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## Study on availability of bee flora and foraging activities of honey bee in Eastern Uttar Pradesh

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### Abstract

The present investigation entitled “study on availability of bee flora and its foraging activities in eastern Uttar Pradesh”, was carried out on the honeybee foraging activities were recorded on different agricultural and horticulture crops during *Rabi* season 2016-17. It was observed that the bee-flora consists of mostly, fruits and agriculture crops like spices, pulses, cereals, oil seed/yielding, fiber, and fodder crops etc. *Brassica rapa* were the major agricultural bee crops of the area with flowering period of three (3) and four (4) months respectively. These plants species served as the excellent sources of pollen and nectar in the study area. The result revealed that 10 crops were useful to honeybees, out of which 5 crops were agricultural crops like as Mustard, pigeon pea, gram, bakla etc. and 4 horticulture crops like as mango, lemon, guava, anola and the forest plant like as eucalyptus, which are well distributed and commonly found in the study area. The identified flora was further grouped into pollen, nectar and both pollen and nectar yielding plants out of 5 agricultural bee crops, three (3) plants were nectar yielding, one (1) pollen yielding and six (6) plants species were both pollen and nectar yielding

**Keywords:** Honeybee, *Apis mellifera*, bee flora and foraging activities etc.

### 1. Introduction

Flowers are the mainstay of the bee's life. From flowers,, they obtain pollen, the protein rich food used mostly to feed the carbohydrate fuel for their flight, foraging, hive activity and for rearing brood. The abundance of bee flora and their continuous availability is one of the major pre-requisites for successful beekeeping. This enables the beekeepers to exploit these sources to the maximum utilization by the bees. Every region has its floral dearth periods of short or long duration and it is essential to manage the honey bees and bee hives in the dearth period. As during this period, there is lack of availability of nectar and pollen in flora required for quantitative and qualitative production of honey [1]. To overcome this problem. It is important to find out the suitable bee flora available in the locality to propagate and manage the plant species with a option of abundant nectar and or pollen to overcome the problem during the dearth period for commercial apiculture [4]. The present bee fauna dates back to Cretaceous period which is more that 70 mya. Bees are members of the kingdom Animalia, the phylum Arthropods, the class Insecta and the order Hymenoptera (from the Greek hymen, for membrane, and Petron, for wing) [2]. This order includes over 100,000 diverse species of bees, wasps, ants, and saw flies that have been identified and described. The most important characteristic of most members of this order for the understanding of layman is a "wasp waist" which is narrow area between the thorax and the abdomen. Of course, they also all have two pairs of wings, multi-segmented antennae and a few species have a piercing ovipositor [5].

The floral sources and its blooming period are the main indicators and tools for modem beekeeping in India. The bee plants are grouped into forest plants, horticultural /agricultural plants and pastures and hay fields [9]. In India, 50 million hectares of land is under bee dependent. Bee keeping (or) apiculture is the maintenance of honey bee colonies commonly in hives by humans. A bee keeper/ Apiarist keeps bees in order to gather honey bee wax to pollinate crops (or) to produce bees for sale to other beekeepers. Normally bee keepers use three types of hives for example traditional hives, top bar and langstroth hives. Newton's bee hive model normally adapted by the honey bee keepers [6, 7, 12].

The characteristics of *A. mellifera* combined with the high demand for Honey products put beekeeping as a key activity for ecosystem conservation and economic development, thus

attracting great interest in different sectors of society and generating income for the farmer; this activity is widely used in the pollination of many crops<sup>[10]</sup>. In this sense, knowledge of plant species with beekeeping relevance, the foraging strategies of *A. mellifera* and its relationships with the different environmental variables, are important for the development of beekeeping and management strategies, for the best use of resources by bees<sup>[11]</sup>.

## 2. Methods and Materials

### 2.1 Experimental site

The experiment was carried out under sodic soil condition and experimental site is located at Main Experimental Station, Department of Horticulture, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) on the Raibareilly road at the distance of 42 km away from Faizabad district headquarters during *Rabi* season 2016-17. Geographically, it is situated at 26.47° N latitude, 82.12° E longitude and altitude of 113 meters from mean sea level. The site is located in typical saline-alkaline belt of Indogangetic plains of eastern Uttar Pradesh.

### 2.2. Bee hive

Five bee hives were selected during *Rabi* season for the present studies on research work at apiary.

### 2.3. Hive frames

These are wooden frames with their side named as top bar two side bars and a bottom bar.

### 2.4 Bee veil

It is made up of frames covered on the four sides with small mesh wire gauge and top and bottom with cloth, and used for covering the head and face to get protection from bee sting.

### 2.5 Hive tool

It is a flat piece steel sharpened at one end for inserting between hive boxes to separate them and the other end bent to separate frames.

### 2.6 Bee gloves

It is the used for protecting from stinging.

### 2.7 Forceps

Forceps was used for capturing the foraging bees required for pollen grains counting sticking on the body of different bee species.

### 2.8 Transparent sheet

An overhead transparent sheet, which was marked with per square inch was used to measure the honey bee population brood area, in bee colonies.

### 2.9 Observation recorded availability of bee flora

Observations will be recorded and the bee flora on different farms of university campus and nearly the village during *Rabi* season 2016-17. For this, visual observation was carried out for *A. mellifera* separately during the *Rabi* season of October and February, in different farms of university campus and nearly the village to find the blooming plants species visited by honeybees for collection of nectar and/ or pollen. The intensity of visitation by the foraging bees was visually monitored by recording the number of times a particular foraging source was visited of bees. The study included

observation of bee's activities on flowers of different plant species. Whenever bees were found on the flowers of such plants, their foraging behavior was observed for a period of 10 minutes. If the success of any foraging attempt was ascertained, the plant was scored as bee foraging species if at least three (3) honeybees visited the flowers simultaneously within 10 minutes of the observation. The observation on nectar and pollen source was based on activities performed by honeybees on different flowers. Honeybees with their activity of extending their proboscis into the flowers are considered as nectar source and bees carrying pollen on their hind legs were determined as pollen source. Honeybees with their activity of extending their proboscis into the flowers and also collecting pollen on their hind legs were determined as nectar and pollen yielding plants. Such plants were identified using the books in situ. If the plants were recorded as bee foraging species at particular site and later encountered in subsequent survey on the other sites; it was only scored for presence. Plants that could not be identified in the field their portion or twig of a branch with necessary botanical features like its leaves, flower and portion of stem.

## 3. Results and Discussion

In the present investigation honey bee foraging activities were recorded on different agricultural and horticulture crops during *Rabi* season 2016-17. The result revealed that 10 crops were useful to honeybees, out of which 5 crops (Mustard, pigeon pea, gram and bakla) were agricultural crops and 4 were horticulture crops (mango, lemon, guava and anola) and one is the forest plant eucalyptus, which are well distributed and commonly found in the study area. The identified flora was further grouped into pollen, nectar and both pollen and nectar yielding plants (Tables No-1) out of 5 agricultural bee crop, three (3) plants were nectar yielding, one (1) pollen yielding and six (6) plants species were both pollen and nectar yielding. The present investigation is also in partial agreement with the finding of WenFeng *et al.*, (2010)<sup>[12]</sup>, Bhalchandra *et al.*, (2014)<sup>[4]</sup> The flowering plants were visited and observed for the presence and foraging activities of honeybees. Plants were scored as bee foraging species when at least three honeybees had visited to the flowers within the period of 10 minutes. The results revealed that 52 plant species were useful to honeybees, out of which 29 were agricultural crops and 23 wild plants. The identified flora was further grouped into pollen, nectar and both pollen and nectar yielding plants. Mid-December to February and mid-July to September were identified as honey flow periods and mid-April to mid-June were the critical dearth periods during the year.

The bee colony efficiency, development as well as production of honey, beeswax and other bee products depend on quality and quantity of pollen and nectar. It was observed that the bee-flora consists of mostly, fruits and agriculture crops like spices, pulses, cereals, oil seed/yeilding, fiber, and fodder crops etc. *Brassica rapa* were the major agricultural bee crops of the area with flowering period of three (3) and four (4) months respectively. These plants species served as the excellent sources of pollen and nectar in the study area. The present investigation are also in partial agreement with the finding of Pushpalatha and Prasad (2016)<sup>[8]</sup> Who observed Honey bee need flowering plants. for their pollen and nectar collection and satisfied with the bee flora. The most favorable orchard trees are mungo, guava, ber, jamun, banana etc. Similarly, the field crops like cotton, sunflower, cucurbitaceous flowers are favored by them.

**Table 1:** List of Bee flora available during *Rabi* season 2016-17

S. No.	Location	Bee flora	Botanical Name	Flowering time	Utility to honey bees
1.	PCP Farm, NDUAT	Mustard	<i>Brassica spp.</i>	10 Dec-20 Jan	N
		Gram	<i>Cicer arietinum</i>	5 Feb-10 Mar	N
		Bakla	<i>Vicia faba</i>	20Feb-30Mar	P
2.	MES Farm, NDUAT	Pigeon Pea	<i>Cajanus cajan</i>	1Feb-10Mar	N
		Gram	<i>Cicer arietinum</i>	1Feb-15Mar	N
3.	GPB Farm, NDUAT	Mustard	<i>Brassica spp.</i>	15Dec-25Jan	P
		Pea	<i>Pisum sativum</i>	10Dec-5Jan	P
		Pigeon Pea	<i>Cajanus cajan</i>	5Feb-15Mar	N
4.	Horticulture Farm, NDUAT	Lemon	<i>Citrus sinensis</i>	20Feb-30Mar	P
		Eucalyptus	<i>Eucalyptus globules</i>	1Feb-10Mar	N
		Mango	<i>Mangifera indica</i>	1Feb-15Mar	P
		Aonla	<i>Emblca officinalis</i>	1Mar-5Apr	P
		Guava	<i>Psidium guajava</i>	Yearly	P
		Bael	<i>Aegle marmelos</i>	Des-Jan	P
5.	Pithla, Faizabad	Pea	<i>Pisum sativum</i>	10Dec-10Jan	P
		Pigeon Pea	<i>Cajanus cajan</i>	5Feb-25Mar	N
		Mustard	<i>Brassica spp.</i>	20Dec-30Jan	N
		Mango	<i>Mangifera indica</i>	1Feb-20Mar	P
6.	Tendha, Faizabad	Mustard	<i>Brassica spp.</i>	20Dec-25Jan	N
		Pigeon Pea	<i>Cajanus cajan</i>	1Feb-10Mar	N
		Pea	<i>Pisum sativum</i>	20Dec-15Jan	P
		Mango	<i>Mangifera indica</i>	5Feb-25Mar	P
7.	Shivnathpur, Faizabad	Mustard	<i>Brassica spp.</i>	20Dec-25Jan	N
		Pigeon Pea	<i>Cajanus cajan</i>	1Feb-10Mar	N
		Mango	<i>Mangifera indica</i>	1Feb-20Mar	P
		Pea	<i>Pisum sativum</i>	20Dec-15Jan	P
8.	Tiwariapurwa, Faizabad	Gram	<i>Cicer arietinum</i>	30Jan-15Feb	N
		Pigeon Pea	<i>Cajanus cajan</i>	1Feb-10Mar	N
		Mustard	<i>Brassica spp.</i>	25Dec-25Jan	N
		Mango	<i>Mangifera indica</i>	1Feb-20Mar	P
		Pea	<i>Pisum sativum</i>	20Dec-15Jan	P

#### 4. Conclusion

Foraging activities were recorded on different agricultural and horticulture crops during *Rabi* season 2016-2017. The result revealed that 10 crops were useful to honeybees, out of which 5 crops were agricultural crops like as Mustard, pigeon pea, gram, bakla etc. and 4 were horticulture crops like as mango, lemon, guava, anola and the forest plant like as eucalyptus, which are well distributed and commonly found in the study area. The identified flora was further grouped into pollen, nectar and both pollen and nectar yielding plants out of 5 Agricultural bee crop, three plants were nectar yielding, one pollen yielding and six plants species were both pollen and nectar yielding. The results revealed that 52 plant species were useful to honeybees, out of which 29 were agricultural crops and 23 wild plants. The identified flora was further grouped into pollen, nectar and both pollen and nectar yielding plants.

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