



EC funded projects on Varroa



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Structure of the presentation

- 1) Completed projects
- 2) On-going projects
- 3) perspectives

1) Completed projects

FP6

BRAVE - Bee research and virology in Europe - identifying the research needs for protecting European agriculture and ecosystems against viral diseases (2005)

http://cordis.europa.eu/project/rcn/75718_en.html

BEE SHOP - Bees in Europe and Sustainable Honey Production (2006-2009) http://cordis.europa.eu/project/rcn/78605_en.html

FP7

BEE DOC - Bees in Europe and the decline of honeybee colonies (2010-2013) http://cordis.europa.eu/project/rcn/94004_en.html

FP7-PEOPLE ; Marie Curie Action

PYNAMITE - Mode of action and selectivity of pyrethroids on economically important mites and ticks (2012-2014)

HORIZON 2020

BEE SHOP

2006 to 2009; 9 partners; ~2 million €

Main topic: Bees in Europe and Sustainable Honey Production

- New analytical tools for honey quality
- Novel treatment of diseases, by understanding the epidemiology of diseases
- Genetic tools to facilitate selection of disease resistant stock
- New strategies to avoid foraging of contaminated honey

BEE SHOP

Results on pathogen transmission and virulence

American Foul Brood:

- Variation in strain virulence but no correlation at individual or colony level
- Practice for breaking transmission routes included in the manual for breeding resistant bee.
- Genetic region identified for resistance to AFB

Varroa:

- Identification of genetic traits for increased tolerance: two regions identified
- Significant positive correlation between mite loads and virus titres (**Deformed Wing Virus**)

BEE DOC

2010 to 2013; 11 partners; ~3 million €

Main topic: Bees in Europe **and the Decline of Honeybee Colonies**

2 model parasites (Nosema and Varroa mites)

2 model viruses (Deformed Wing Virus, Black Queen Cell Virus)

2 model pesticides (thiacloprid, τ -fluvalinate)

And how **interactions** affect **individual** bees and **colonies** in different European areas.

BEE DOC

Results on Varroa resistance

2 separate European honey bee populations survive Varroa infestations without mite control (Gotland and Avignon) due to the suppression (or reduction) of mite reproduction (probably achieved through different mechanisms)

Less virus load (BQCV, SBV, DWV)

Although many different factors or pathogens may be associated with colony losses, the main culprit is the Varroa mite

PYNAMITE

Mode of action and selectivity of pyrethroids on economically important mites and ticks (2012-2014)

EU contribution:

EUR 278 807

Coordinated in:

United Kingdom



Subprogramme: FP7-PEOPLE-2011-IEF -

Marie-Curie Action: "Intra-European fellowships for career development"

Call for proposal: FP7-PEOPLE-2011-IEF

Funding scheme: MC-IEF - Intra-European Fellowships (IEF)

Project reference: 298831

Funded under: FP7-PEOPLE

http://cordis.europa.eu/project/rcn/103821_en.html

HORIZON 2020



PYNAMITE

Mode of action and selectivity of pyrethroids on economically important mites and ticks (2012-2014)

Objectives

- to increase the understanding of pyrethroid **effect mechanism and selectivity** on mites/ticks (crucial for the design of next generation compounds).
- to enhance selectivity of pyrethroid pesticides - **model organism Varroa mites on honeybees**.
- to characterise pyrethroid **interactions** with tick/mite Na channels **at molecular level**.
- to identify **novel resistance mutations**, as resistance development in pest populations threatens the long-term success of currently effective compounds.
- to develop rapid, high throughput DNA-based **assays for diagnosing** the presence/absence of resistance **mutations** in field populations of ticks/mites.



PYNAMITE

Mode of action and selectivity of pyrethroids on economically important mites and ticks (2012-2014)



PYNAMITE collected Varroa destructor mites (partly responsible for the worldwide decline in bee health) from bee colonies around Europe, and searched for pyrethroid resistance.

Researchers narrowed down the resistance to a specific mutation in the VGSC gene (voltage-gated sodium channels (VGSCs), a protein targeted by pyrethroid insecticides on the membrane of insect cells).

From this work, scientists designed a rapid assay that can detect pyrethroid resistance in Varroa destructor populations.

2) On-going EC funded research

FP7-KBBE - Research Theme: 'Food, agriculture and fisheries, and biotechnology'

SMARTBEES – Sustainable Management of Resilient Bee populations (2014-2018)

SMARTBEES

Sustainable Management of Resilient Bee populations (2014-2018)

Project reference: 613960



Total cost:

EUR 7 762 261

EU contribution:

EUR 5 998 866

Coordinated in:

Germany

Subprogramme:

KBBE.2013.1.3-02 - Sustainable apiculture and conservation of honey bee genetic diversity

Call for proposal:

FP7-KBBE-2013-7-single-stage

Funding scheme:

CP-TP - Collaborative Project targeted to a special group (such as SMEs)

http://cordis.europa.eu/project/rcn/192071_en.html

HORIZON 2020



Objectives

- to identify crucial facets of **honeybee resistance** to colony losses, **Varroa** and viruses;
- to characterise the **genetic background** of the resistance mechanisms in honeybees;
- to develop **breeding strategies** to increase the frequencies of these valuable traits in local honeybee populations;
- to promote multiple local breeding efforts, to conserve **local resilient populations** and will develop molecular tools for describing and safeguarding future populations;
- to protect European natural honeybee heritage.

SMARTBEES has not yet done a first reporting.

The state of play is best visible through the newsletter

<http://www.smartbees-fp7.eu/Extension/newsletter-1/>

The project's work is divided into 10 separate work packages. Work packages (WP) which share common objectives are grouped into so-called working groups (WG); Biodiversity (WP3, 4), Extension (WP 5, 6, 7), Breeding (WP 1, 2), Pathogens (WP 8, 9). An overview of these work packages is depicted in figure 1.

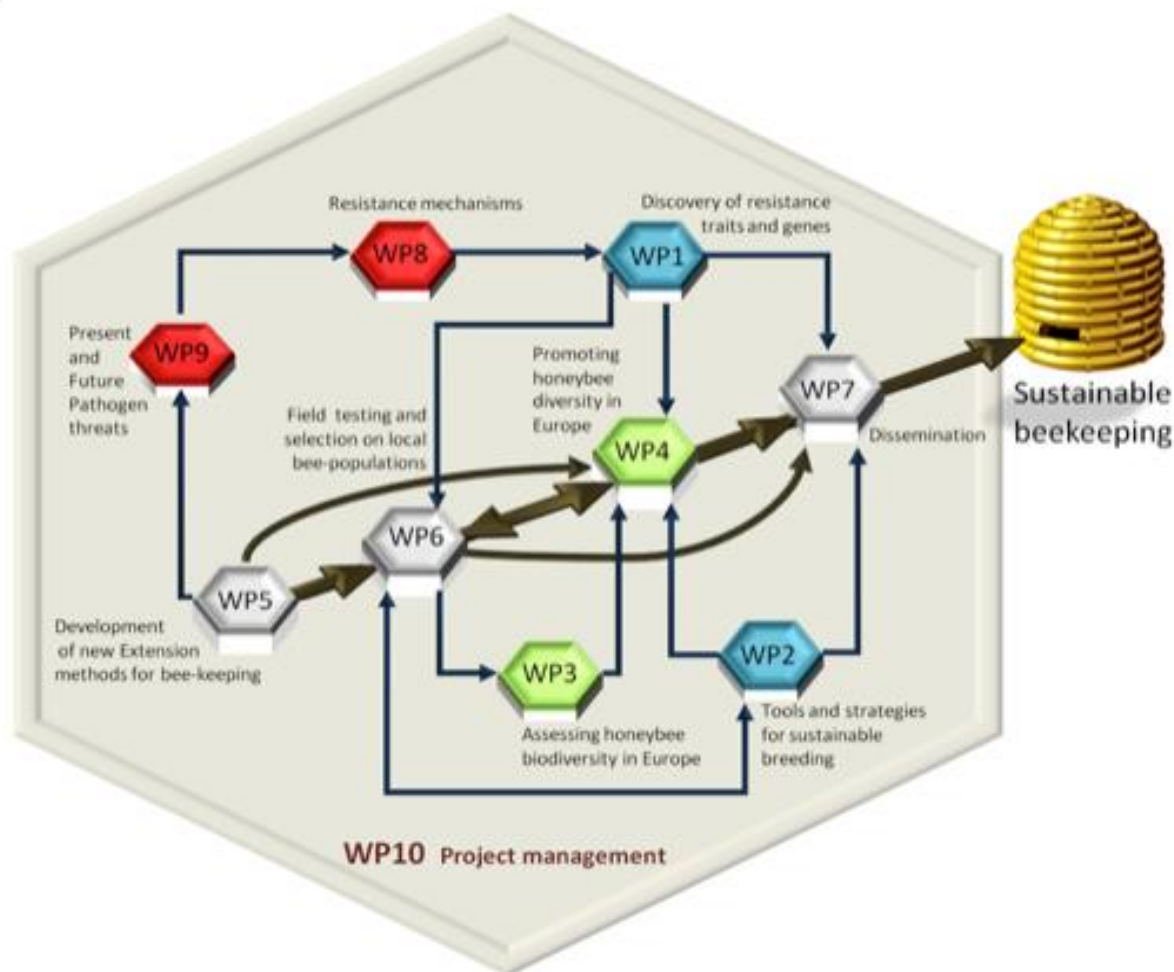


Figure 1. Work packages, their connections and organization into working groups.

WG Pathogens

Focuses on:

- Investigating the underlying mechanisms that determine the resistance and tolerance of the honey bees to Varroa and deformed wing virus (DWV)
- Determining both the present and future threats from DWV, the most important viral disease of honey bees in Europe.

WP8 : Aims to understand how the immune system of the honey bee might resist DWV. We will help inform other SmartBees partners, namely WP1, what genes and traits are beneficial in a breeding programme. We will also investigate how factors such as pesticides, poor diet and unfavourable weather impact the immune system of the honey bee and the subsequent effect on DWV infections. Studies on optimising bee diets for resistance to DWV will be performed to help beekeepers protect their bees from DWV by supplementing nutrition.

WP9: aims to understand how the normally non-pathogenic DWV becomes highly pathogenic when the honey bee colony has Varroa. What happens to DWV as it is passed between the bee and the Varroa and then transmits back to the bee that causes it to become so damaging? If we understand the change in DWV in the presence of Varroa, we will be better able to predict and control DWV damage. We will also survey across Europe DWV variants that have varying degrees of pathogenicity and are present in different honey bee subspecies to help understand and predict DWV outbreaks.

3) Perspectives

FP7 is replaced by Horizon 2020

Increase in budget, coupling research to innovation, challenge-based approach, new approach to Work Programme and Calls...

THERE IS ROOM for project proposals on bees and pollination

Excellent Science

- European Research Council (ERC)

Industrial leadership

- Innovation in SMEs

Societal Challenges

- SC2: Food Security, Sustainable Agriculture and Forestry...
- SC5: Climate Action, Environment, Resource Efficiency...

SFS-16-2017: Bee health and sustainable pollination *(indicative)*

Challenge:

Bees (including managed and wild bees, social and solitary bees) are subject to numerous pressures in the modern world: exposure to cocktails of agrochemicals, various pathogens, lack of abundance and diversity of feed, flowers, etc., and possibly even climate change. Stressors do not necessarily act in isolation, but often in combination, and may differ between warm and cold geographical areas.

Regulations and beekeeping or agricultural practices do not currently address such interactions. Even studying the interactions poses a major challenge, due to the difficulty of testing and control in natural conditions. There are gaps in our understanding of the underlying mechanisms and how to interpret them in order to discern trends and understand the natural biology of colony health how it interacts with the stress factors.

Previous and on-going EU projects have sought to shed some light in particular areas.

The European Food Safety Authority (EFSA) and the EU reference laboratory (EURL) for bee health are addressing more focused aspects of a holistic risk assessment of multiple stressors in honeybees in the MUST-B project. Nevertheless, there have been no significant breakthroughs in our ability to understand and therefore mitigate the stressors of bee health (at least not without possible detriment to other sectors), and to ensure sustainable beekeeping and/or the provision of adequate pollination services in the EU.

SFS-16-2017: Bee health and sustainable pollination *(indicative)*

Scope:

The research will focus on bee health and sustainable pollination, taking a transdisciplinary approach and building on and synthesising knowledge from previous EU projects, national research and existing networks, and EFSA and EURL initiatives. The projects should address the most critical obstacles to sustainable beekeeping and the provision of bee pollination services, taking account of socio-economic factors and human behaviour, in various regional EU scenarios, and propose measures to mitigate the most critical gaps/stressors/threats. It should be based on a comprehensive mapping of our current understanding, in particular including recent research. The research activities should provide as far as possible model systems for sustainable apiculture in several representative EU settings of environment and beekeeping and a better understanding of the contribution of bees to sustainable pollination for major dependent crops in the EU (with or without managed honeybees). Projects should fall under the concept of the 'multi-actor approach'. The projects should ensure appropriate dissemination to the breeding and professional sectors and other relevant stakeholders to facilitate uptake of results.

SFS-16-2017: Bee health and sustainable pollination *(indicative)*

Contribution from the EU of **up to EUR 4.5 million** would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude the submission and selection of proposals requesting other amounts. *Total budget for topic: EUR 9 million*

Expected Impact:

Review of the **most critical gaps/stressors/threats** in achieving bee health, sustainable pollination and sustainable beekeeping in different European.

Contribution to the development of **mitigation measures for the most critical gaps/stressors/threats**.

Provision of **model systems for sustainable apiculture**.

Type of Action: Research and Innovation action

Thank you for your attention!

