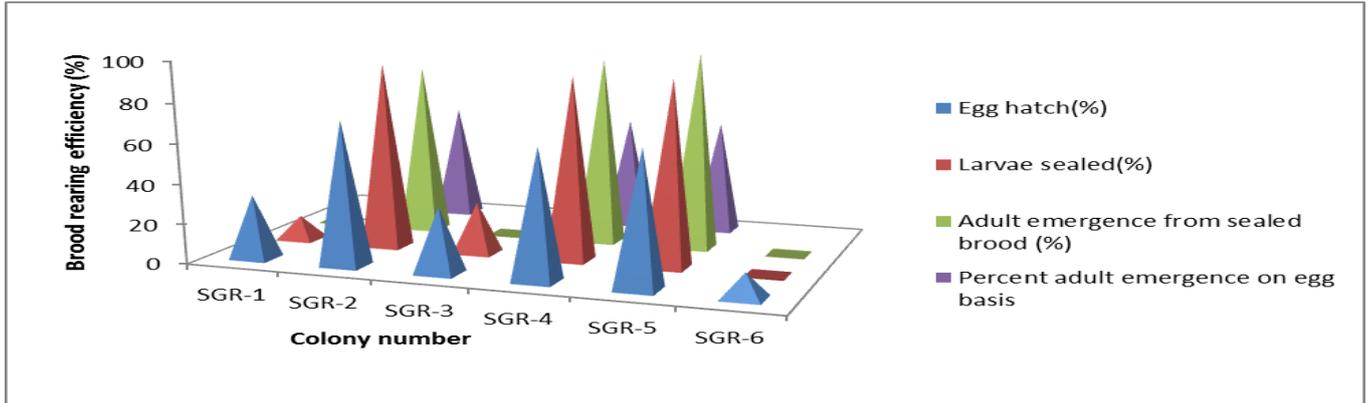
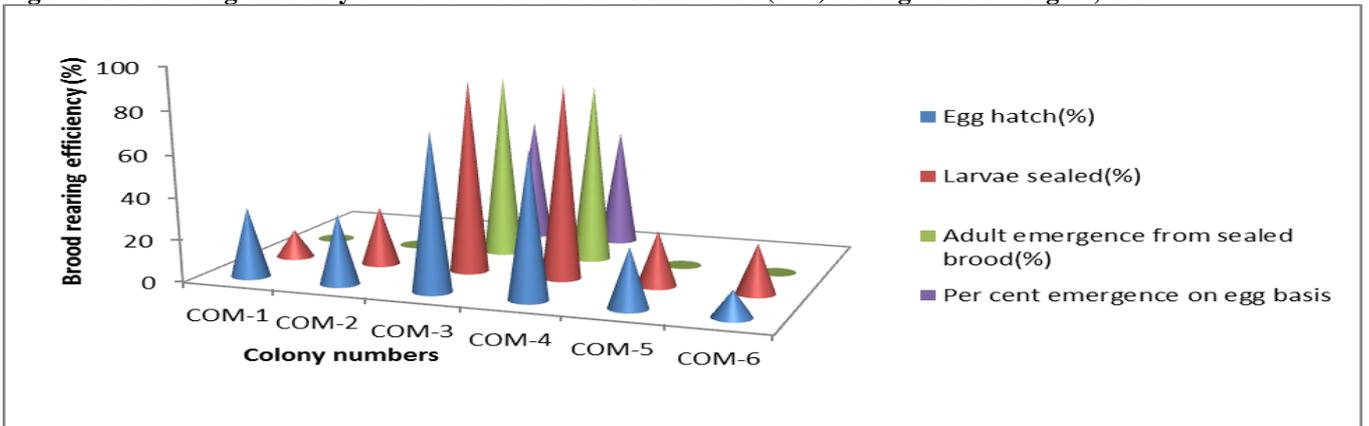


Fig 2. Brood rearing efficiency of *A.cerana* colonies at Coimbatore (T.N) during March -August, 2013



Brood rearing efficiency is the study of estimating the level of adult emergence from the laid eggs. Data on brood rearing efficiency collected for Srinagar (J&K) and Coimbatore (T.N) are given in table 1 and 2. The results revealed that per cent adult emergence on egg basis at Srinagar (J&K) averaged to 46.98 per cent. In some colonies there was no adult emergence though sealed brood was present in these colonies. The survival level of larvae at hatching stage averaged to 47.16 ± 12.36 per cent, at sealing 52.99 ± 18.83 per cent. Similarly, during August, 2012 adult emergence averaged to 28.76 per cent. Here, egg hatch averaged 41.70 ± 10.26 per cent, larvae sealed 45.47 ± 11.86 per cent and adult emergence from the sealed brood as high as 87.43 per cent colonies varied at the same locality during different periods of observations and thus it cannot be accounted for the inherent factors. The brood rearing efficiency at Coimbatore (T.N) was very low as compared to Srinagar (J&K). The mortality to the level of more than 67 per cent was at egg hatch level and to about 65 per cent at larval sealing level from the available larvae. This high level of mortality in Coimbatore (T.N)

was due to prevalence of Thai sac brood disease in the colonies. Some other factors were also responsible for low brood rearing efficiency at Coimbatore (T.). Such studies on *A. cerana* are lacking though Fukuda and sakagami [19] have given survival figures in different developmental stages of *A. mellifera* to be 100 eggs, 94 larvae, 86 sealed brood and 85 adults which cannot, however, be compared with *A. cerana*.

CONCLUSION

The present study revealed that brood rearing efficiency of *Apis cerana* at Coimbatore (T.N) is very low as compared to brood rearing efficiency at Srinagar (J&K) and the mortality rate at Coimbatore (T.N) colonies is more than 67 per cent at hatch level and to about 65 per cent at larval sealing from available larvae. The highest mortality rate at Coimbatore was due to the prevalence of Thai sac brood disease and low availability of pollen storage in the colonies. The present study concludes that all these factors are responsible for low brood rearing efficiency in bee colonies at Coimbatore (T.N).

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