SUSTAINABLE MANAGEMENT OF RESILIENT BEE POPULATIONS

SmartBees

Katherine E Roberts and Jason Learner, National Bee Unit, York

The genetic diversity of the European honey bee has been the result of natural selection over millions of years, in which each population became adapted to the climate, vegetation, parasites and diseases of its environment. This led to a number of different *Apis mellifera* sub-species across the continent.

Today, however, the situation is dramatically different. One of the many reasons for this is the incursion of the parasitic mite, *Varroa destructor*, which is tolerated in its natural host, the Asian honey bee (*Apis cerana*), but has led to catastrophic losses of honey bee populations across the world. In addition there has been a systematic replacement of many native European bee subspecies with races that have been bred for productivity, behaviour and disease resistance for many years.

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Both of these factors drastically reduce the genetic diversity of honey bees in Europe and endanger sustainable, regionally acclimated beekeeping. Recently, the European Union has taken steps to find new approaches to advance the understanding of the complex interactions between the honey bee and the mite in the €6 million, EU-sponsored "**S**ustainable **Ma**nagement of **R**esilien**t Bee** Population**s**' or SmartBees project, over the next four years.

This unique project combines the expertise of geneticists, molecular biologists, virologists, parasitologists, immunologists, communication specialists, mathematicians, bee specialists and beekeepers from 11 countries across 16 organisations, including universities, research institutions and companies. The aim of this international project is twofold:

- To analyse and improve the current state of genetic diversity among European bees
- To understand further the interrelationship between bees, mites and their associated viruses (particularly deformed wing virus – DWV).

The project is being coordinated by the Institute for Bee Research Hohen Neuendorf, in Germany, alongside the National Bee Unit (NBU), York, which heads the project in the UK along with its collaborators at the University of Aberdeen.

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WP5 – breeding to maintain honey bee genetic diversity

SmartBees comprises nine work packages (WP) which divide up the research activities. The NBU is involved in six of the work packages.

WP 1 – 'Gene discovery of resistance traits', where we aim to identify bees with enhanced virus (DWV) resistance

WP 5 – 'The development of new husbandry methods for sustainable apicultural production and maintained honey bee genetic diversity', engaging with beekeepers and bee breeders on their needs for dissemination strategies in order to develop a general method for apicultural development in honey bee management

WP 6 – 'Field testing and selecting local bee populations', where the performance and disease resistance of local honey bee populations and breeding lines will be analysed

WP 7 – 'Dissemination', where training and findings will be disseminated to stakeholders, including producing articles for beekeeping magazines and peer-reviewed journals

WP 8 – 'Elucidating and enhancing honey bee resistance mechanisms to parasitic diseases'

WP 9 – 'Determining present and future pathogen threats', by investigating the virulence of Europe-wide DWV isolates.

Field Testing

WP 6 (Field testing) will be of particular interest to beekeepers throughout Europe. In this WP, which is under the

WP1 will aim to identify bees with enhanced virus resistance

responsibility of the German Bee Institute in Kirchhain, Germany, honey bee colonies from different subspecies across Europe will be tested for traditional traits. These include honey production, docility and swarming. Principally, however, traits associated with levels of resistance against varroa mites will be assessed, including hygienic and grooming behaviour, varroa-sensitive hygiene (VSH) and natural mite mortality.

Standardised methods for assessment of these traits will be established for use by participating beekeepers, while some more specialist methods will be carried out with partner research institutes. Around 80 testing apiaries, each consisting of 10–20 colonies, will be established across Europe out of which around six will be in Great Britain and Ireland.

The applied management and testing protocol will be adapted to local conditions and beekeeping approaches. However, the test colonies should be managed with a restricted number of locally adapted methods to allow colonies to express their true potential.

Trained and Updated

All the beekeepers involved in SmartBees will be trained and updated frequently during the project; this is fundamental to the project's success as dissatisfaction with the performance of native bee races was a fundamental reason for their replacement with races enhanced by breeding strategies. Therefore, breeding strategies that have proven to be successful will be adapted for previously neglected bee races.

Data from the European Reference Laboratory for Bee Diseases will be analysed in order to prepare for future diseases and threats, while a working group specialising in knowledge transfer will prepare the findings for practical use, creating learning modules and building information networks within and between countries. The project's findings and development of new methods and strategies will only lead to a sustainable improvement of bee health and diversity if European beekeepers are actively involved. We would therefore invite you to visit the SmartBees (www.smartbees-fp7.eu/extension) and NBU (www.nationalbeeunit.com) websites (see below), for further information and updates.

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