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Ivana Tlak Gajger

University of Zagreb, Croatia

The impact of feed supplementation with effective organisms on vitellogenin concentrations in honey bee (*Apis mellifera*) hemolymph

Main parasites of honeybees, *Nosema ceranae* and *Varroa destructor* can cause major health problems such as immune suppression and reduced worker bee lifespan, or even suddenly colony collapse. Effective microorganisms are combinations of numerous species of useful microbes, which are widely used in different fields associated with livestock farming. In animals, commercial probiotic called EM[®] is commonly used as feed supplement to regulate intestinal function by stabilizing and maintaining the microbiological balance between the pathogenic and beneficial microbiota. As a novel approach in therapy, we hypothesize the EM[®] PROBIOTIC FOR BEES for beekeeping usage could play an important immunomodulation role in stimulating synthesis of vitellogenin which has impact in immunological responses and pathogen defence at both, the individual and honeybee colony level. Emerged young adults were placed into plastic cages with holes on each side for air flow. Bees fed probiotic were given sugar solution (water:sugar 1:1), with two different dilutions (2.5%; 5%) of commercial probiotic called EM[®] BEES and kept in an incubator. Sampling of workers' hemolymph was performed 11th and 15th day after initial feeding. Concentrations of vitellogenin in hemolymph samples were determined by MyBioSource ELISA kit using spectrophotometer (Shimadzu, USA). Statistical analyses of the estimated values were carried out using Graph Pad Prism software (USA). Results showed that concentrations of vitellogenin (ng vitellogenin/mg protein) were increased and significantly different ($p < 0.05$) in hemolymph samples of experimental in comparison with control bees groups, for 11th and 15th day after initial feeding. The current results have presented valuable insights into the possible immunomodulation in honeybees and into novel biotechnological approach that may address the current needs of global beekeeping. Future studies rely on measurements of other immunological parameters and molecular analyses of diversity of microbial communities of worker bees in the overall health of honeybee colonies.



Figure 1: Experimental design.

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Recent Publications

1. Pinoargote G, G Flores, K Cooper, S Ravishankar (2018) Effects on survival and bacterial community composition of the aquaculture water and gastrointestinal tract of shrimp (*Litopenaeus vannamei*) exposed to probiotic treatments after an induced infection of acute hepatopancreatic necrosis disease. *Aquacul. Res* 1-19.
2. Hawood G P, K E Ihle, H Salmela and GV Adam (2017) Regulation of honeybee worker (*Apis mellifera*) life histories by vitellogenin. *Hormones, Brain and Behavior* 3: 403-420.
3. Omar A A, A E Khodairy, R Moosbeckhofer, K Crailsheim, R Brodschneider (2017) Influence of different pollen diets on the development of hypopharyngeal glands and size of acid gland sacs in caged honey bees (*Apis mellifera*). *Apidologie* 48:425-436.
4. Sabate D C, M S Cruz, M R Beni 'tez-Ahrendts, M C Audisio (2012) Beneficial Effects of *Bacillus subtilis* subsp. *subtilis* Mori2, a Honey-Associated Strain, on Honeybee Colony Performance. *Probiot Antimicro Prot* 4:39-46.
5. Ohland C L and W K Macnaughton (2010) Probiotic bacteria and intestinal epithelial barrier function. *Am J Physiol Gastrointest Liver Physiol* 298: G807-19.

Biography

Ivana Tlak Gajger has completed her Graduation in the Veterinary Faculty at University of Zagreb in 2005. Currently, she is the Head of Department for Biology and Pathology of Fish and Bees where she works as an Associate Professor. Besides activities in scientific and research work, she is active as Lecturer of mandatory and elective courses from field of biology and pathology of aquatic animals and beneficial insects. Also, she is Head of accredited National Laboratory for Honeybee Diseases APISlab and participates to perform professional and clinic work in field conditions (apiaries and fish farms). She has published 40 scientific papers whose theme field is linked with pathology of beneficial insects and she is the Coauthor of two handbooks: *Veterinary handbook* and *Good veterinary praxis in apiary*.

ivana.tlak@vef.hr

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