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Deepayan Padhy

Department of Entomology, M S Swaminathan School of Agriculture, Centurion University of Technology and Management, Odisha, India

V Ramalakshmi

Department of Entomology, M S Swaminathan School of Agriculture, Centurion University of Technology and Management, Odisha, India

Lipsa Dash

Department of Entomology, M S Swaminathan School of Agriculture, Centurion University of Technology and Management, Odisha, India

Dr. Sudhanshu Bala Nayak

Department of Entomology, M S Swaminathan School of Agriculture, Centurion University of Technology and Management, Odisha, India

Dr. Nihal R

Department of Entomology, M S Swaminathan School of Agriculture, Centurion University of Technology and Management, Odisha, India

Corresponding Author:

Deepayan Padhy

Department of Entomology, M S Swaminathan School of Agriculture, Centurion University of Technology and Management, Odisha, India

Pollen carrying capacity of *Apis cerana indica* F. in Gajapati District of Odisha

Deepayan Padhy, V Ramalakshmi, Lipsa Dash, Dr. Sudhanshu Bala Nayak and Dr. Nihal R

Abstract

Growth of the profitable beekeeping industry totally dependent upon the bee species, bee colony selection, bee management and bee forage. The research investigations were conducted in Apiary Unit situated at M S Swaminathan School of Agriculture, Centurion University of Technology and Management, Odisha. To investigate the mean pollen carrying capacity of workers at different times of the day in the study period and mean pollen stores and honey stores of foraging bees at all seasons of the study period and also pollen and honey area were recorded simultaneously. The present investigation has concluded that the pollen foraging activity decreased at higher ambient temperatures. The pollen carrying capacity was more during winter months followed by summer and rainy season. The peak pollen gathering activity was observed during 09:00 AM followed by 12:00 PM and 03:00 PM of the day. Higher honey area was observed during summer season whereas higher pollen area was observed during winter months of the year in the combs. The rainy season regarded as dearth period neither is a good time for pollen load nor for honey production.

Keywords: Pollen carrying capacity, pollen and honey area inside a comb, beekeeping

Introduction

Honeybees are the important versatile pollinators. They are always associated with extensive pollination of different open pollinated field, vegetable and orchard crops. These pollinators can collect nectar and pollen from a wide range of flower crops. Adult bees feed on honey whereas their larval stages are provided with bee bread (made up of pollen and honey) for feeding purpose to survive. That's why bees collect both pollen and nectar (from which they prepare honey). So the storage of surplus honey availability inside a hive is dependent upon the availability of nectar secreting plants present around the plants. So for enrichment of apiculture, presence of bee flora and carrying capacity of bees for pollen and nectar are the prerequisites. The behavioral traits such as queen reproduction capacity, worker foraging capacity, nectar collection capacity, pollen carrying capacity, pollen and honey storage and colony population optimization were the most important traits for honey production of *Apis cerana indica* F. Apart from the above mentioned factors different biotic and abiotic factors also plays role in honey production by bees. In this investigation, observation has been made on abiotic factors like climatic factors. Traynor during 1966 in his studies on "Increasing the pollination efficiency of honeybees" has accused weather as the primary dependent factor for bee activity. Heinrich during 1979 and 1980 in his studies has revealed that honeybees always maintain a thoracic temperature of 25 °C. During higher ambient temperature condition, bees evaporate water to regulate the temperature. According to a study undertaken at Sonoran desert by Cooper *et al.* during 1985 on foraging behavior of *Agave schotti*, it has been observed that bees stops foraging activity at an ambient temperature of 35 °C. If we focus on biotic factor, Koeniger *et al.* in 1983 has revealed that mite infestation is comparatively less in case of *Apis cerana indica* as compared to *Apis mellifera*. A detailed study on bee foraging activity with specific to their pollen carrying capacity has been envisaged in this current study.

Materials and Methods

An experiment has been conducted on Pollen carrying capacity of Indian honeybee *Apis cerana indica* of Gajapati district, Odisha. Gajapati district located at the south-east of Odisha between longitude 84° 32'E and 83° 47'E and latitude 18° 44'N and 19° 39'N at the coast of Mahendratana River. The district borders with Andhra Pradesh in the south, District of Rayagada to west, District of Ganjam to East and District of Kandhamala to the North. The district is located on a hilly terrain of Eastern Ghats.

The mountain Mahendragiri, a segment of Eastern Ghats is situated in this district. Climatic condition supports dry deciduous forest type of vegetation. Study was made on *A. cerana indica* bee colonies under natural floral conditions of Gajapati District.

Pollen load Carrying capacity of *Apis cerana indica* F for pollen load was determined for research. For conduction of the experiment, at first the hive entrance was closed for a short period of time. After which, ten foraging bees which are returning to their hives carrying pollen load in their corbicula (pollen basket) of hind legs were collected. After brushing off the pollen pellets from the corbicula, fresh weight of pollen pellets were observed and noted. The above mentioned observations were recorded at 09.00 AM, 12.00 PM and 03.00 PM at an interval of 10 days during three different season viz. Rainy season, winter season and summer season and the peak season and hours of activity were compared. Rainy season was coinciding with the month of mid June to mid October receiving approximately 1000 mm of rainfall primarily from the southwest monsoons whereas winter months were coming during mid September to February and summer was observed from March to mid June. Apart from pollen carrying capacity, both honey and pollen area inside combs are also been observed during the study.

The present investigation was carried out with the hope to help the local bee farmers for managing their bee boxes according to the seasonal activity of bees.

Results and Discussion

Investigations carried out to evaluate the pollen carrying capacity of Indian honeybee *Apis cerana indica* F. bee

colonies under Gajapati District floral conditions showed that they carried higher amount of pollen in winter season than summer and rainy season.

In the first year, pollen carrying capacity was more in winter (5 mg) followed by Summer (3.7 mg) and rainy (2.7 mg) season. In all of the three season, the higher amount of pollen were collected at 09:00 AM (4.0 mg) followed by 12:00 PM (3.7 mg) and 03:00 PM (3.6 mg) during the day time.

In the second year, pollen carrying capacity was more in winter (4.8 mg) followed by Summer (3.6 mg) and rainy (2.5 mg) season. In all of the three season, the higher amount of pollen were collected at 09:00 AM (3.8 mg) followed by 12:00 PM (3.6 mg) and 03:00 PM (3.5 mg) during the day time.

The present investigation has revealed that pollen area was more in winter season whereas honey area was more during summer season in both the years of experimentation (Fig 2). The reason for the fact that winter season attributes more pollen load may be presence of bee flora and optimum number of bee population. Predominance in morning hours i.e. 09:00 AM may be subjected to higher humidity, lower temperature and more moisture content of pollen. More pollen area in winter and more honey area in summer as compared to the rainy season were not in line with the studies of Shruti *et al.* who has revealed that both pollen and honey area were maximum during winter season. The differences may be due to the change in environment and bee flora. The investigation can conclude that the beekeepers must take intensive care during rainy season and may work for honey production and apiary expansion during winter and summer season.

Table 1: Pollen carrying capacity (mg) and seasonal variations of *Apis cerana indica* F in first year (2019-2020)

Season 1	09:00 AM	12:00 PM	03:00 PM	Mean Day load
Rainy	2.88	2.63	2.53	2.7
	3.01	2.74	2.59	2.8
	2.81	2.54	2.43	2.6
	3.08	2.7	2.63	2.8
Mean				2.7
Winter	5.16	4.96	4.82	5.0
	5.18	5	4.89	5.0
	5.11	4.86	4.75	4.9
	5.36	5.13	4.93	5.1
Mean				5
Summer	3.83	3.58	3.47	3.6
	3.91	3.64	3.55	3.7
	3.8	3.51	3.42	3.6
	4.01	3.67	3.59	3.8
Mean				3.7

Table 2: Pollen carrying capacity (mg) and seasonal variations of *Apis cerana indica* F in second year (2020-2021)

Season 1	09:00 AM	12:00 PM	03:00 PM	Mean Day load
Rainy	2.69	2.49	2.33	2.5
	2.75	2.58	2.39	2.6
	2.62	2.4	2.25	2.4
	2.87	2.59	2.42	2.6
Mean				2.5
Winter	4.93	4.77	4.67	4.8
	4.99	4.84	4.75	4.9
	4.86	4.69	4.58	4.7
	5.09	4.88	4.74	4.9
Mean				4.8
Summer	3.67	3.48	3.35	3.5
	3.76	3.55	3.45	3.6
	3.66	3.43	3.3	3.5

	3.79	3.64	3.53	3.7
Mean				3.6

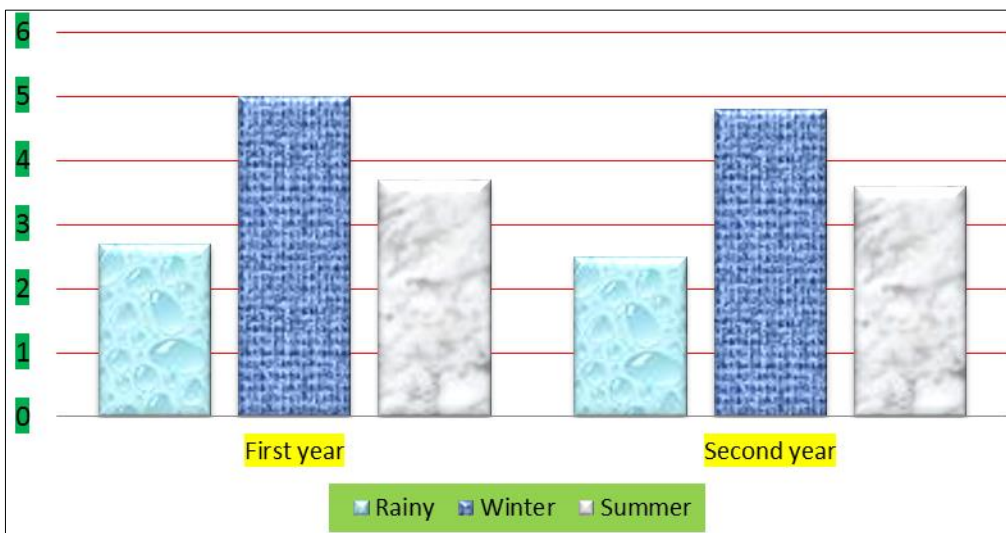


Fig 1: Pollen carrying capacity (mg) of *Apis cerana indica* F in two research years.

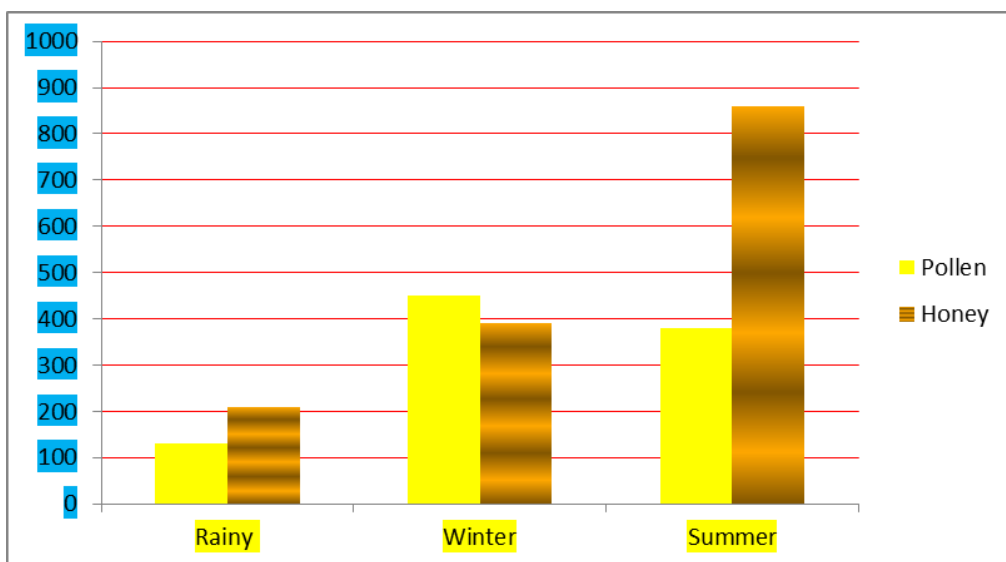


Fig 2: Area under Pollen and honey (cm²) in both the years of research

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