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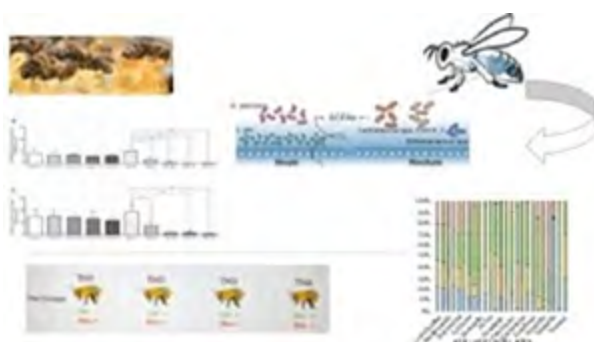


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Impacts of EM[®] Probiotic for Bees on Physiological Parameters and Gut Microbiota of Honeybees

Multiple causal factors are considered to contribute to honeybee colony losses parasites and pathogens, exposure to pesticides, diet quantity, quality, and diversity, as well as unfavorable weather and forage circumstances. Also, the health status of honeybee colonies is highly influenced by beekeepers' management practices. All these factors affect honeybee colonies individually or in various combinations, possibly causing severe disturbance of honeybee intestines microbiota composition. Adult honeybee dysbiosis - gastrointestinal microbial imbalance is linked to lower body weight, deficient development, and early workers mortality. Furthermore, the altered microbiota is associated with host deficiencies when the environmental stressors could change gut bacterial balance and lead to the visible manifestation of opportunistic diseases. Among them the increased number of *Nosema* spp. spores in the midgut, premature foragers, and immune suppression linked with oxidative stress were reported. The intestinal microbiota of honeybees can provide novel insights into the pathogenesis-related factors involved in pathogen infection. Hence, we investigated the comparison of intestinal microbiota communities in control and *Nosema ceranae* infected groups of honeybee colonies through high-throughput sequencing of the 16S rRNA. As a novel approach in therapy, we hypothesize that EM[®] probiotic for bees could potentially have an important therapeutic and immunomodulatory effect on honeybee colonies. The aim of our study was to evaluate its impact on different physiological parameters and gut microbiota composition of honeybees. The 25 major genera with a total of more than 1000 OTUs were detected, with *Lactobacillus* being the most abundant genus, followed by *Gilliamella*, *Snodgrassella* and *Bifidobacterium*. In EM treatment groups *Kluyvera*, *Klebsiella*, *Escherichia*, and *Cedecea* concentrations were higher than in the control groups. This result indicates that continuous EM treatments shall clearly change bees' gut microbiome composition. *Snodgrassella alvi* was a major member of the honeybee gut microbiota and may be significantly increased by long-term EM treatment. According to those results, it would be possible with EM treatments to protect honeybees from herbicide-negative effects (e.g., Glyphosate) in agricultural fields, by improving microbiome and immune functions.



Recent Publications

1. Tlak Gajger, I., M. I. Smodiš Škerl, P. Šoštarić, J. Šuran, P. Sikirić, J. Vlainić (2021): Physiological and Immunological Status of Adult Honeybees (*Apis mellifera*) Fed Sugar Syrup Supplemented with Pentadecapeptide BPC 157. *Biology* 10, 9, 891. doi.org/10.3390/biology10090891
2. Tlak Gajger, I., J. Vlainić, P. Šoštarić, J. Prešern, J. Bubnič, M. I. Smodiš Škerl (2020): Effects on some therapeutical, biochemical, and immunological parameters of honey bee (*Apis mellifera*) exposed to probiotic treatments, in field and laboratory conditions. *Insects* 11, 9, 638. doi:10.3390/insects11090638
3. Tlak Gajger, I., S. A. Dar (2021): Plant allelochemicals as sources of insecticides. *Insects* 12, 189. doi.org/10.3390/insects12030189

Biography

Ivana Tlak Gajger has been employed at the Department for Biology and Pathology of Fish and Bees, faculty of the Veterinary Medicine University of Zagreb, Croatia Since 2006, where she is still working as full Professor. Besides activities in scientific and research work she is active as a lecturer of mandatory and elective courses in the field of biology and pathology of beneficial insects. She is the course leader for the mandatory undergraduate course Biology and Pathology of Bees, and the elective course Honeybee diseases in intensive production, at the study of Veterinary Medicine in English. She was supervisor of 39 graduate and two doctoral students. She is Head of Postgraduate Master Study Programme Honeybee Health Protection in English language. Also, she is Head of accredited (according to HRN EN ISO/IEC 17025), official and reference National Reference Laboratory for Honeybee Diseases APISlab and participates to perform professional and clinical work in field conditions.

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