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Foraging Efficiency of Indian Honeybees, *Apis Cerana Indica* (Fabricius) Apidae: Hymenoptera

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Abstract: ***Foraging efficiency of a colony was measured in terms of number of bees with pollen load entering into the hive. The floral sources present near the colonies on which bees reached for pollen collection were observed. Honeybees play a vital role in foraging behavior of worker bees such as weather, distance of food source from the hive, food quality & quantity of nectar and pollen. Normally honey is obtained from the species Apis dorsata, Apis florea, Apis cerena indica and Italian bee, Apis mellifera but Indian honeybees are domesticated bees. Moreover a single foraging trip of A.cerena indica foragers tend to collect either pollen (or) nectar sometimes from a single species of plant, continuing to collect pollen (or) nectar from that plant throughout the day.***

Keywords: Apis cerena indica, colony behaviour weight of honeybee at different seasons, Wp (With pollen) Wop (Without pollen) foraging behaviour.

1. Introduction

Apis cerana indica (Fabricius)., also called as Asian honey bee, Asiatic honeybee, Asian hive bee, Indian bee, Indian honey bee, Chinese bee, Mee bee, eastern honey bee is endemic to most of Asia where it has been used for honey production and pollination services for thousands of years. Flowers have male and female structures and it is process of pollination that transfer pollen from the male part to the female part. After pollination pollen releases a male gamete that fertilizes a female gamete in the ovule and their genetic material. Indian honey bees are relatively non-aggressive and rarely exhibiting swarming behaviour, it is ideal for bee keeping.

1.1 Foraging behaviour of Indian honey bees

Honeybees collects nectar and pollen which are needed for bee nutrition. Pollen is a source of protein , nectar is a source of carbohydrates and together they provide all the food necessary for larval growth and metamorphosis and for adult function and development.

While bees collect nectar and pollen, they provide one of the most important ecological services-pollination. Pollination will be coveredin more detail further on. Here, general foraging and its importance to the bee colony will be covered.

On a single foraging trip *A.cerana* forages tend to collect either pollen (or) nectar (sometimes both) from a single species of plant, continuing to collect pollen or)nectar from the plant throughout the day.

Foraging ranges of *A.cerana* vary between different studies, but generally apis honey bees prefer to forage within 200-300m of their nest.

1.2 Pollination among different crops

A.cerana is an important canopy pollinator in the rain forests of western Ghats and Srilanka, but little is known about the relationship between wild *A.cerana* and wild florain other parts of asia(or) the world. At high altitudes pollen in the Asian tropics, and in north-eastern Asia, *A.cerana* is the only social bee present and so is likely to be an important if not the bee pollinator during winter months.

In Hong kong, *A.cerana* is a very important pollinator as it is the dominant visitor to 55% of the 83 wood plant species studied.*A.cerana* ability to thrive in disturbed land scapes may also give it an important role as a pollinator compensating for loss of other pollinators, similar to the role of *A.mellifera* in tropical America.

1.3 Importance of pollen (collected from *A.cerana*)

Pollen is the sole protein source food of a honey bee colony harvested by bee foragers in their natural environment. The presence of pollen in the nest is pre requisite for normal colony development and first of all for regular growth and development of the brood.

The rich amino acid composition of the pollen protein and other valuable pollen constituents (fats, enzymes, vitamins, mineral compounds) made pollen one of products recovered from the bees harvested by man so it is often referred to as bee pollen (Brathowski And Wilde 1996; Brathowski And Siuda 1998; Wilde And Wilde 2002)

Valuable dietary, prophylactic and even curative properties of pollen caused the demand for the product to be on the increase so more and more attention has been paid to pollen recovery from bees.capture of pollen and pollen and pollen sales also contribute to the pay ability of honey farming. Pollen can be collected from bees in two forms; as pollen loads – granules formed by the bees from fresh pollen and as bees bread – a product of milk fermentation processed by the bees in the combs.

1.4 *A.cerana* act as a service bee

Honey bee foragers load a small amount of honey into the crop before leaving the hive (Beutler 1950; Also Reviewed In Beutler 1951) the honey serves as fuel for generating energy during the foraging trip (Gmeinbauer And Crailsheim1993) because bees have only limited energy stores, such as fat and glycogen in the body.

2. Results and Discussion

In Asia ,*A.cerana* is regarded as an excellent crop pollinator for a large variety of fruit and vegetable crops. This is thought to be due to the fact that *A.cerana* begin foraging earlier in the day and cease later in the day , pollinating flowers for longer than *A.mellifera* and also because *A.cerana* employ relatively larger numbers of pollen collectors 9 compared to nectar collectors) than *A.mellifera.*

3. Materials and Methods

Methods for Keeping Sugar Solution

a) The study was conducted at Annamalai Nagar campus during 2015-2016 in the dept of entomology, Annamalai Nagar. Indian bees are involved with various regular activities and bee behaviour to ascertain its efficient exploitation for pollination. Observations were made with Annamalai Nagar crop ecosystem with latitude of 11^{o}.23'48''N and longitude with 79^{o}.42'58'' with +4.680 m MSL.
b) Bees can also use the sugar syrup as food (sugar dissolved) in an equal quantity of water. Sugar is offered to supplement honey resources or in the extreme case to save the weak colonies from starvation. Early in the spring, when the flowers are not in abundance bees can be stimulated to start brood rearing, as it should synchronize with the main honey flow, so that the bees can take best advantage of it.

Under proper management, not more than one or two kilograms of sugar are needed to use in a year/colony.

When the stores fall below this level, bees should be fed artificially. If syrup is given as a winter reserve, the syrup should be thick, prepared by mixing two parts of sugar with one part of warm water.

4. Results and Discussions

Bees activity observed with dawn and dusk time and worker bees activities noticed. The observation hours like 6:45a.m, 7:00a.m, 7:15a.m, 7:30a.m, 8:00a.m, and 9:00a.m. Similarly the evening activities of honey bees also noticed. During evening hours like 5:45 p.m., 6:00 p.m., 6:15 p.m., 6:30 p.m.

The colony of honey bees needs warmth, sun, nectar, pollen and water to thrive. The temperature needs to be at least 12.hour for the bees to be able to fly out to collect food. Honey bees collect nectar from flowers as food and store it in their hive for the winter.

Besides collect nectar, bees also collect pollen which is an important protein food for the bees and is essential for young bees to grow.

Swarming generally occurs in March to June. The old queen departs with about half of the bees to a new home elsewhere. The remaining bees in the colony continue their work rearing brood and collecting their work rearing brood and collecting food. When a virgin queen emerges from her cell, she stings the remaining queen cells and kills any other queen she finds. Six to eight days after emergence the virgin queen flies out to mate with drones and return to the colony as the new queen and starts to lay eggs two to three days after mating.

Table: Weight of honeybees with pollen and without pollen during honey flow period & honey dearth period

Month-January

weeks	Weight of honeybees with pollen basket(wp)				Weight of honeybees without pollen basket(wop)			
	R1	R2	R3	Average No.of.Population	R1	R2	R3	Average No.of.Population
I	0.421	0.421	0.422	0.421	0.219	0.218	0.216	0.217
II	0.422	0.423	0.420	0.421	0.218	0.217	0.219	0.218
III	0.423	0.420	0.422	0.421	0.215	0.216	0.218	0.216
IV	0.421	0.422	0.423	0.422	0.216	0.219	0.214	0.216

Mean of three replications Mean of three replications

February

Weeks	Weight of honeybees with pollen basket(wp)				Weight of honeybees without pollen basket(wop)			
	R1	R2	R3	Average No.of.Population	R1	R2	R3	Average No.of.Population
I	0.423	0.420	0.422	0.422	0.218	0.215	0.216	0.216
II	0.421	0.423	0.420	0.421	0.216	0.216	0.217	0.216
III	0.422	0.423	0.421	0.422	0.215	0.217	0.215	0.215
IV	0.423	0.422	0.423	0.423	0.213	0.218	0.213	0.214

Mean of three replications Mean of three replications

March

Weeks	Weight of honeybees with pollen basket(wp)				Weight of honeybees without pollen basket(wop)			
	R1	R2	R3	Average No.of.Population	R1	R2	R3	Average No.of.Population
I	0.423	0.421	0.422	0.422	0.215	0.216	0.216	0.216
II	0.421	0.423	0.423	0.423	0.213	0.215	0.217	0.215
III	0.422	0.422	0.423	0.422	0.216	0.217	0.218	0.217
IV	0.424	0.421	0.422	0.422	0.217	0.218	0.219	0.218

Mean of three replications Mean of three replications

April

Weeks	Weight of honeybees with pollen basket(wp)				Weight of honeybees without pollen basket(wop)			
	R1	R2	R3	Average No.of.Population	R1	R2	R3	Average No.of.Population
I	0.422	0.423	0.422	0.422	0.218	0.219	0.218	0.218
II	0.421	0.422	0.423	0.422	0.219	0.215	0.215	0.215
III	0.423	0.421	0.421	0.422	0.218	0.216	0.217	0.217
IV	0.422	0.422	0.423	0.422	0.217	0.217	0.216	0.217

Mean of three replications Mean of three replications

May

Weeks	Weight of honeybees with pollen basket(wp)				Weight of honeybees without pollen basket(wop)			
	R1	R2	R3	Average No.of.Population	R1	R2	R3	Average No.of.Population
I	0.425	0.422	0.423	0.423	0.216	0.215	0.213	0.215
II	0.423	0.421	0.422	0.422	0.215	0.214	0.217	0.215
III	0.421	0.422	0.423	0.422	0.217	0.219	0.215	0.216
IV	0.422	0.423	0.421	0.422	0.213	0.217	0.216	0.213

Mean of three replications Mean of three replications

June

Weeks	Weight of honeybees with pollen basket(wp)				Weight of honeybees without pollen basket(wop)			
	R1	R2	R3	Average No.of.Population	R1	R2	R3	Average No.of.Population
I	0.421	0.423	0.422	0.422	0.216	0.218	0.215	0.215
II	0.423	0.421	0.421	0.421	0.215	0.216	0.217	0.216
III	0.422	0.422	0.423	0.422	0.217	0.217	0.219	0.217
IV	0.424	0.423	0.422	0.423	0.218	0.215	0.216	0.217

Mean of three replications Mean of three replications

July

Weeks	Weight of honeybees with pollen basket(wp)				Weight of honeybees without pollen basket(wop)			
	R1	R2	R3	Average No.of.Population	R1	R2	R3	Average No.of.Population
I	0.422	0.421	0.423	0.422	0.215	0.217	0.216	0.216
II	0.421	0.423	0.421	0.421	0.216	0.215	0.219	0.217
III	0.423	0.422	0.422	0.422	0.217	0.218	0.218	0.217
IV	0.422	0.421	0.423	0.422	0.215	0.219	0.217	0.216

Mean of three replications Mean of three replications

August

Weeks	Weight of honeybees with pollen basket(wp)				Weight of honeybees without pollen basket(wop)			
	R1	R2	R3	Average No.of.Population	R1	R2	R3	Average No.of.Population
I	0.421	0.423	0.422	0.422	0.216	0.218	0.216	0.216
II	0.423	0.422	0.421	0.422	0.215	0.219	0.219	0.219
III	0.420	0.423	0.422	0.422	0.217	0.216	0.217	0.217
IV	0.423	0.421	0.423	0.423	0.218	0.217	0.218	0.218

Mean of three replications Mean of three replications

September

Weeks	Weight of honeybees with pollen basket(wp)				Weight of honeybees without pollen basket(wop)			
	R1	R2	R3	Average No.of.Population	R1	R2	R3	Average No.of.Population
I	0.422	0.423	0.421	0.422	0.215	0.216	0.219	0.216
II	0.421	0.425	0.422	0.423	0.214	0.215	0.218	0.215
III	0.423	0.423	0.420	0.423	0.217	0.218	0.216	0.217
IV	0.420	0.422	0.423	0.422	0.218	0.219	0.215	0.218

Mean of three replications Mean of three replications

October

Weeks	Weight of honeybees with pollen basket(wp)				Weight of honeybees without pollen basket(wop)			
	R1	R2	R3	Average No.of.Population	R1	R2	R3	Average No.of.Population
I	0.423	0.422	0.421	0.422	0.216	0.217	0.218	0.217
II	0.421	0.422	0.423	0.422	0.217	0.216	0.219	0.217
III	0.423	0.421	0.422	0.422	0.218	0.217	0.216	0.217
IV	0.422	0.423	0.421	0.422	0.215	0.219	0.215	0.215

Mean of three replications Mean of three replications

November

Weeks	Weight of honeybees with pollen basket(wp)				Weight of honeybees without pollen basket(wop)			
	R1	R2	R3	Average No.of.Population	R1	R2	R3	Average No.of.Population
I	0.425	0.421	0.423	0.423	0.216	0.215	0.217	0.216
II	0.420	0.422	0.421	0.421	0.217	0.216	0.217	0.217
III	0.421	0.423	0.422	0.422	0.215	0.215	0.218	0.216
IV	0.422	0.420	0.424	0.422	0.218	0.217	0.217	0.217

Mean of three replications Mean of three replications

December

weeks	Weight of honeybees with pollen basket(wp)				Weight of honeybees without pollen basket(wop)			
	R1	R2	R3	Average No.of.Population	R1	R2	R3	Average No.of.Population
I	0.422	0.421	0.423	0.422	0.215	0.216	0.216	0.216
II	0.423	0.422	0.421	0.422	0.219	0.217	0.216	0.216
III	0.422	0.422	0.423	0.422	0.217	0.218	0.216	0.217
IV	0.425	0.424	0.421	0.423	0.218	0.215	0.217	0.217

Mean of three replications

5. Observation

In the month of ***January*** the weight of the honey bees i.e either pollen basket is more comparatively more than bees without pollen.

During ***February*** month the weight of the honey bees is more than that of bees without pollen.

Regarding ***March*** month observation also the weight of the honey bees is relatively more when compared to bees without pollen

In the month of ***April*** observation regarding bees are more weight in case of pollen basket with honey bes and less weight in without pollen basket.

During the Month of ***May*** the weight of the honeybees is more than that of bees without pollen.

Observation regarding ***June*** month, weight of the honey bees is relatively more when compared to bees without pollen

During the month of ***July*** the weight of the honeybees are relatively more when compared to bees without pollen.

In the month of ***August*** observation regarding bees are more weight in case of pollen basket with honey bees and less weight in without pollen basket

During ***Septembe***r month weight of honey bees with pollen basket is more compared to without pollen bees.

The observation notices in the month of ***October*** the weight of honey bees with pollen basket is more when compared to bees without pollens

The observation noticed in the month of ***November*** the weight of honey bees with pollen basket is more compared to bees without pollens.

During ***December*** month weight of honeybees with pollen basket is more compared to wihout pollen bees.

Honeybee weight observation during honey flow period and honey dearth period.

Weight of honeybees with pollen basket & without pollen basket.

6. Conclusion

Pollen efficiency of honeybee colonies varied over successive study periods. Weight of single pollen loads recovered from incoming foragers varied, among other things, over different period of the foraging season. The weight of single pollen loads made by the bees of individual honey bee colonies was a more stable character over the two seasons than the amounts of pollen recovered from those colonies. From the above said observations shows the population of honeybees is more in the month of honey flow period when compared to honey dearth period.

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