Fakulta agrobiologie, potravinových a přírodních zdrojů

DOKTORSKÝ STUDIJNÍ PROGRAM/*DOCTORAL STUDY PROGRAM*

VYPSÁNÍ TÉMATU/*LISTING OF TOPIC*

Studijní program/*Study Program*: **Agricultural Chemistry**

Katedra/*Department of*: **mikrobiologie, výživy a dietetiky**

Školitel, email/*Supervisor, email*: **havlik@af.czu.cz**

Konzultant, email/*Co-supervisor, email*:

Forma studia/*Form of Study*: **prezenční**

Téma/*Topic*: Microbiome–metabolite interactions as critical drivers of honey bee health and pollinator decline

Hypotézy/*Hypotheses*: 1. Host-specific probiotic strains isolated from honey bees can beneficially modulate the gut microbiome composition and metabolic activity; 2. Probiotic-induced microbial and metabolite shifts occur not only locally in the gut but also systemically across multiple bee tissues (head, fat body, hemolymph), indicating a gut–systemic axis of regulation

Anotace/*Summary*: This Ph.D. project aims to develop and evaluate a host-specific probiotic supplement for honey bees (*Apis mellifera*) and to explore microbiome–metabolite interactions as key determinants of bee health and resilience. The probiotic will be formulated from bacterial strains naturally isolated from healthy bees, focusing on *Bifidobacterium* and *Lactobacillus* species with strong host adaptation. These strains will be characterized for their fermentation and cultivation properties, including substrate utilization, metabolic outputs, and tolerance to physicochemical stressors mimicking the bee gut environment. The most promising isolates will be combined into a multi-strain consortium optimized for stability and functionality.

The biological effects of the probiotic will be tested in controlled experiments using honey bee colonies. Particular attention will be paid to assessing its impact on the microbiome composition, metabolic status, and systemic physiology. Changes in microbial communities will be characterized by full-length 16S rRNA gene sequencing using PacBio technology, providing high-resolution taxonomic insights. Metabolomic profiling of bee tissues (gut, head, fat body, hemolymph) and fermentation media will be performed using ^{1}H NMR spectroscopy to identify metabolic pathways affected by probiotic treatment. The integration of metagenomic and metabolomic datasets will allow a comprehensive systems-level interpretation of host–microbe–metabolite interactions and their relevance to bee health.

This interdisciplinary research will contribute to understanding how microbiome-driven metabolic processes influence immunity, neurophysiology, and energy metabolism in bees. The outcomes are expected to result in the development of a scientifically validated, host-specific probiotic supplement capable of enhancing bee vitality and resistance to pathogens and environmental stressors. Ultimately, the project will provide mechanistic insights into how microbial and metabolic dysregulation contributes to pollinator decline and how microbiome-targeted interventions can support sustainable apiculture and ecosystem stability.

The applicant is expected to demonstrate the ability to work independently, strong self-organization, logical and analytical reasoning, and proficiency in R programming—or clear potential to develop these skills.

V/*In* Prague dne/*Date*: 11.11.2018

Podpis školitele/*Signature of the Supervisor*:

Podpis konzultanta/ *Signature of the Co-supervisor*:

Podpis vedoucího katedry/*Signature of the Head of the Department*:

Příloha/*Attachement*: Finanční plán u témat vypsaných pro prezenční formu studia/*Financial plan for topics listed for full-time study*

Finanční plán pro PHD téma na FAPPZ/Financial plan for PhD topic

Studijní program/Study program

Agricultural Chemistry

Katedra/Department of

Food Science

Téma/Topic

Microbiome–metabolite interactions as critical drivers of honey bee health and pollinator decline

Školitel

Jaroslav Havlík

zdroje financování	**zakázka**	**rok 1**	**rok 2**	**rok 3**	**rok 4**
doktorské stipendium	x	17000	17000	17000	17000
mimořádné stipendium - SGS					
mimořádné stipendium					
DKRVO katedry					
stipendium z projektů					
jiný příjem					
jiný příjem - externí zaměstnavatel					
mzda - projekt		12001	12001	12001	12001
mzda - projekt					
suma (min. 300 000, 1.2 násobek minimální mzdy)		300000	300000	300000	300000

! Vkládají se měsíční částky. U jiných příjmů a mzdy se v sumě načítají jen 2/3 z vložené částky

celkem doktorské stipendium	816000
celkem ostatní (min. 336 000)	384000
celkem za 4 roky (minimálně 1,2 milionu)	1200000

poznámka/comment

projekt v roce 1 až 3

školitel:

Podpis/Signature

vedoucí katedry:

Podpis/Signature