



Research Paper

Effect of Electromagnetic (cell phone) radiations on *Apis mellifera*

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ABSTRACT:- Study conducted on effects of electromagnetic radiations on *Apis mellifera* colonies revealed that such exposure caused disturbance, more aggressiveness as well as significant decrease in colony strength, honey stores, pollen reserves, number of foragers returning to their hives and egg laying capacity of queens in test colonies. Cell phone radiations disturbed navigational skills of foragers.

Keywords:- *Apis mellifera*, colony collapse disorder, cell phone radiations.

I. INTRODUCTION

Pollution caused by electromagnetic radiations is increasing day by day because number of cell phones as well as cell phone towers is increasing abundantly. These cell phone radiations are effecting honeybees very badly. Many studies [1, 2 and 3] have revealed that there is direct relationship between decline in honeybee populations and electromagnetic radiations. These radiations effect the behaviour of *Apis mellifera*, cause decline in colony strength and this situation may lead to colony collapse disorder. This phenomenon may give economic set back in the form of pollination deficiency (decrease in crop yield), decline in yield of hive products, even failure of apiculture and degradation of biodiversity. A study was conducted to know various influences of cell phone radiations on *Apis mellifera* colonies. Study may also help to understand *A. mellifera* bees as indicator of pollution caused by electromagnetic radiations and degrading environment.

II. MATERIALS AND METHODS

Some colonies of *Apis mellifera*, which were approximately similar to each other in all respects were selected for experiment, in already running apiary under Punjab conditions. Two cell phones were kept in working condition (call mode) in each test colony (Figure 1) for 15 minutes for 20 days at the time when foraging activity of bees was at peak (12:30 pm). Behaviour of the bees was observed before, during and after the treatment in colonies under experiment and observations were compared with those of the colonies kept as control. Parameters selected were disturbance, degree of aggressive behaviour, number of outgoing as well as returning foragers/minute, egg laying capacity of queen/day, pollen stores, honey reserves, number of young and mature workers, absconding if any. Total area under brood (egg, larvae and pupae), honey and pollen was measured in all test and control colonies with the help of a 1 square centimeter grid made on a comb frame [4] Data collected was consolidated, tabulated and conclusions were drawn.

III. RESULT AND DISCUSSION

In test colonies, it was observed during exposure that bees got disturbed, irritated and degree of stinging behaviour was very high (Fig 2.) as compared to normal colonies (control) and test colonies before exposure (table 1.). Worker bees showed behaviour as they used to do just before swarming. Change in behavioural pattern of honeybees when they were very close to mobile phones or towers has also been observed. Similar type of observations were recorded by favre [5] that when mobile phones were placed in close vicinity of honeybees then there was dramatic effect of radiations on behaviour of bees. These radiations induce the worker bees for piping signal. Under natural conditions this signal either announces the swarming of the bee colony or is a indication of a disturbed colony.

Strength of colonies decreased significantly, pollen stores and honey reserves declined considerably after exposure (Fig 4.). Average egg laying rate of queen per day was reduced from 450 to 150 during exposure and 65 after experiment in test colonies (Fig 3). A significant decrease in egg laying rate, brood area (egg, larvae

and pupae), honey and pollen stores after exposure to cell phone radiations has also been reported by many workers [6,7 and 8]

Number of returning foragers to their respective hives was much lesser as compared to outgoing bees. Number of outgoing bees was also lesser as compared to that of normal (control) colonies. At the end of experiment negligible number of bees were coming back to their hives. Colonies with 7 frames covered with bees reduced to 3 frames after treatment. Colonies were left only with eggs, various stages of brood, young workers and queen. Number of mature workers (foragers) was negligible. Dwindling took place in some colonies. Decline in number of bees leaving hives per minute, percentage of returning bees and percentage of bees returning with pollen loads was also confirmed by many workers [10 and 11].

It may be concluded from above results that strong cell phone radiations disturb navigational abilities of worker bees, therefore most of foragers were unable to return and consequently number of mature workers decreased in hives. Pollen and nectar stores declined considerably. So electromagnetic pollution may be one of the major factors responsible for colony collapse disorder and is indication of severe environmental disaster.

More research work is urgently required to understand impact of cell phone radiations on biology of honeybees and solution of adverse effects.

Table-1 Change in behaviour of *A.mellifera* colonies exposed to cell phone radiations.

Sr.No.	Parameter	Test Colonies	Control Colonies
1	Degree of aggressive behaviour Before exposure During exposure After exposure	Calm Irritated and aggressive Irritated and aggressive	Calm Calm Calm
2	Disturbance Before exposure During exposure After exposure	Calm Disturbed and showed behaviour as just before swarming Disturbed and showed behaviour as just before swarming	Calm Calm Calm
3	No. of outgoing bees/min./colony Before exposure During exposure After exposure	25 15 10	28 30 29
4	Percentage of returning bees Before exposure During exposure After exposure	98% 70% 30%	98% 96% 98%
5	Strength of colonies Before exposure During exposure After exposure	7 frame 5 frame 3 frame	7 frame 7 frame 8 frame
6	Egg laying capacity of queen Before exposure During exposure After exposure	500 eggs/day 150 eggs/day 65 eggs/day	475 500 590
7	Area under Brood Before exposure During exposure After exposure	1576.5 cm ² 1000 cm ² 200cm ²	1666.5 cm ² 1700.5 cm ² 1740 cm ²
8	Area under Honey and nectar stores Before exposure During exposure After exposure	1800 cm ² 1000 cm ² 200 cm ²	1850 cm ² 1900 cm ² 1970 cm ²
9	Area under Pollen Stores Before exposure During exposure After exposure	200.5 cm ² 150 cm ² 125.5 cm ²	230 cm ² 226.5 cm ² 250 cm ²



Fig 1. Test colony with two cell phones on call mode



Fig 2. Aggressive behaviour of *A. mellifera* bees after exposure of cell phone radiations



Fig 3. *A. mellifera* queen laying eggs



Fig 4. *A. mellifera* queen with some young workers at the end of experiment



Fig 5. Frame with sealed brood in *A. mellifera* colony (control).

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