INFLUENCE OF CELL PHONE RADIATIONS ON *Apis mellifera* SEMEN

**Kumar, Neelima R., Taruna Verma and Anudeep**

Entomology Laboratory, Department of Zoology, Panjab University, Chandigarh-160014

**Abstract**

In present study, the impact of cell phone radiations on various biochemical and physiological aspects of semen of drone honey bee *Apis mellifera* L. was observed. The drones were exposed to radiations for 30 minutes, using live cell phones kept in working mode with tape recorder at the speaker end, and positive response at the receiver’s end. The parameters were analysed and compared with that of control drones. The concentration of various biomolecules- viz. carbohydrates, proteins and lipids were found to be increased whereas, the activities of seminal enzymes decreased leading to reduced utilization of the biomolecules, and hence increase in their concentration.

**Key words:** *Apis mellifera*, biomolecules., cell phone radiations., semen., drone.

**Introduction**

Bees are good biological indicators for electromagnetic pollution as they have magnetite granules present in their head, thorax and abdomen helping in their navigation flight. Cell phone radiations have been reported to be responsible for affecting the biological and physiological processes in the body of the bees. Behavior of honey bee is altered by high or low energy fields or EMR[1-5]. A media report in April 2007 asserted that cellular phones were a possible cause of honey bee colony collapse disorder [6,7]. Hence, the present studies were planned to study the effect of EMR on the semen of drones of honey bees.

**Material and Methods**

**Study area**

The semen samples of adult drones were drawn from the 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. A comb frame without bees was put in the observation hive. 20-30 drone bees were segregated from the healthy colony and released in the observation hive. The 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 10 drones were collected at random, put in test tubes and labeled as exposed. A similar set was installed for control which did not have cell phones. Random sample of 10 drones was likewise collected and labeled control.

**Sample preparation**

For the collection of semen, drones were activated by allowing them to move freely on a glass pane. Drones were then caused to evert by gently pressing the thorax dorsoventrally. A drop of semen oozed out at the tip of genitalia and was immediately collected with the help of auto pipette and dispersed in 0.5 ml of saline or PBS as the experiment demanded. Biochemical tests and enzyme assays were performed and the results were analyzed.

**Results**

The changes in the biomolecules and activities of different enzymes upon exposure to EMR from live cell phones in semen of drone are presented in Table I and II respectively. The following changes were observed in the semen of drones exposed to cell phone radiations-

- The concentration of various biomolecules such as carbohydrates, proteins and lipids, increased under the influence of EMR.
- The activities of seminal enzymes decreased perhaps due to reduced utilization of the biomolecules and hence increase in their concentration.
- The normal constitution and physiology of semen was therefore disrupted.

**Discussion**

Because of different modalities of their orientation, bees are inseparably linked to the magnetic field of the earth and to the electromagnetic oscillations[8-10]. This association attains great significance in case of drones because of mating of drones with queen...
takes place in air, in special areas known as the drone congregation areas. Location of these areas by drones can be disturbed under the influence of EMR. Drones under influence of 500 Hz flew away from the hive and never came back [2]. Changes in the concentration of biomolecules and in the activities of enzymes as observed during the present study are a clear indication of metabolic disturbances in spermatozoa and semen quality. This observation is supported by the findings of other workers with respect to biochemical changes under stress conditions in various insects [11,12]. Drones are the only fertile males in the colony. The success of mating and subsequent reproduction depends on organized behavioral, biochemical and physiological characteristics of the drones and their semen. Any change in its reproductive physiology can lead to incompetent mating and hence failure of reproduction. Thorough investigation of literature reveals the possible ill effects of electric fields and EMR on honey bee biology and behavior, but still there is very little work done to understand the mechanism of these modulations by studying biochemical changes regulating physiology.

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Table I: Influence of cell phone radiations on biomolecules

<table>
<thead>
<tr>
<th>Biochemical estimation</th>
<th>Protocol</th>
<th>Control drone</th>
<th>Exposed drone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Carbohydrates</td>
<td>Sawhney and Singh (2000)[13]</td>
<td>0.63±0.032 mg/ml</td>
<td>1.40±0.017 mg/ml</td>
</tr>
<tr>
<td>Glycogen</td>
<td>Seiffer et al. (1950)[14]</td>
<td>0.04±0.00 mg/ml</td>
<td>0.114±0.00 mg/ml</td>
</tr>
<tr>
<td>Glucose</td>
<td>Somogyi and Nelson (1945)[15]</td>
<td>0.17±0.002 mg/ml</td>
<td>0.28±0.002 mg/ml</td>
</tr>
<tr>
<td>Total lipids</td>
<td>Fringes and Dunn (1970)[16]</td>
<td>0.176±0.001 mg/ml</td>
<td>1.03±0.015 mg/ml</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>Zalatki et al. (1953)[17]</td>
<td>0.136±0.01 mg/ml</td>
<td>0.130±0.01 mg/ml</td>
</tr>
<tr>
<td>Protein</td>
<td>Lowry et al. (1951)[18]</td>
<td>0.076±0.008 mg/ml</td>
<td>0.207±0.072 mg/ml</td>
</tr>
<tr>
<td>SDS-PAGE</td>
<td>Laemmli, (1971)[19]</td>
<td>12 protein types with molecular weights from 21 kDa to 217 kDa</td>
<td>6 protein types with molecular weights from 33.2 kDa to 217 kDa</td>
</tr>
<tr>
<td>Free amino acid assay- Circular filter paper chromatography</td>
<td>Swarup et al. (1981)[20]</td>
<td>4 amino acids</td>
<td>3 amino acids</td>
</tr>
</tbody>
</table>

Table II: Influence of cell phone radiations on activities of different enzymes Enzyme assays-

<table>
<thead>
<tr>
<th>Enzyme assays</th>
<th>Protocol</th>
<th>Control drone</th>
<th>Exposed drone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acid phosphatase</td>
<td>Bergmyer (1963)[21]</td>
<td>25.9±0.616 units/mg of proteins</td>
<td>7.922±0.695 units/mg of proteins</td>
</tr>
<tr>
<td>Alkaline phosphatase</td>
<td>Bergmyer (1963)[21]</td>
<td>1.04±0.018 units/mg of proteins</td>
<td>0.187±0.005 units/mg of protein</td>
</tr>
<tr>
<td>Glucose-6-phosphatase</td>
<td>Freeland and Harper (1959)[22]</td>
<td>26.25±0.443 units/mg of protein</td>
<td>8.09±0.799 units/mg of protein</td>
</tr>
<tr>
<td>Hexokinase</td>
<td>Crane and Sols (1995)[23]</td>
<td>26.25±0.173 units/mg of protein</td>
<td>8.54±0.365 units/mg of protein</td>
</tr>
</tbody>
</table>
References
6) Anonymous. 2007. Good Morning America. Where have the bees gone? Cell phones are linked to the mysterious disappearance of honey bees.
7) Lean, G., Shawcross, H. 2007. Are mobile phones wiping out our bees? Scientists claim radiation from handsets are to blame for mysterious ‘colony collapse’ of bees. 2007;