

SEASONAL INFLUENCE ON COLONY PERFORMANCE INDEX (CPI) IN *APIS CERANA INDICA* UNDER BANGALORE CONDITION

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Five colonies of 4 frame strength *A. cerana indica* were studied for the colony performance index for a period of one month during different season's viz. rainy, winter and spring seasons. The peak foraging activity was assessed from 08:00 h to 12:00 h in respective seasons before recording CPI in the experimental colonies. The peak foraging activity was at 9:30 to 10:30 h, 10:00 to 11:00 h and 8:30 to 9:30 hours in rainy, winter and spring seasons respectively. The mean Colony Performance Index was 5.46 in rainy, 14.14 in winter and 7.28 in spring and these showed significant differences among themselves. There was significant increase in CPI for successive three weeks from the start of the experiment, irrespective of seasons.

Key words : *Apis cerana*, Colony Performance Index, Peak activity, Season's.

INTRODUCTION

The relative pollen income of a colony or colony performance index is evaluated during peak pollen flow period of the day. Punchihewa (1994) proposed an index called colony performance index (CPI), to measure the overall ability of the colony to stay at the nesting site. The index was used to predict the absconding in *A. cerana indica* colony in Sri Lanka. The daily pollen collections of the forager show a distinct pattern. The pollen collection does not take place throughout the day at the same rate. Instead, in many situations, the daily pollen income is received during hours between 07:00 to 12:00 and of these 5 hours; the most intense pollen collection period is confined to only about 3 hours, usually between 08:00 to 11:00 hours when more than 80 per cent of the daily pollen income is received (Punchihewa, 1994). The foraging activity was varied with regions and climatic condition (Singh, 1980; Verma 1983; Bhalla *et al.*, 1983; Thakur *et al.* 1982). The CPI monitoring gives an alarm to beekeepers about the absconding of colonies, so that preventive measures can be taken to avoid the same.

MATERIALS AND METHODS

Experiments were carried out during 2011-2012 to study the Colony Performance Index (CPI) as influenced by various factors, internal and external to hive.

Experimental site : The experiment was carried out in department apiary, during 2011 to 2012 (July 2011 to April 2012). The experimental site is located at latitude of 12° 58' north, a longitude of 77° 36' East and at an altitude of 930 meters above the mean sea level.

Nature of experimental site : The department apiaries have many colonies of *Apis cerana* F. and were located in areas surrounding of campus. It was containing different kinds of bee flora like medicinal and aromatic plants, trees like eucalyptus, pongamea, tabebuia, *Peltophorum* sp, jacaranda, rain tree, red sandal, cashew, nerale, bilwara, *Spathodia* sp and fruit crops like guava, sapota, pomegranate and pulses like cowpea,

grams and oil seeds like sunflower, mustard, sesemum and vegetables grown in the campus. These floras were available in that area during different periods of the year :

Climatic condition : The Weather data for the period under study (July 2011 to April 2012) are presented in Table I.

The Colony Performance Index (CPI) : This tool was proposed by Punchihewa (1994) from Srilanka.

$$\text{CPI} = \frac{(\text{Number of pollen foragers entering the hive})^2}{\text{Total no of bees entering the hive} \times \text{observation period in seconds}} \times 100$$

Table 1. Meteorological data at GKVK, Bangalore during 2011 – 12.

Months	Rain fall (mm)	Temperature (C°)		Relative Humidity (%)		Wind speed km/day	Sun Shine (h. day)
		Max.	Min.	Max.	Min.		
July-2011	95.80	27.8	19.3	94	53	7.6	4.2
August	253.2	27.3	19.3	94	55	6.4	3.3
September	69.70	28.0	18.9	94	51	5.8	5.9
October	122.6	28.6	19.2	93	51	2.9	5.6
November	38.00	26.6	15.9	89	53	4.8	6.2
December	05.20	26.9	14.4	91	52	4.5	7.3
January-2012	0.00	28.0	14.3	90	46	4.5	9.2
February	0.00	30.5	15.1	86	36	5.0	9.3
March	00.40	33.7	18.7	82	32	4.4	8.9
April	08.60	34.6	21.2	82	32	4.2	8.6

Seasonal influence on Colony Performance Index (CPI) under Bangalore condition : Five colonies of four frames strength *A. cerana* F. were studied for the colony performance index in alternative days for period of month during different season's i.e. rainy, winter and spring. The data was collected from Aug 15 to Sept 15 for rainy, Nov 15 to Dec 15 for winter and Feb 20 to Mar 20 for spring seasons. The relative pollen income of a colony or the empirical estimate of Colony Performance Index (CPI) was evaluated during the peak pollen-flow period of the day, when external condition such as rain are not restrictive of foraging activity and the colony remains undisturbed for making observations at the entrance to the nest. The CPI was computed on the basis of observation taken every alternate day for a month.

RESULT AND DISCUSSION

The CPI of a colony is calculated based on the incoming pollen foragers during the peak pollen foraging hour. Therefore, pollen foraging activity was assessed throughout the day during the chosen period in rainy, winter and spring seasons to fix the timing of recording of the CPI. The peak pollen foraging was at 9:00 AM in spring season; 10:00 AM in rainy and 10:30 AM in winter season. The result on CPI indicated clearly that the winter season was most favorable for colony growth; rainy season with lowest CPI was the most unfavorable time for colony growth. This was revealed by the jump in CPI value by 11.7 units in winter, 5.6 units in spring and 4.6 units in rainy season from the start to the end of the observational period of each season.

Alternate days	Seasonal Colony Performance Index (CPI)			Mean
	Rainy (Aug15- Sept15)	Winter (Nov15- Dec15)	Spring (Feb20- March15)	
Day 1	3.54	7.30	4.40	5.08
Day 3	4.06	8.34	4.70	5.70
Day 5	4.02	9.48	4.76	6.08
Day 7	3.86	11.60	5.86	7.10
Day 9	4.80	13.80	5.70	8.10
Day 11	4.96	11.90	7.10	7.98
Day 13	4.80	16.40	7.90	9.70
Day 15	4.50	17.40	7.30	9.73
Day 17	6.10	16.80	8.40	10.43
Day 19	5.60	17.60	7.90	10.36
Day 21	6.04	13.80	8.00	9.28
Day 23	6.50	19.60	8.90	11.66
Day 25	7.00	14.20	9.10	10.10
Day 27	7.84	19.00	9.30	12.04
Day 29	8.34	19.00	10.00	12.44
Mean	5.46	14.41	7.28	9.05
Season	SEm ±		CD (0.05%)	
	0.268		0.744*	
Days	0.600		1.66*	
Season x Days	1.040		2.884*	

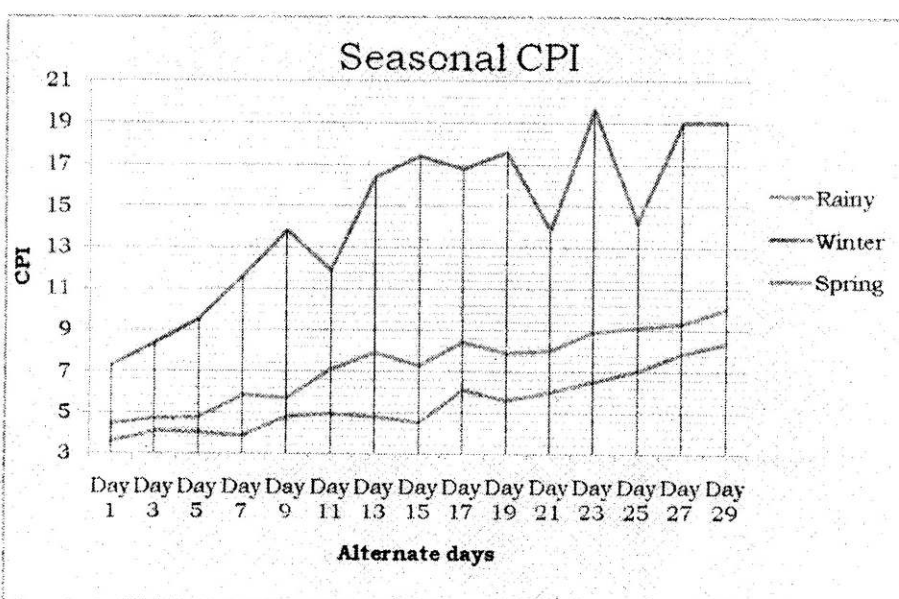


Fig. 1 : Seasonal Colony Performance Index (CPI)

In the present study, observations in rainy season were made from 15 August to 15 September. During these months, in 2011, the highest rainfall of the year was received (253.2 and 69.7 mm). The sunshine hrs were the least (3.3 and 5.9 h/day), and wind speed (6.4 and 5.8 km/day) was higher than other months (Table.1 & Fig.1). The most favorable month in Bangalore for colony growth was November to December when meager rainfall (38 and 5 mm), lower wind speed (4.8 and 4.5 km/day) and longer sunshine hours (6.2 and 7.3 h.day) were prevalent. These differential weather factors prevailing during various months were contributing for differences in foraging activity vis-à-vis CPI.

In the experimental area the CPI forage availability is highest during winter season of the year. Eucalyptus which is a major flora in Bangalore region brings about honey flow here in winter and other oilseed crops including sunflower, Niger, Sessamum and trees like Peltophorum provide plenty of pollen and nectar to honey bees in this season. The highest availability of flora therefore would have pushed the CPI by 11.7 units during winter. In spring, the pasturage included Pongamia, Tabebuia, Jacaranda, Red Sandal and Cashew, and was able to push the CPI by 5.6 units. The flora in rainy season is limited which included *Cassia* sp, Peltophorum, Akash mallige, Sandal wood and Rain tree and these could push the CPI by 4.8 units. There was no information available in literature on the factors affecting the CPI of a colony. Reddy (1983) reported that in Bangalore condition foraging activity was greatest during 8:00 h to 12:0 h. whereas, the number of pollen gatherer was highest in the morning (9:0 to 12:0 h) and it decreased in afternoon. This was in agreement with our findings. In Srilanka too over 90% pollen collection was received during morning hours, usually between 8:00 to 11:00 hours (Punchihewa, 1994). Winter as most favorable month for honey bees is supported by Mallikarjun (2000) who noticed the maximum foraging activity from December to March in Bangalore region.

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