

## Biochemical changes in haemolymph of *Apis mellifera* L. drone under the influence of cell phone radiations

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**Abstract:** The effects of Electromagnetic radiations (EMR) are being felt by wildlife and the environment as a whole, birds, bees, worms, trees are being affected. So the main focus of present study was carried out to analyse the influence of cell phone radiations on the biochemical aspects of drone of *Apis mellifera* L. The drone was exposed for 30 mins to radiations using live cell phones kept in working mode with tape recorder at the speaker end and positive response at the receiver's end. The results of the treatment were analyzed and compared with the control. The concentration of various biomolecules increased from 1.65 mg/ml to 2.75 mg/ml for carbohydrates, 3.74 mg/ml to 4.85 mg/ml for proteins and from 0.325 mg/ml to 1.33 mg/ml for lipids under the influence of EMR.

**Keywords:** *Apis mellifera*, Biomolecules, Cell phone radiations, Drone, Haemolymph

### INTRODUCTION

The mobile phone has greatly changed people's lifestyle. It has made day to day communication so much easier that one can communicate with another whenever one wants. The last decade has seen several researches reporting the influence of cell phone radiations on human physiological processes. Electromagnetic radiations have a considerable effect on other life forms. Soares (1981) observed eye mutation in honey bee under the influence of electromagnetic radiations. Greenberg *et al.* (1981) studied the biological effects of high voltage transmission line on honey bee colony and reported that in the exposed colony there was increased motor activity with increased hive temperature, abnormal propolization, impaired hive weight gain, queen loss, decreased sealed brood and poor winter survival. The queen produced drones with abnormal wings, antenna and legs under the influence of cell phone radiations (Brandes and Frisch, 1986). Due to this reason, honey bees have been frequently used as bioindicators of electro pollution. The focus of present research work was to investigate the changes in biochemical make up of the haemolymph of *Apis mellifera* L. drone under the influence of cell phone radiations.

### MATERIALS AND METHODS

**Study area:** The samples of *A. mellifera* adult drones were taken from colonies maintained by Department of Zoology, Panjab University, Chandigarh.

**Experimental design:** A specially designed box called the observation hive was used for the experiments. The front and back of the box were made up of glass. The sides had wire gauze for proper ventilation. Two such

boxes, one experimental and other control were taken for the study. Two comb frames were taken from a healthy colony, all bees were brushed off and one frame was placed in each of the hive. Ten drones were released in each hive. The experimental observation hive had 2 mobile phones placed against the sides having wire gauze. An exposure of 30 minutes was given to the drones kept in observation hive by keeping cell phones in listen and talk mode for 30 minutes using a tape recorder. After 30 minutes 5 drones were collected at random, put in test tubes and labelled as exposed. A similar set was installed for control which did not have cell phones. Random sample of 5 drones was likewise collected and labelled control. The experiment was repeated three times.

**Sample preparation:** Haemolymph of drone bees was taken for biochemical investigations. For collection of haemolymph the tip of a micropipette was inserted into the intersegmental region of the drone's abdomen. By applying mild pressure at one end of the abdomen the haemolymph was sucked into the tip of a micropipette. Equal volume of haemolymph from all drones was dissolved in 0.5ml of normal saline.

**Biochemical studies:** Various quantitative and qualitative tests were performed for total carbohydrates, glucose, glycogen, total lipids, cholesterol, proteins and free amino acids. Activities of important enzymes were assayed using standard protocols.

### RESULTS AND DISCUSSION

The results of the methods employed to study changes in biochemical parameter of the drone haemolymph upon exposure to electromagnetic radiations (EMR) from live

**Table 1.** Changes in biochemical parameters of the drone haemolymph upon exposure to EMR from live cell phones.

Biochemical estimation	Protocol	Control drone pupae	Exposed drone pupae
Total carbohydrates	Sawhney and Singh (2000)	1.65±0.015mg/ml	2.75± 0.015mg/ml*
Glucose	Somogyi and Nelson (1945)	0.023±0.002mg/ml	0.302±0.002mg/ml*
Glycogen	Seifter <i>et al.</i> (1950)	0.50± 0.081mg/ml	1.16± 0.030mg/ml*
Total lipids	Fringes and Dunn (1970)	0.325±0.005mg/ml	1.33±0.014mg/ml*
Cholesterol	Zalatki <i>et al.</i> (1953)	0.25±0.041mg/ml	0.24±0.026mg/ml*
Protein	Lowry <i>et al.</i> (1951)	3.74±0.047mg/ml	4.85±0.020mg/ml*
SDS-PAGE	Laemmli (1971)	7 protein types with molecular weights 27kDa to 216kDa	13 protein types with molecular weights 20.5kDa to 217kDa
Free amino acid assay – Circular filter paper chromatography	Swarup <i>et al.</i> (1981)	5 amino acids (Serine, Threonine, Tyrosine, Butyric acid, Tryptophan)	3 amino acids ( Histidine, Serine, Aspartic acid)
Acid phosphate	Bergmeyer (1963)	0.54±0.018 units/mg of protein	0.42±0.018 units/mg of proteins*
Alkaline phosphatase	Bergmeyer (1963)	1.04±0.018 units/mg of protein	0.82±0.015 units/mg of protein*
Glucose 6 phosphatase	Freeland and Harper (1959)	0.126±0.00units/mg of protein	0.047±0.011 units/mg of protein*
Hexokinase	Crane and Sols (1995)	0.537±0.009 units /mg of protein	0.422±0.018 units/mg of protein*

\*Significant increase:  $p < 0.05$  (Student t-test)

cell phones are presented in Table 1. Since p value is less than 0.05, all the results are statistically significant. The results showed an increase in concentration of primary macromolecules. Increase in types of proteins and availability of fewer free amino acids indicated synthesis of newer functional proteins to fight the stress. The activity of enzymes decreased which led to corresponding increase in concentration of the specific metabolites.

Mobile phones, Wi- Fi systems, electric power lines and similar sources of “electrosmog” are disrupting nature on a massive scale, causing birds and bees to lose their bearing, fail to reproduce and die. Animals that depend on natural electrical, magnetic and electromagnetic fields for their orientation and navigation are confused by the much stronger and constantly changing artificial fields. The role of EMR in causing CCD was supported by Carlo (2007). To test the authenticity of these assumptions honey bees are good biological indicators as they have magnetic granules in their head, thorax and abdomen which help them in their navigation flight. These magnetic granules are affected by EMR which gives a good reason to study the effect of EMR on honey bees. Honey bees are one of the most extensively studied species so that the anatomy and physiology of bees is well known. It is therefore that the present investigations on the influence of cell phone radiations on some biochemical and

physiological aspects of the honey bee drone biology were undertaken. Studies on the biology, behaviour and biochemical make up of the worker honey bee (*Apis mellifera*) have been undertaken in this laboratory (Sharma, 2008; Sangwan, 2009; Kumar *et al.*, 2010). It is observed that survival ability of an animal depends on its protein synthetic potential. Any stress on animal invokes compensatory metabolic adjustments in its tissues through modifications or modulations of proteins (Bano *et al.*, 1981; Aseem and Hanke, 1983). Hence, the total protein profile of a tissue may be considered as a diagnostic tool in assessing physiological status of an animal. The concentration of total proteins was seen to increase during present study. The results of SDS- PAGE showed increase in number of protein bands in case of exposed drones whereas the number of free amino acids decreased in case of exposed drones. These results were supported by the observations of Sangwan (2009) and Kumar *et al.* (2010). Similarly the overall increase in total carbohydrates in the haemolymph of EMR exposed drones was due to decreased activity as also studied by Sangwan (2009). The major energy reservoirs of the insects are the lipids. In present study, the estimation of total lipids in the haemolymph of drone *A. mellifera* showed an increase in concentration in samples exposed as compared to the control. The activities of different enzymes like acid, alkaline phosphatase, hexokinase and

glucose 6 phosphatase decreased in case of exposed drone as compared to that of control drone which is due to decrease activity and confusion amongst drones under the influence of electromagnetic pollution.

The present study concluded that there is definite influence of cell phone radiations on the biomolecules as well as on the enzyme activities present in the haemolymph of drone. These EMR radiations grossly interfered with the normal metabolic and physiological processes of *A. mellifera*.

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