

Executive summary

The BEE DOC comprised a network of eleven partners from honeybee pathology, chemistry, genetics and apicultural extension aiming to improve colony health of honeybees. The BEE DOC filled empirically and experimentally knowledge gaps in honeybee pests and diseases' and quantified the impact of interactions between parasites, pathogens and pesticides on honeybee mortality. Specifically BEE DOC showed for two model parasites (*Nosema* and *Varroa* mites), two model viruses (Deformed Wing Virus, Black Queen Cell Virus) and two model pesticides (thiacloprid, τ -fluvalinate) how interactions affect individual honeybees and colonies. The BEE DOC analysed the transcriptome of honeybees to explore host-pathogen-pesticide interactions and identified novel genes for resistance against *Nosema*. The BEE DOC specifically addressed sublethal and chronic exposures to pesticides. Whereas interaction effects between the tested pathogens and pesticides could be identified at the level of the individual honeybee, these were strongly buffered at the colony level where no such effects could be found. Although this does not exclude potential interactions for other pathogens and pesticides in general, it did show that the colony provides a system that is better buffered against environmental changes than is the individual.

The BEE DOC developed various novel diagnostic screening methods including the BEE DOCTOR tool for multiple pathogen diagnostics in one single test assay. The BEE DOC identified novel compounds in bee products with relevance for honeybee health and developed concepts for disease prevention using novel treatments with probiotic bacteria. The BEE DOC was linked to various national and international ongoing European, North- and South-American colony health monitoring and research programs, which not only ensured a pan-European but also a global visibility. This greatly facilitated the transfer of results not only within the scientific community but also into apicultural practice in the world community of beekeepers and the general public.

The BEE DOC's broad dissemination strategy succeeded in enhancing the public appreciation for the role of honeybees not only for honey production but also for its pollination services. The significance of honeybee colony losses for ecology, economy and society has been recognized at the level of policy makers and BEE DOC could substantially contribute to this raised awareness.