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PP-111 [Bee Health]

BEENERGIA

Pathogens on the move:

Impact of pathogen transmission between managed and wild bees

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Wild bee populations are declining in many regions[1] - and that's bad news for nature and for us. Why? Because wild bees are key to pollination and healthy ecosystems, as honey bees are.

Managed honey bees do not just share flowers with wild bees - they also share diseases[2]. Are these diseases also responsible for wild bee declines[3,4]?

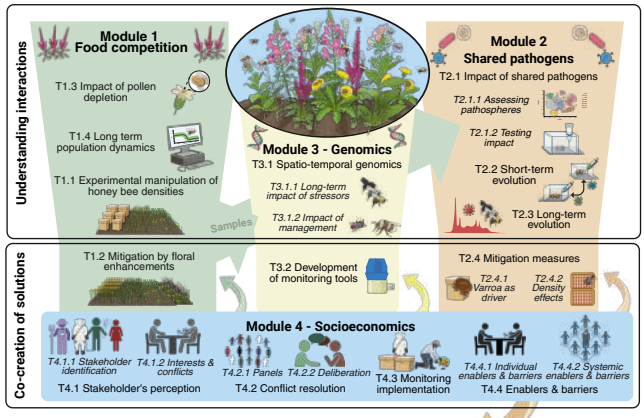
BEENERGIA aims to identify if, when, and how managed bees pose a risk to the resilience of wild bee populations.

Module 1
Explores how wild bee reproduction is affected when they must compete for nectar and pollen, especially during the flower-scarce summer months.

Module 3
Explores how managed bees shape the genetics and evolution of wild bee populations.

Module 4
Connects science with beekeepers, conservationists, and policymakers and how they perceive bee interactions

Graphical overview of the BEENERGIA project



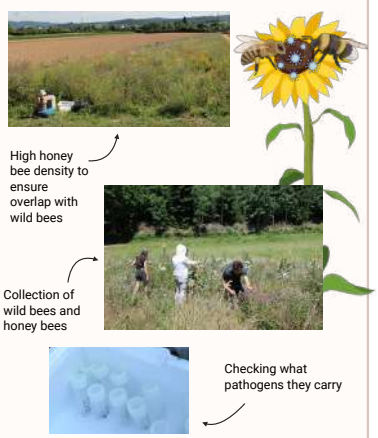
Module 2

Can diseases of managed bees affect wild bees?

How does transmission affect the short- and long-term evolution of pathogens?

How can we mitigate potential effects of pathogen transmission?

Field survey: are pathogens shared?



High honey bee density to ensure overlap with wild bees

Collection of wild bees and honey bees

Checking what pathogens they carry

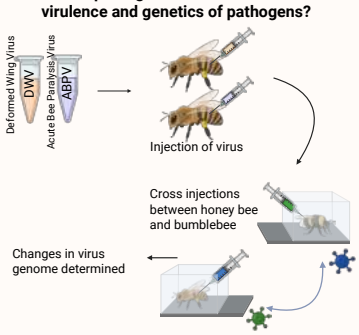
Do the shared pathogens affect wild bee reproduction and survival?

Knauer et al. 2022

Screening wild bee females for pathogens found in the first step

Link pathogens found with the number of offspring and their sex ratio

How does pathogen transmission affect the virulence and genetics of pathogens?

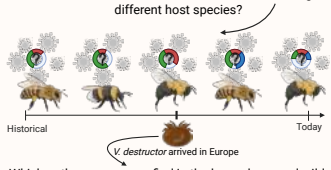


What is the long-term impact of bee management on pathogen transmission and evolution?

We screen museum samples

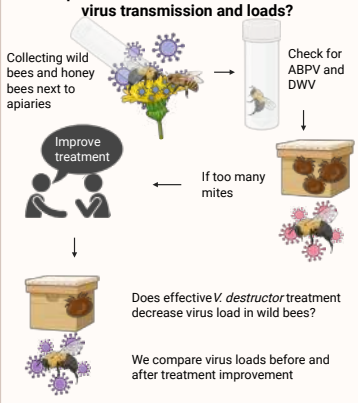
Endogenous Viral Elements (EVEs) are used. EVEs are viral genome sections integrated into the host genome.

When did the viruses start infecting the different host species?



Which pathogens can we find in the honey bees and wild bees before *V. destructor* was present in Switzerland

Does improved *Varroa destructor* control decrease virus transmission and loads?



Are big bee hotels pathogen and parasite paradises?

Compare big and small wild bee hotels and compare the virus loads

Visual inspection of brood mortality and parasites

References

1. D. Goulson, E. Nicholls, C. Botías, E. L. Rotheray, Bee declines driven by combined stress from parasites, pesticides, and lack of flowers. Science. 347 (2015).
2. O. Yañez, N. Piot, A. Dalmon, J. R. de Miranda, P. Chantawannakul, D. Panziera, E. Amiri, G. Smagghe, D. Schroeder, N. Chejanovsky, Bee viruses: routes of infection in *Hymenoptera*. Front. Microbiol. 11, 943 (2020).
3. D. Goulson, E. Nicholls, C. Botías, E. L. Rotheray, Bee declines driven by combined stress from parasites, pesticides, and lack of flowers. Science. 347 (2015).
4. J. M. Iwasaki, K. Hogendoorn, Mounting evidence that managed and introduced bees have negative impacts on wild bees: an updated review. Curr. Res. Insect Sci. 2 (2022).

The poster and most illustrations were made with BioRender

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Pathogens on the move: impact of transmission between managed and wild bees

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Wild and managed bees are essential pollinators, supporting natural ecosystems and agricultural productivity. However, growing concerns about wild bee declines have highlighted the need to better understand the impact of shared pathogens. Indeed, previous research has suggested that pathogens can be shared between managed honey bees and wild pollinators. However, the extent of this transmission, the consequences for wild bee reproduction, and the role of bee management remain unclear. In this project, we will use a comprehensive approach with nine managed and wild species to better understand these factors using genomic tools, we will explore which pathogens are shared, which actually have an impact on survival and reproduction, and how viruses evolve as a result of interspecific transmission. This project will also compare historical and contemporary samples to study long-term pathogen infection dynamics. In addition, we will evaluate whether improved control of Varroa destructor, a known vector of viruses, can reduce virus spillover to wild bees, and whether managed solitary bee densities affect their level of infection. Altogether, this interdisciplinary project will integrate state-of-the-art molecular techniques with innovative field and laboratory assays to provide critical insights into pathogen spillover dynamics. In collaboration with farmers and beekeepers, BEENERGIA (Bridging Ecological and socio-Economic scieNces to Enhance our undeRstandinG of the Interactions between mAnaged and wild bees) aims to develop evidence-based management strategies to mitigate disease transmission and support both wild and managed bee populations. These findings will contribute to a more sustainable coexistence of managed and wild pollinators, informing conservation policies and promoting best practices in beekeeping and pollinator management.