

**ORIGINAL ARTICLE**

**STUDIES ON *APIS CERANA INDICA* COLONIES WITH BIOLOGICAL TRAIT  
(BEE STRENGTH) FROM SELECTED BEEKEEPING AREAS IN TAMILNADU**

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**ABSTRACT**

Beekeeping is an important component of present strategies for sustainable agriculture and integrated rural development programmes. It provides nutritional, economic and ecological security to rural communities, especially in the developing countries like India. Being a non land based activity; it does not compete with other resource demanding components of farming systems. Moreover, it is an additional income generating activity. This study aims to identify *A. cerana indica* colonies with vital and economically important trait with bee strength, brood rearing capacity, pollen storage, honey storage, honey yield potential, disease incidence and absconding behavior, which can thrive well from different beekeeping pockets of the State. The colonies with better characters will be selected for producing better performing colonies through selective breeding which can be used for commercial beekeeping.

**Keywords:** Apiculture, Colonies, Beekeeping, Resource, Nutritional Honey Yield.

**1. INTRODUCTION**

The Indian honey bee, *Apis cerana indica* Fab. is used in South India for commercial beekeeping and honey production. Eventhough the industry had developed tremendously, better performing colonies/strains with desirable traits are required for increased productivity and sustainable apiculture in South India. Concurrently, most of the colonies of *A. cerana indica* are not economically viable. Selective breeding is the best solution for stock improvement. Better genetic traits can be transferred and the productivity can be increased through selective breeding, so as to evolve best performing Indian bee colonies. Hence the present study was undertaken with a view to identify Indian bee *A. cerana indica* colonies with viable characters and develop a better performing strain with desirable traits for improving the stock through selective breeding for sustainable apiculture in Tamilnadu. The study identified Indian bee *A. cerana indica* colonies possessing better economically important character like bee strength from among the existing bee colonies in Tamilnadu.

The strength of honey bee colony is depends on the availability of bee forage and season and colony strength is poor during winter. Colonies were selected on their performance on the basis of bee strength, brood area, honey

stores and pollen area for the studies on the selective breeding (RAU, 2004). Pokhrel *et al.*, (2006) observed that, in Nepal, stronger colony strength was recorded in *A. cerana* colonies during May and the bee population and colony strength were reduced in April. Shruthi *et al.*, (2009) revealed that in Kamataka, bee population in both black and yellow strain colonies of *A. cerana indica* were more in winter and among the strains, black strain colony recorded more bee population throughout the season compared to yellow strain colony. Mohapatra and Satapathy (2012) reported that in *A. cerana* colonies in Orissa, maximum bee population was during May.

**2. MATERIAL AND METHODS**

**Selection and management of experimental *A. cerana indica* colonies**

Six locations each from three natural topographic division viz., Highland, Midland and Lowland of Tamilnadu were selected for the present investigation. The mountainous land including Western Ghats, with jutting rocks and loamy soils constituted the highland. The hilly tracts on the western side of the Western Ghats constituted the midland. The lowland plains have an undulating terrain intersected by numerous rivers, small hills and valleys. The 18 locations were identified to ensure complete coverage of the State for the study.

Colonies of *A. cerana indica* were selected from the apiaries of bee breeders/progressive beekeepers from the different

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locations. Selection of colonies was done by checking colony registers maintained by the beekeepers with data on the performance and honey yield of the colonies in the previous years and also by visual observation of the colonies. Colonies with a newly mated queen and of approximately same bee strength (3 frames) were selected. Three such colonies were collected from each location, marked and maintained in the apiary.

The colonies were kept strong and healthy, under same condition, by adopting the management practices recommended by the Tamilnadu Agricultural University POP (Package of Practices): (i) using only standard hives and other equipment (ii) cleaning of hives at regular intervals (iii) timely renewal of old and worn out combs (iv) colonies supplying with approximately 300 ml 1:1 sugar solution at weekly interval throughout the dearth season and brood rearing seasons. v) Keeping the colonies in coconut garden to ensure pollen supply (vi) prevention of swarming.

#### Assessment of comparative performance of experimental colonies

*A. cerana indica* colonies assessed for one year from August, 2014 to July, 2015. Observations were recorded during the

growth period (August 2014-January 2015), honey flow period (February-May, 2015) and dearth period (June-July, 2015) at 15 day intervals. The colonies were divided during November. Bee strength was assessed by counting the comb well covered with bees on both sides as one (Taha, 2007). The number of such frames / combs per colony was recorded.

### 3.RESULTS

#### Comparative performance of *Apis cerana indica* colonies from different locations

Among the bee colonies studied, the bees from two locations in the highland divisions were black morphs and one location each from midland and lowland were yellow morphs. The bees from all the other locations were the common brown bees. The colour of the queen and workers of the two variants differed from the common brown bees. The abdomen of the queen of black bees was very black, that of yellow bees yellowish light brown and in common brown bees dark brown (Figure: 1a,1b and 1 c). The colour of the abdomen of worker bees was very distinctive too. in black bees, the abdomen and tergite were black; in yellow bees light yellowish brown and in common brown bees dark brown (Figure: 2a,2b and 2c).

Fig.1 Queen of different morphs of *Apis cerana indica*



Figure: 1a. Common Brown Morph

Figure: 1b. Black Morph

Figure: 1c. Yellow Morph

Fi. 2 Worker bees of different morphs of *Apis cerana indica*

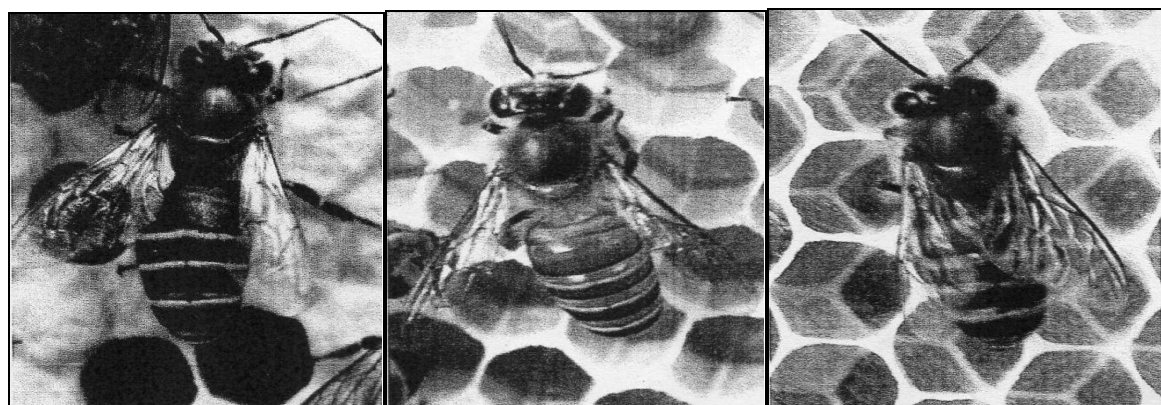


Figure: 2a. Black Morph

Figure: 2b. YellowMorph

Figure: 2c. Brown Morph

Data on the bee strength of *A. cerana indica* colonies from different locations measured in terms of number of bee frames with bees on both sides during the growth period, honey flow period and dearth period are presented in (Table: 1).

There was no significant difference in the bee strength in colonies from all the locations during August and September 2012. The bee strength in the common bee colonies ranged from 3.001 to 3.300 while that of the black morphs and yellow morphs ranged from 3.145 to 3.150 and 3.148 to 3.165 respectively. A gradual increase in bee strength was noted in October which reached a high level in November. Black bee colonies from L3 and L6 had mean bee strength of 6.537 and 6.525 respectively during November which were on par with those of yellow bee colonies from L11 and L18 (6.496 and 6.133 respectively). The bee strength ranged from 3.937 to 5.841 in common bees from different locations.

After division of colonies, during the month of December, highest bee strength was observed in black bees from L3 (5.175) which were significantly higher than that of bee colonies from other locations. It was followed by that of yellow bees from L18 and L11 (4.308 and 4.112 respectively) and that of brown bees from L2, L14, L9, L16, L15 and L7 which were on par. The mean bee strength ranged from 2391 to 2.971 in common brown bees from different locations and the lowest mean bee strength was recorded from colonies of L12. Similarly, bee strength was the highest (7.021) in black bee colonies from L3 followed by yellow bees from L11 (5.837) and L18 (5.658) during January which were on par with that of common bees from L14, L16, L2, L9, L7 and L13. The mean bee strength ranged from 2.966 to 4.837 in common brown bees.

The second peak in bee strength was observed in the honey flow period. The mean bee strength in colonies from different locations ranged from 3.276 to 7.452 during February. The bee strength was higher in black bee colonies from L3 and L6 (7.452 and 5.624 respectively) and in yellow bees from L18 and L11 (6.911 and 6.568 respectively) which were on par with that of brown bees from locations L14, L13, L16, L9, L7, L2 and L4. The bee strength of common brown bees from other locations ranged from 3.276 to 5.405. A similar trend was observed during March also. The black bee colonies (L3, L6) and yellow bee colonies (L11, L18) recorded higher mean bee strength (7.123, 5.220, 6272 and 6.244 respectively) which were on par with the common brown bee colonies from L2, L6, L7, L9, L13, L14, L15 and L16. The mean bee strength in brown bees ranged from 3.432 to 5.200, the least bee strength being recorded from colonies in L17. During April mean bee strength declined in all the colonies and black bees from L3 recorded the highest bee strength (6.104) which was on par with that of yellow bees from L11 and L18 (5.540 and 5.344 respectively) which in turn were on par with that of bees from locations L14, L16, L5, L6, L13, L2, L15, L7 and L9. Common brown bees recorded significantly lower bee strength, ranging from 3.014 to 5.000. The mean strength decreased again during May and highest bee strength (5.782) was observed in black bee colonies from L6 which was on par with that of yellow bees from L11 and black bees from L3 which were on par with that of brown bees from locations L14, L13, L9, L16, L15, L2 and L7. The mean bee strength in common brown bees ranged from 2.479 to 4.250 and the lowest mean bee strength was recorded in bee colonies of L1.

During June in the dearth period, the black bees from L3 and L6 showed higher bee strength (6.073 and 6.011) which were on par with that of yellow bees from L18 and L11 (5.339, 5.252 respectively). This was followed by the common brown bees from L14, L13, L15, L2, L4, L9, L4, L7 and L16. The bee strength in common brown bees ranged from 2.851 to 4.620 with the lowest from L12. A same trend was noticed during July also with highest bee strength of 7.010 in black morphs in L3 followed by L6 and yellow bees in L11 (6.115) and L18 (5.996).

Overall analysis of the data on the bee strength indicated that the bee strength was higher in black morph colonies (5.729 and 5.025) and yellow morph colonies (5.238 and 5.214) than in the common brown bee colonies (3.175 to 4.566) (Figures: 3a, 3b and 3c).

**Bee strength of different morphs of *Apis cerana indica***

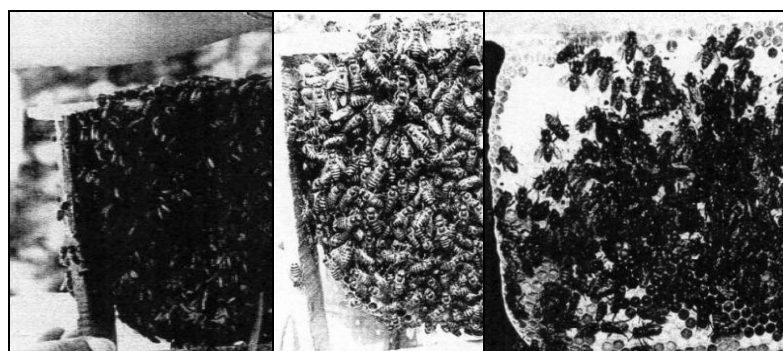


Figure: 3a. Black Bee Morph      Figure: 3b. Yellow Bee Morph      Figure: 3c. Common Brown Bee Morph

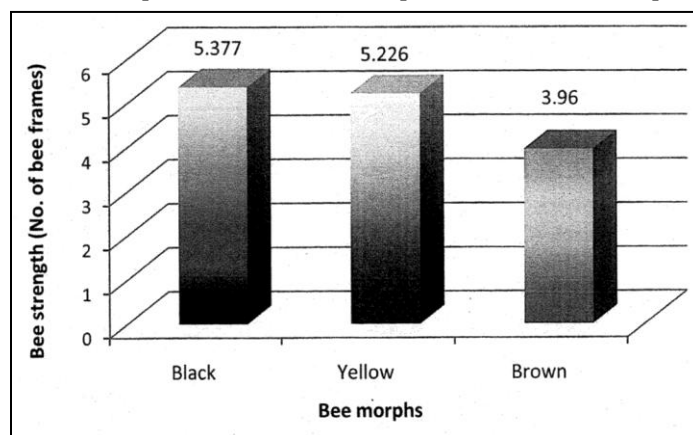


Figure: 4a. Bee strength different morphs of *Apis cerana indica* colonies

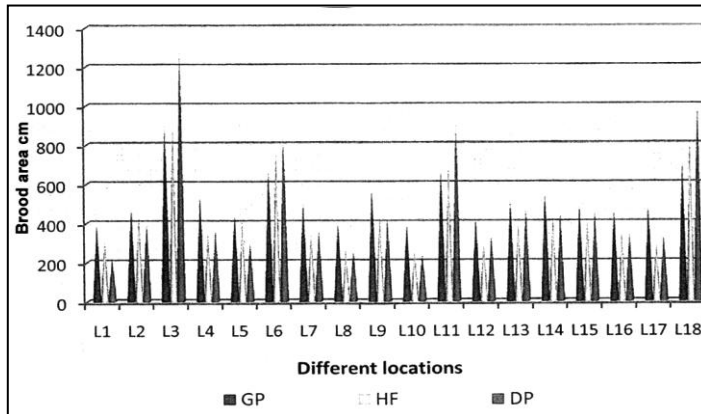


Figure: 4b. Bee strength of *Apis cerana indica* colonies from different locations during growth period, honey flow period and dearth period in tamilnadu

Table 1. Bee strength of *Apis cerana indica* colonies from different locations in Tamilnadu during 2014-15

Topographic division	Location	Bee morphs	Bee strength ( no of frames with bees on both sides)												Pooled mean		
			Growth period						Honey flow period							Death period	
			Before division						After division								
			Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.			
HL	L1	CB	3.001	3.208	3.750	3.750	2.574	2.966	3.276	3.625	3.014	2.479	2.995	3.282	3.175		
	L2	CB	3.155	3.250	4.500	5.841	3.791	4.608	5.227	5.052	4.255	3.887	4.451	5.0344	4.421		
	L3	BK	3.145	3.335	5.083	6.537	5.175	7.012	7.452	7.123	6.104	4.708	6.073	7.010	5.729		
	L4	CB	3.130	3.166	3.916	5.379	3.495	4.449	4.885	4.010	3.245	3.470	4.383	4.911	4.069		
	L5	CB	3.112	3.125	4.665	5.441	3.317	3.795	4.289	4.125	4.525	3.485	3.766	4.087	3.975		
	L6	BK	3.150	3.375	5.249	6.525	3.474	4.912	5.624	5.220	4.350	5.782	6.011	6.622	5.025		
ML	L7	CB	3.160	3.165	4.145	5.212	3.533	4.575	5.232	5.120	4.120	3.886	4.241	4.848	4.261		
	L8	CB	3.255	3.541	3.958	4.204	2.646	3.195	3.625	3.401	3.247	2.680	2.953	3.353	3.338		
	L9	CB	3.300	3.665	5.335	5.829	3.750	4.587	5.312	5.184	4.100	3.987	4.407	5.046	4.541		
	L10	CB	3.205	3.335	4.224	4.424	2.533	3.416	3.872	3.630	3.533	2.765	3.120	3.556	3.467		
	L11	YEL	3.148	3.333	5.624	6.496	4.112	5.837	6.568	6.272	5.540	4.570	5.252	6.115	5.238		
	L12	CB	3.205	3.291	4.200	4.025	2.391	3.020	3.414	3.648	3.224	2.640	2.851	3.115	3.252		
LL	L13	CB	3.150	3.233	4.666	5.654	3.258	4.541	5.078	5.011	4.333	4.065	4.504	4.753	4.353		
	L14	CB	3.175	3.183	4.835	5.516	3.766	4.837	5.405	5.200	5.000	4.250	4.620	4.999	4.566		
	L15	CB	3.125	3.191	4.808	5.466	3.608	4.208	4.778	4.555	4.125	3.906	4.499	4.831	4.258		
	L16	CB	3.175	3.275	4.635	5.570	3.687	4.624	5.067	5.012	4.720	3.945	4.163	4.411	4.357		
	L17	CB	3.120	3.250	4.274	5.200	3.529	3.741	3.829	3.432	3.135	2.822	3.027	3.193	3.546		
	L18	YEL	3.165	3.358	5.333	6.133	4.308	5.658	6.911	6.244	5.344	4.780	5.339	5.996	5.214		
CD(0.5)			NS	NS	0.5174	1.0948	1.657	2.551	2.8743	2.9641	2.5743	2.1045	2.5725	2.7324	2.1642		

#### 4.DISCUSSION

The results of the studies on the biologically and economically important characters of *A. cerana indica* colonies collected from selected locations of the three topographic divisions of Tamilnadu are discussed. Two distinct colour morphs of *A. cerana indica* could be observed from certain beekeeping pockets in the present study, in addition to the common brown bees. The bees from the highland locations and black morphs from the midland location and lowland location were yellow morphs, The bees from all other locations were the common brown bees. The colour of the queen and workers of the different morphs differed conspicuously from the common brown bees. The abdomen of the queen of the black bees was very black and that of yellow morphs yellowish brown compared to the dark brown in common brown bees. The abdomen and tergites of worker bees were black in black bees; light yellowish brown in yellow bees and dark brown in common brown bees. The black and yellow morphs of *A. cerana indica* are being reported from Kerala for the first time. The results conform to the earlier observations on the prevalence of different colour morphs of *A. cerana indica* elsewhere. Earlier, Oldroyd *et al.* (2000) observed that *A. cerana indica* population in Karnataka was

composed of two distinct colour morphs: the yellow 'plain' morph and the black 'hill' morph. Later, Banakar (2009) reported that the black 'hill' morph was distributed in Uttara Kannada, Udupi, Dakshina Kannada, Shimoga, Kodagu, parts of Dharwad, Belgaum, Mysore and Chamarajanagar districts. Shruthi *et al.*, 2009 also studied the behavioural traits of the two colour morphs from low land location. Even though, Devanesan (1998) reported four clusters of *A. cerana indica*, from Kerala, black and yellow morphs were not identified. The comparative performance on biological and economically important desirable characters of *A. cerana indica* colonies selected from different locations showed that yellow bee morphs and black bee morphs were significantly superior in all the characters including honey production compared to common brown bees.

Maximum bee strength was recorded in black bees and yellow bees compared to common brown bees, Black bee colonies had a mean bee strength of 5.377 which was followed by that of yellow bees (5.226) and were significantly higher than that of common brown bees (3.960) (Figure: 4a). This agreed with the report of Shruthi *et al.*, (2009) who reported that in Karnataka, bee population in both black and yellow strain colonies of *A. cerana indica* were

more and among the strains, black strain colony recorded higher bee population compared to yellow strain colony.

The results on bee strength during different periods revealed that mean bee strength was higher in all the colonies during honey flow period than the growth period and dearth period (**Figure: 4b**). Maximum bee strength was recorded in November and February and least in May, *ie.*, first peak during November and second peak during February. Variations in bee strength during different periods are well documented. According to Das and Rahman (2000) highest bee population was observed during February and the lowest during August in Assam. Partap and Partap (2002) reported that the strength of honey bee colony was poor during winter in Hindu Kush Region.

According to Pokhrel *et al.*, (2006) stronger colony strength was recorded in colonies during May and colony strength was reduced in April in Nepal. Mohapatra and Satapathy (2012) also reported that in *A. cerana* colonies in Orissa, maximum bee population was during May. These variations in bee strength may be due to various climatic conditions and flora available in different States.

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