[ID: 250] Bacteriophage biodistribution and infectivity– from honeybee to bee larvae

Henrique Ribeiro [1], Rossana Correia [2, 3], Tiago Moreira [4], Diana Vilas Boas [1], Ana Oliveira [1]

[1] *Center of Biological Engineering - University of Minho, Braga, Portugal*
[2] *I3S - Institute for Research and Innovation in Health Sciences, University of Porto., Porto, Portugal*
[3] *Ipatimup - Institute of Molecular Pathology and Immunology of the University of Porto., Porto, Portugal*
[4] *BeePrado Unipessoal, Lda., Braga, Portugal*

Bacteriophages have been extensively exploited as biocontrol agents to fight animal and plant bacterial diseases. They offer many advantages compared to antibiotics, in the control of American Foulbrood (AFB). This is a disease caused by Paenibacillus larvae, a spore-forming Gram-positive bacteria. It affects honeybee larvae and occurs through the transmission of highly resistant spores that easily spread across apiaries. The appropriated control measure is to burn contaminated hives, which cause serious ecological and economic losses. The use of antibiotics is discarded due to bacterial resistances and to restrictions of European legislation.

Though phages capable of controlling P. larvae have already been discovered, their biodistribution in adult bees and bioavailability to young larvae has not yet been determined. The present in vivo study investigated the ability of a T7 phage to reach larvae in an infective state after oral administration to honeybees, as this strategy is considered the most feasible toward hive management. Phages were administered in the bee food at 1x10^9 PFU.mL-1 and bees/larvae samples were collected 24 h post-administration. The screening (by direct PFU count) and quantification (by real-time PCR) of T7 phage in bee organs and in larvae after ingestion revealed that phages were successfully uptaken by bee, were transported in their internal organs and reached larvae through the bee-larvae feeding chain. However, considering the total amount of particles detected in larvae (ranging 10^4 phages), a very low quantity was recovered in an infective form, able to reduce P. larvae load and to control AFB (in average 32 phages were infective). Their fast inactivation in royal jelly is pointed herein as a potential threat to this therapeutic approach, and therefore, the improvement of the oral delivery effectiveness in the AFB therapeutic might be achieved by the development of phage protection strategies from general hive-derived conditions.