

atics Polina Magdalena Górka

Development of a metabolic preparation with high antimicrobial potential for use in the prophylaxis against *Paenibacillus* larvae causing American foulbrood in bee colonies

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The honeybee is accompanied by a microflora whose biodiversity is modified by a number of environmental and stress factors. One such threat is the bacterium *Paenibacillus* larvae, which causes the brood disease American foulbrood, which is subject to physical eradication by order of the Veterinary Inspectorate. Infected colonies weaken very quickly, the number of brood and bees being reared decreases dramatically, with the consequence that the economics of the farm is reduced or the apiary is completely closed and pollination is impaired. Seeing the untapped potential of biotechnology and microbiology in prevention of livestock diseases, an effort was made to develop and test, both in vitro and in vivo, a targeted and contact metabolic biopreparation with high antimicrobial potential against *P. larvae*, which, when used as a preventive measure, would reduce losses in apiary management and increase the preservation of the safety of the honeybee in the food production chain. The research problem was to reduce American foulbrood pressure in bee colonies by promoting the development of a physiological microbiome of competing brood and blocking the excessive proliferation and production of *P. larvae* endospores. The aim of this study was to provide beekeepers with a microbial product that: used in specific doses and forms of application, will reduce the pressure of the pathogen on the bee microbiome; will eliminate the increasing number of infested areas and disease outbreaks; will strengthen the microbiome of honeybee larvae and adults and break the chain of infection. The effect generated in this innovative product was achieved by multiple antagonistic and antimicrobial mechanisms conferred by the synergistic formulation consisting of a consortium of probiotic bacteria and 14 plants. Classical and molecular microbiology methods were used: antimicrobial activity (MIC, MBC, time-kill, halo effect) was determined according to EUCAST standards and qPCR. The safety of the product against bees was confirmed. The antimicrobial activity of the product was confirmed under laboratory conditions and a statistically significant reduction of several log orders of *P. larvae* in field apiaries. In an antibiotic-free, environmentally safe and food-safe manner, a probiotic administered prophylactically will be able to control *P. larvae* population.