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Standard Methods For Behavioral Studies Of Honey Bees

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Abstract:

The present paper deals with the methods for quantifying honey bee behavior. Productive efficiency of the apicultural industry depends upon improvements in bee breed, bee management and bee forage. The behavioral traits such as pollen carrying capacity, pollen and honey stores and colony population were compared for black and yellow strains of Indian honey bee Apis. cerana indica F. Observations of honey bees showing maximum activity support the conjecture that pollen foragers carry relatively little fluid during the hottest periods and pollen foraging decreased at high ambient temperatures. The notable difference in the activity between the species may occur due to availability of pollen source, variation in genetic character, preference for pollen, foraging efficiency, foraging distance and competition for pollen. The final outcome of the study interprets that black strain has higher pollen carrying capacity, maximum area under pollen and honey stores and relatively high population when compared with the yellow strain.

Key words: Honeybees, Behavioural importance, Diversity, Nector.

1. Introduction

Honey bees are the prime pollinators; they are analysis and paleogeography [3]. Involved in pollination of most field and orchard crops. Amongst the numerous kind of bees found in India, Social bees are especially versatile as they are able to the typical honeybees which are social in habits comprise exploit a broad range of different flower forms. Bees live four different forms, viz. Apis dorsata. F. (rock bee), on nectar; they collect pollen also to feed their larvae. The A. indica. F. (Indian bee), A. florae. F. (little bee) and amount of surplus honey that could be gathered from bee Melipona iridipennis, Dal. (dammar bee) [4]. Deodikar colonies is mainly dependent upon the abundance of says that dialects of two different races of a species may nectar secreting plants in the vicinity of an apiary [1]. It will be so very distinct that intermixing of workers of two Investigations on evaluation of behavioral traits of races makes their intercommunication impossible resulting different strains of Indian honey bee Apis cerana indica in disorganization or even extinction of a colony [5]. This F. are carried out. The genus Apis has an Indo-Malayan illustrates how ethological or behavioral differences can origin where both diploid (A. florea, A. dorsata) and function as effective isolation mechanisms in the process earlier tetraploid (A. indica) species first appeared. During of taxonomic differentiation even at infraspecific levels, its northward migration by various land routes across the According to Traynor weather is a prime determinant of Himalayan barrier, A. indica seems to have gradually bee activity and until man is able to control the weather, differentiated into A. mellifera and a number of its beekeepers and growers will have to do their best to work African, Eurasian and Sino-Japanese races. Heinrich reported that honey bees regulated races have accumulated enough gene differentiation and thoracic temperature above 25°C ambient and that sexual as well as behavioral isolation mechanisms so as evaporation of water from mouth is used at high ambient to deserve recognition or creation of new species among temperatures to prevent overheating [7, 8]. In the study of foraging patterns of bees on Agave schottii in the Experiment-2: Bee population of black and yellow strains Sonoran desert, bees were observed to stop foraging at ambient temperatures of 35°C [9]. Ages of bees do not influence the foraging distance or the tendency to collect pollen [10]. Infestation by mites of A. cerana is at a lower level than in A. mellifera [11]. A thorough knowledge of morph metrics and behavioral traits are an essential prerequisite for a rational approach to the selection and breeding.

The economic and ecological importance of honey bees (Apis mellifera) as pollinators of many cultivated and native plants make them an important system for studying the effects of illness at both the individual and colony or social levels. In the U.S. and worldwide, it has become increasingly difficult to keep colonies alive as bees are challenged with numerous factors that threaten their survival. Mite pests, pathogens, pesticides, and nutritional deficiencies create a combination of circumstances that can interact negatively to jeopardize colony health. For the U.S. specifically, the outcome of this health crisis has been losses of nearly one-third of colonies annually since 2006. This recurring level of death may be unsustainable for the beekeeping industry, and could debase the value of crops and other products requiring pollination.

Many pathogens and parasites are common and widespread in non-symptomatic, or apparently healthy, colonies. This burden emphasizes the buffering capacity of honey bee societies, but makes it difficult to state with confidence the impact a specific factor has on colony health. Fortunately, a wealth of research is available describing physiological factors that influence the age-based division of labor of workers within healthy colonies. We relied on this research background to explore mechanisms that could interfere with worker behavior following exposure to a single specific pathogen, Nosema ceranae, considered to be a factor in colony decline.

The honey bee worker caste displays an age-based division of labor. In northern temperate climates, workers that emerge as adults during the summer live 6 wks on average. Upon emergence, workers less than 3 wks of age remain in the hive as nurses, feeding the larvae and queen, or performing nest maintenance. At about 3 wks, workers transition from nursing duties to foraging for nectar and pollen outside the nest. Once workers transition to foraging, they typically live an additional 2−3 wks, regardless of the age at which the shift occurs. To maintain colony cohesion, workers demonstrate a level of flexibility by advancing, delaying, or reverting behavioral development in response to the needs of the colony such as a loss of foragers from predation or confinement of foragers during inclement weather.

2. Material and Methods

Method 1. Pollen load carrying capacity of black and yellow strains of Apis. cerana indica F.-Individual honey bee colonies were selected and were designated for studying. The hive entrance was closed for a short while at the time of observation. Ten foraging bees returning with pollen load were collected from each hive and pollen pellets were brushed off from the pollen basket and fresh weight of pollen pellets was taken. Such observations were recorded at 09.00h, 12.00h and 15.00h during the day at an interval of 15days and compared the peak hours of activity.

Method 2: Pollen and honey stores of black and yellow strains of Apis. cerana indica F.-Observations on pollen and honey stores were recorded at 15 days intervals in all the experimental colonies using the marked transparent sheet, which consisted of number of squares and each square with an area of 1cm . This sheet was 2 placed on brood and super frames and number of squares with honey and pollen were recorded. Cells filled with pollen or honey scattered in different parts in a comb were counted separately and converted into square centimeter area. The above parameters were recorded on both faces of all brood and super frames.
The present studies regarding the bee behavioral traits have been conducted in this area during rainy, winter and summer seasons of 2000-2004 with the hope that the information will help the local bee keepers in assessing the seasonal availability of bee forage and in managing their colonies accordingly.

3. Results

Results of the present investigations carried out to determine the seasonal variations in behaviour of both strains of Indian honeybee Apis. cerana indica F. viz., black strain and yellow strain bee colonies under Shivamogga floral conditions showed that the worker bees of both strains carried less quantum of pollen during rainy (BS-4.48, 4.58, 4.39, 4.60; YS-4.30, 4.37, 4.22, 4.42), lesser amount in summer (BS-4.82, 4.90, 4.77, 4.95; YS-4.70, 4.78, 4.66, 4.85) and maximum at winter season (BS-7.08, 7.12, 7.00, 7.24; YS-6.89, 6.96, 6.81, 7.00) of study period. The data are presented in the Tables 1 and 2, which also indicate that black strain brought heavier pollen pellets throughout the year compared to yellow strain. Both the strains stored higher amount of pollen and honey in winter season than summer and rainy season. Among the strains, black strain recorded more pollen and honey stores compared to yellow strain. The variations in area under pollen and honey stores are graphed out in Fig. 1 and 2. Bee population in both black and yellow strain colonies were more in winter decreased continuously from summer to rainy season. The variation in number of population with season is shown in graph 3. In the present study black strain colony was recorded more bee population throughout the season compared to yellow strain colony.

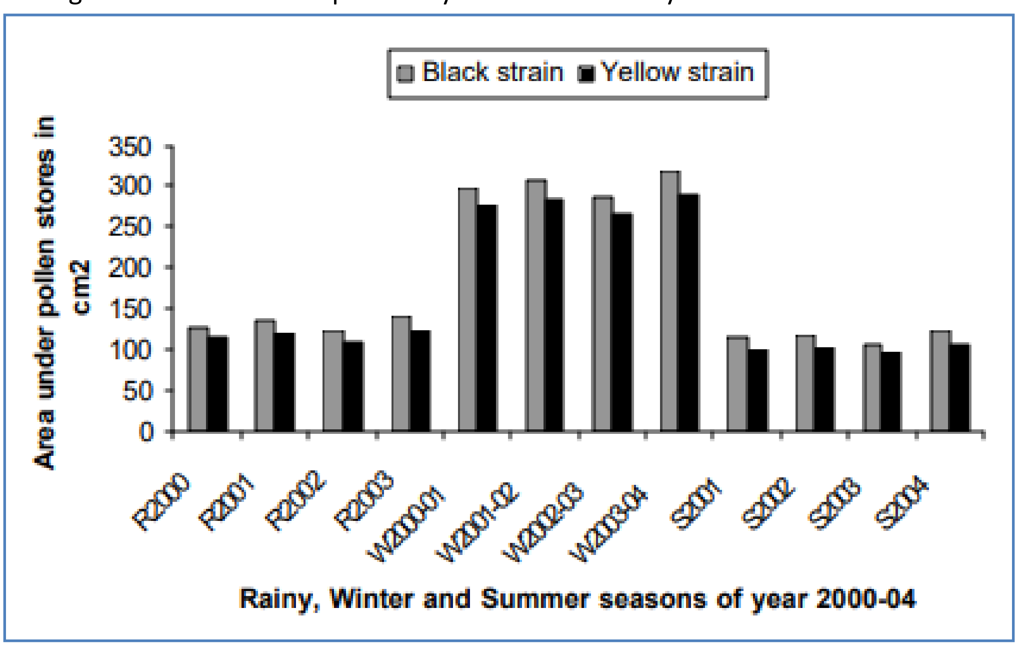

Figure 1: Graph showing Variation in pollen stores of Black and Yellow strain of Apis cerana indica F.

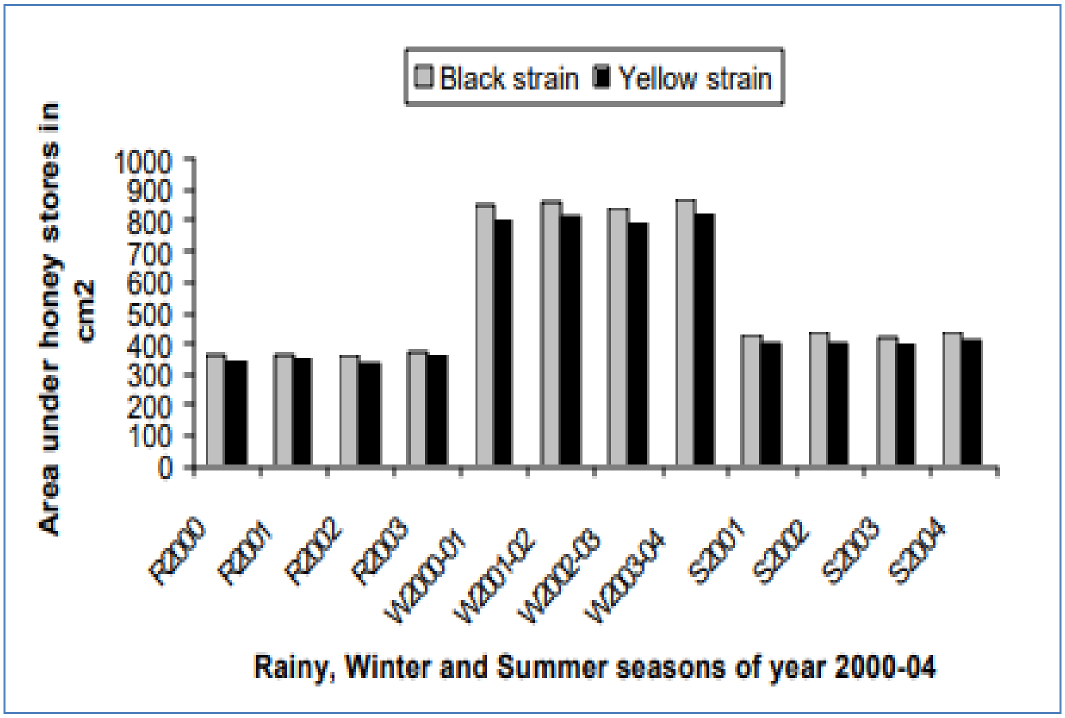

Figure 2: Graph showing Variation in honey stores of Black and Yellow strain of Apis cerana indica F.

	Pollen carrying capacity in mg					
			Different times of day			
Black Strain	Season	Year	9.00 Hr	12.00 Hr	15.00 Hr	Values (mean) in mg
	Rainy(Jun-Sep)	2000	4.68	4.43	4.33	4.48
		2001	4.81	4.54	4.39	4.58
		2002	4.61	4.34	4.23	4.39
		2003	4.88	4.50	4.43	4.60
	Winter (Oct-Jan)	2000-01	7.26	7.06	6.92	7.08
		2001-02	7.28	7.10	6.99	7.12
		2002-03	7.21	6.96	6.85	7.00
		2003-04	7.46	7.23	7.03	7.24
	Summer (Feb-May)	2001	5.03	4.78	4.67	4.82
		2002	5.11	4.84	4.75	4.90
		2003	5.00	4.71	4.62	4.77
		2004	5.21	4.87	4.79	4.95

Table 1: Pollen carrying capacity and seasonal variations of Black strain of Apis cerana indica F

Yellow Strain	Season	Year	Pollen carrying capacity in mg — Different times of day: 9.00 Hr	12.00 Hr	15.00 Hr	Values (mean) in mg
	Rainy (Jun-Sep)	2000	4.49	4.29	4.13	4.30
		2001	4.55	4.38	4.19	4.37
		2002	4.42	4.20	4.05	4.22
		2003	4.67	4.39	4.22	4.42
	Winter (Oct-Jan)	2000-01	7.03	6.87	6.77	6.89
		2001-02	7.09	6.94	6.85	6.96
		2002-03	6.96	6.79	6.68	6.81
		2003-04	7.19	6.98	6.84	7.00
	Summer (Feb-May)	2001	4.87	4.68	4.55	4.70
		2002	4.96	4.75	4.65	4.78
		2003	4.86	4.63	4.50	4.66
		2004	4.99	4.84	4.73	4.85

Table 2: Pollen carrying capacity and seasonal variations of Yellow strain of Apis cerana indica F

4. Discussion and Conclusion

One of the pre requisites for the improvement of bee keeping industry with the native hive bee Apis. cerana indica. It is the identification of the different natural sub-species/ ecotypes of this native bee species in the region and their further genetic improvement by selection and breeding. This study was successful not only in identification and selective the breeding program of honey bees but also in improving the management practices for better honey production as well as to increase pollination services for higher crop productivity. Geographical features, altitude of place, morphological characters and many other factors determine the distribution of honeybee races [12]. The behavior of honey bees depends on racial characters of queen bee and availability of bee flora. The reason that worker bees of both strains carried less quantum of pollen during rainy season of study period may be attributed to availability of pollen grains because; bee flora was very less during early period of rainy season. Sharma reported that less amount of pollen pellets are carried worker bees during rainy season [13]. Pollen carrying capacity of both black and yellow strains was maximum in winter season. Dhaliwal reported that more amount of pollen is collected by hill station of Apis cerana and stated that weight of pollen load depends upon the sources of pollen and weather conditions prevailing during the season [14]. Bees carried heavier pollen load at 09.00 h followed by 12.00 h and least at 15.00 h. The difference may be due to high humidity, low temperature and more moisture content on the pollen at morning hours. Further bee's efficiency may be decreased due to continuous foraging as the day advances. Pollen and honey stores in black and yellow strain were recorded throughout the year. Verma et al., reported greater pollen and honey stores in summer and autumn, while minimum in rainy season which supported our result [15]. Higher amount of pollen and honey in winter season than summer and rainy are attributed to availability of bee flora in study area at different periods. Verma et al., recorded greater quantity of pollen and honey stores in autumn at

Shimla, Himachal Pradesh. These variations were possibly due to increased foraging activity and availability of pollen and nectar. The population number of bees was maximum in winter season. Similar results were reported by Ramachandran and Mahadevan at Coimbatore [16]. However, bee population in both black and yellow strain bees was highest during winter due to the availability of pollen and nectar yielding plants around apiary. Verma et al. reported maximum population of bees in summer and autumn and minimum in the rainy season at Shimla. Among two strains, the black strain showed better performance in pollen carrying, honey store, pollen store and had comparatively higher population throughout the year compared to yellow strain. This may be due to variation in genetic character, preference for pollen foraging efficiency, competition for pollen between the species, tongue length, pollen load carrying capacity floral preference, floral availability, competition in foraging between the species, pollen and nectar gathering capacity and brood rearing activities. Hence, the black colonies are better for breeding work.

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