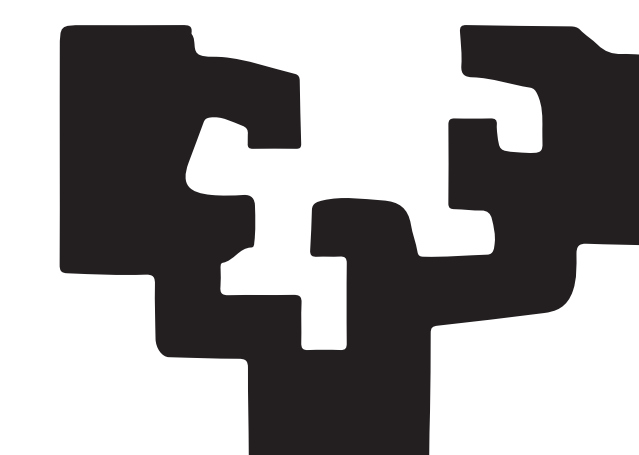


Study of the honeybee holobiont to unravel management and environment-driven changes in colony resilience



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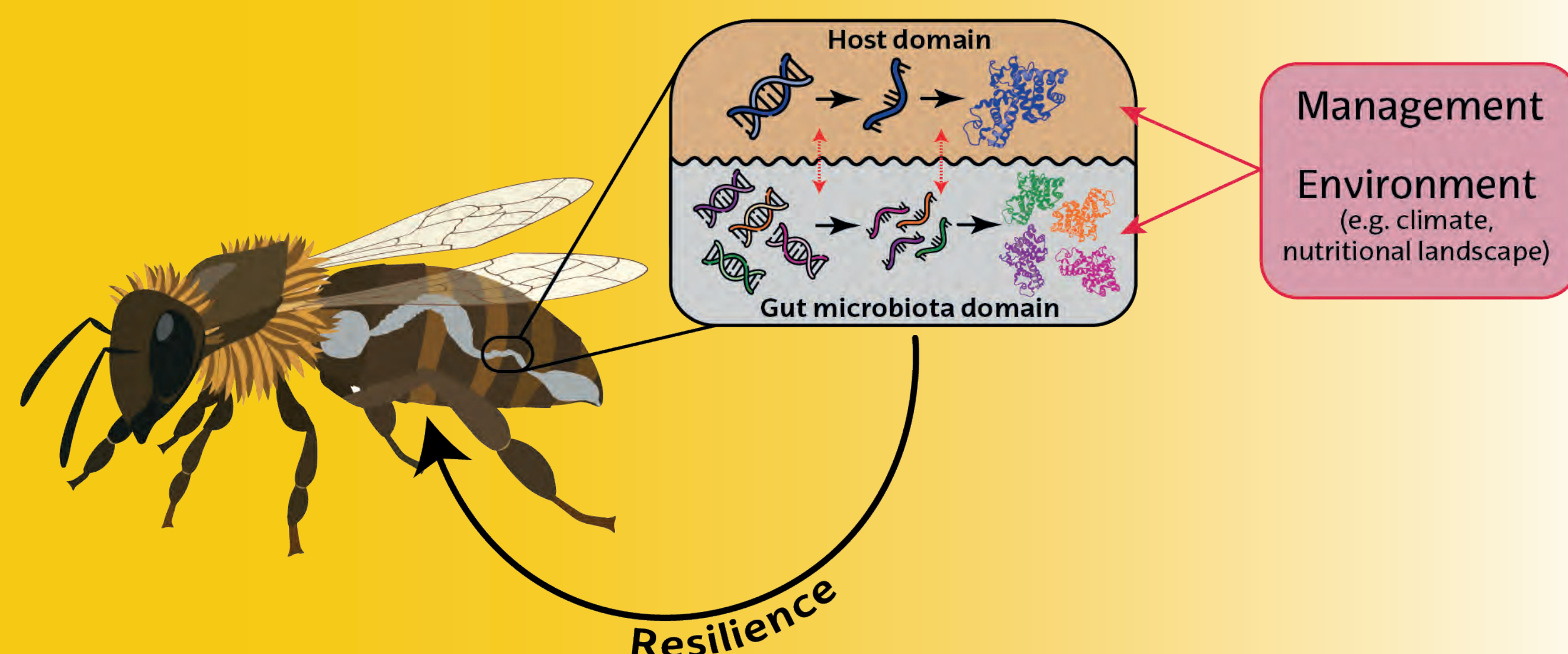
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BEEGUARDS

The European HorizonEurope BeeGuards project (2023-2027) aims to provide sustainable management and breeding strategies and strengthen the resilience of the European beekeeping sector. The core of the project is an international field study across Europe where we will test in parallel an innovative threshold-based management vs. a conventional management. The innovative management is expected to grant selective advantage to colonies with improved varroa mite resistance and environmental adaptation. In this context within **WP4**, we will study the honeybee holobiont to unravel management and environment-driven changes in colony resilience.

WP4 Main objectives

- We provide a hologenomic framework
- to identify the microbiome+genome combinations that are being selected in the innovative management
 - to provide molecular evidence on how these microbiome+genome combinations contribute to a more resilient honey bee



Methodological approach: holo-omics

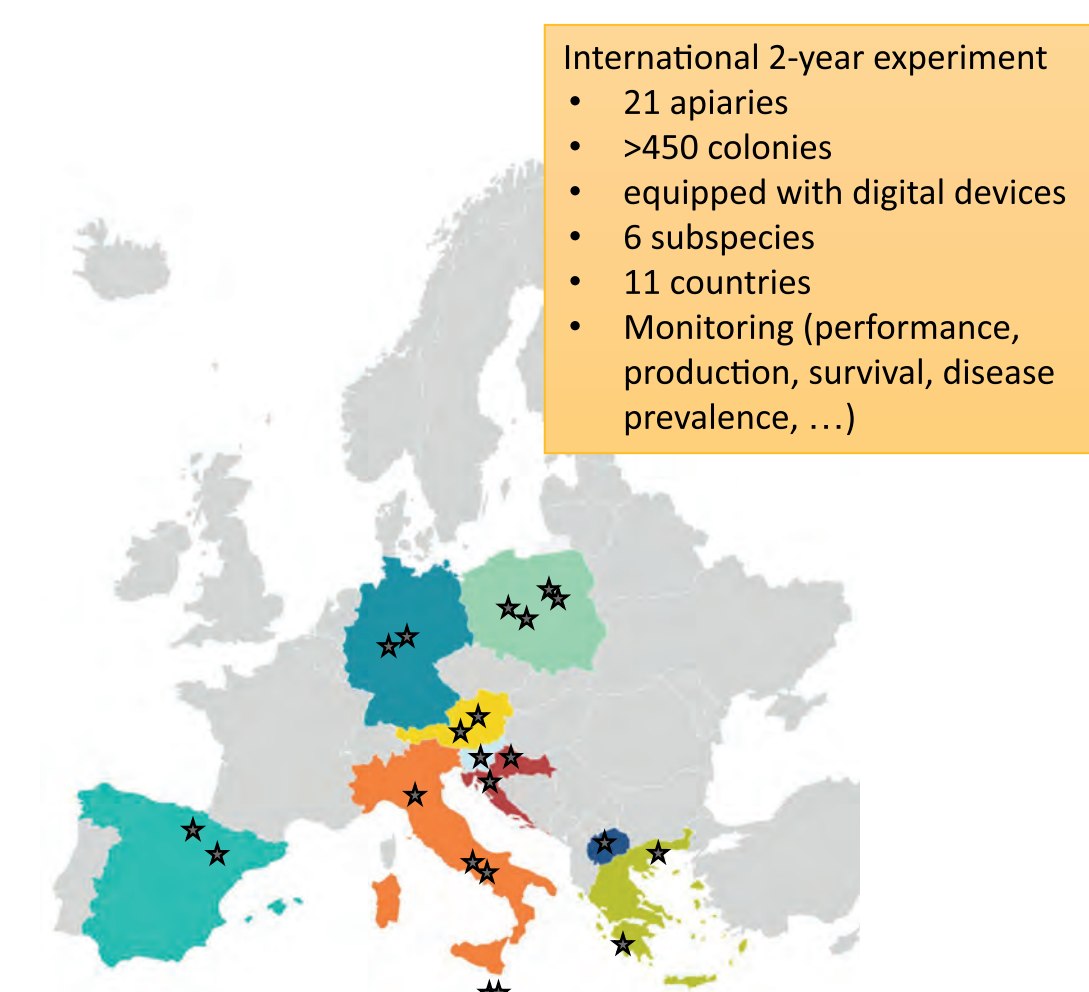
- Shotgun sequencing of honeybee and microbial DNA ((meta)genomics)
- Honeybee and microbial RNA sequencing ((meta)transcriptomics)
- 16S amplicon sequencing for temporal microbial analysis
- Virus qPCR



PAN-EUROPEAN MICROBIOME FIELD EXPERIMENT

Generation of an integrated honeybee gut metagenome catalogue (MAGs) (iBeeMC) by capturing the bacterial strain diversity across subspecies, climates, and nutritional landscapes
 - Deep sequencing of 48 individuals

Study of the effect of management on the honeybee gut microbiome strain level diversity and function by comparing innovative vs conventional colonies across Europe
 - Sequencing of a total of 120 paired-samples (innovative vs. conventional management) from across Europe

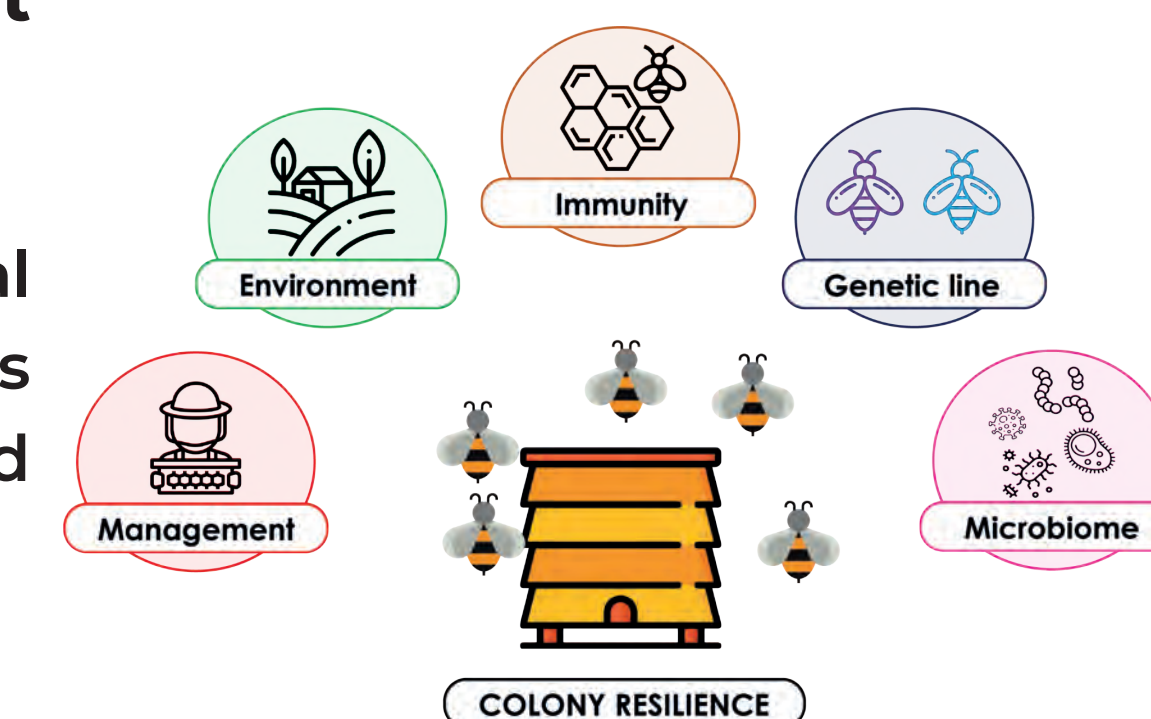


- International 2-year experiment
- 21 apiaries
 - >450 colonies
 - equipped with digital devices
 - 6 subspecies
 - 11 countries
 - Monitoring (performance, production, survival, disease prevalence, ...)

HOLOBIONT FIELD EXPERIMENT

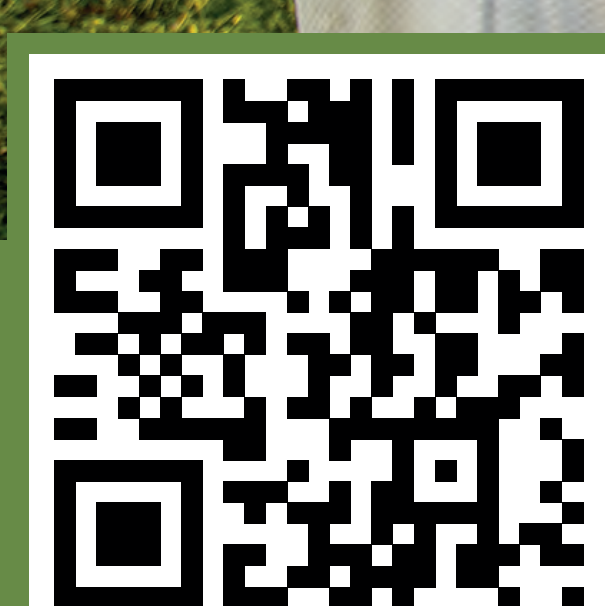
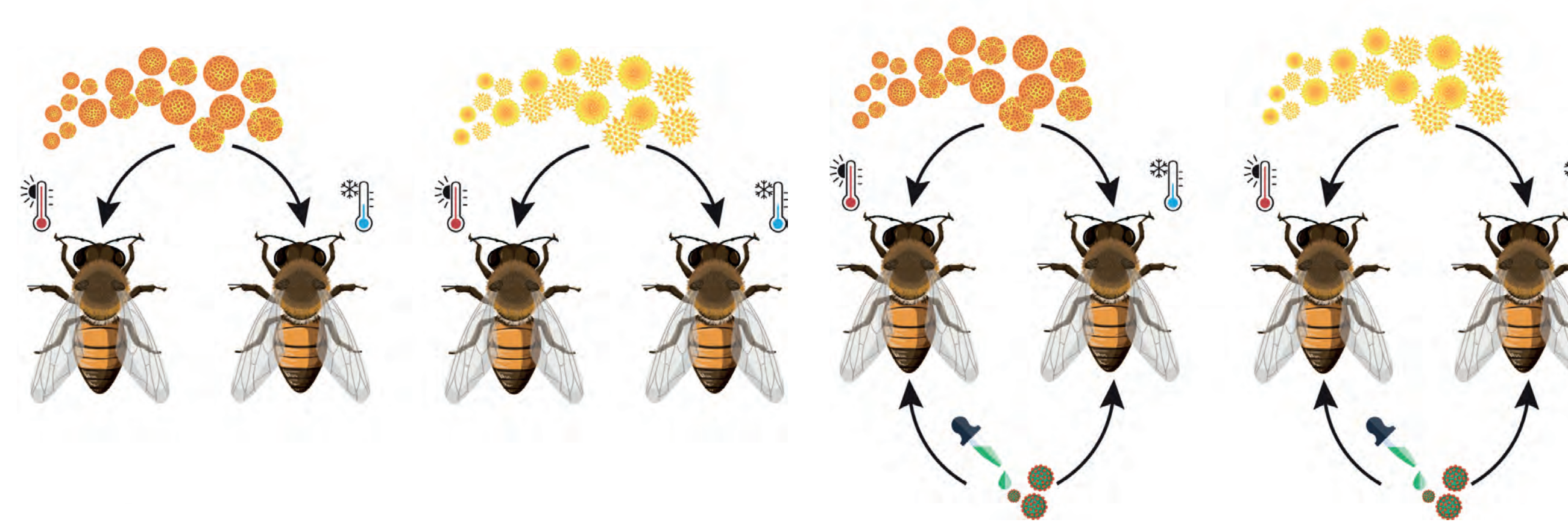
Identification of microbial profiles linked to resilience under different management conditions, landscapes and in different honeybee genotypes

- Dedicated field experiment to study microbial community dynamics and virus abundances associated with management, landscape and host genetic line at colony level
- 2 genetic lines (selected and un-selected for varroa resistance).
 - 2 contrasting environments (agricultural and seminatural/forest)
 - 2 management (innovative vs conventional)



HOLOBIONT LAB EXPERIMENT

Identification of holobiont functional traits at the individual level
 Controlled laboratory experiments to determine functional hologenomic profiles at individual level (shotgun genomics (DNA) and metatranscriptomics (RNA)) associated with exposures to nutrient stress and pathogen challenge.



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