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Assessing the Impact of Indoor RF-EMF Exposure at 3.6 GHz on the Development of Honey bees

Anastasia Kalapouti[1], Leonidas Charistos[1], Jürg Fröhlich[2], Fabian Schneider[2], Marco Zahner[2], Zoi Thanou[3]
Antonios Tsagkarakis[3], Andri Varnava[4], Menelaos Stavrinides[4], Pieterjan De Boose[5], Felipe Oliveira Ribas[5], Arno Thielens[6]
Anke Huss[7], Maria Bouga[3], Fani Hatjina[1]
[1]Department of Apiculture Institute of Animal Science, Hellenic Agriculture Org. "DIMITRA", Nea Moudania, Greece
[2]Fields at Work GmbH, Zurich, Switzerland
[3]Department of Crop Science, Agricultural University of Athens, Athens, Greece
[4]Department of Agricultural Sciences, Cyprus University of Technology, Limassol, Cyprus
[5]Department of Information Technology, Ghent University - imec, Ghent, Belgium
[6]Photonics Initiative, Advanced Science and Research Center, the Graduate Center of the City University of New York, New York, USA
[7]Institute for Risk Assessment Sciences, Utrecht University, Utrecht, The Netherlands

Newly introduced telecommunication technology results in changes in exposure patterns of radiofrequency electromagnetic fields (RF-EMFs) that can be absorbed in organisms (like insects) which have unclear biological consequences. The current study aims at investigating the effects of RF-EMFs at 3.6 GHz on honeybee brood development under controlled conditions (ETAIN- HORIZON project).

To achieve this objective, three honey bee colonies were exposed to a 5G-like modulated RF-EMF signal at 3.6 GHz with an incident rms-power density of 1W/m2 (10% of the maximum permissible incident power density for the general public in the EU), while three parallel control colonies were not. The two groups of colonies were kept in separate rooms electromagnetically shielded from each other. The colonies were placed on digital scales and equipped with sensors continuously measuring RF electric field strengths, temperature, humidity, and CO2. The development of the eggs, larvae and pupae was monitored continuously, as well as the state of the queens.

We observed that 11% of eggs and 20% of larvae from the exposed colonies as well as 22% of eggs and 15% of larvae from control colonies were removed by bees before the capping stage (n.s. difference). We also observed a one day delay in hatching for 23% and 8% of eggs in exposed and control groups, respectively (significant difference), and one day delay in the emergence of adult bees for 19% and 4% of larvae, in exposed and control bees, respectively (n.s. difference). Total emergence percentage was not different between the exposed and the control group (ca. 100%). No differences were observed in queen status and weight of the colonies. However, brood temperature, humidity, or CO2 between the two experimental groups still need to be analysed. Further tests are currently conducted to increase data points. Field tests on honey bee colonies are also planned to determine the wellbeing of the colonies also while applying a higher frequency (e.g. 26 GHz) exposure.

Outcomes of the above and further investigations will increase our knowledge and understanding of honey bees' behaviour under these exposure patterns, explain the biological meaning of these effects and determine any mitigation measures needed.