

# Honey Bee Research at the National Bee Unit

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The National Bee Unit (NBU) is part of the Animal and Plant Health Agency (APHA) and is funded by the Department for Environment, Food and Rural Affairs (Defra) and Welsh Government to provide and manage an inspectorate for notifiable honey bee diseases and pests in England and Wales. Separately, Defra also funds Fera Science Limited, which provides diagnostics and research for the NBU under the terms of the Long Term Services Agreement (LTSA). The organisations' different roles and their relationship are described in a recent article by Sandra Gray and Julian Parker<sup>(1)</sup>.

The NBU itself does not have a research budget and all research projects are funded by Defra or external grant awarding bodies. Below is a summary of some of the projects of recent times. Further details of past projects can be found on BeeBase, on the NBU research pages. We have broken the research down by how it is funded, as that helps explain the range of research the NBU is involved with.

## Research at Fera Science Under the Long Term Services Agreement

Recent research projects at Fera Science funded by Defra under the LTSA have focused on invasive species that pose a

threat to honey bees, such as the small hive beetle (*Aethina tumida*) and the yellow-legged or Asian hornet (*Vespa velutina nigrithorax*).

The small hive beetle (SHB) is an invasive species that poses a global threat to apiculture. A contingency plan has been developed to deal with any incursions of this insect into the United Kingdom (UK). As part of the preparedness and contingency planning, knowledge of effective treatment methods for use in the event of an outbreak of SHB in the UK is required. Previous research conducted at Fera assessed control methods for the SHB based on both chemical and biological treatments. A more recent project built

Fera Science Limited is based at the York Biotech Campus in Yorkshire



on these previous findings, which had established that entomopathogenic nematodes could provide effective control of SHB through infection of the wandering larvae/pupal stage.

Efficacy of several entomopathogenic nematode species was demonstrated and subsequent studies focused on the use of *Steinernema krausse*, which is native to the UK.

In the most recent study, the focus was on the evaluation of a different entomopathogenic nematode species, *Steinernema carpocapsae*. Trials examined the efficacy when applied to sand and to different soil types. The effect of the addition of adjuvants – substances that improve the efficacy of an insecticide – was also examined. Publication of results from this research project is expected in 2021.

Incursions of the yellow-legged or Asian hornet have been reported in Great Britain since 2016. On each occasion, nests have been found and destroyed. Fera has examined all nests found to date and studied the individuals within the nest to ascertain the life stages present and whether it was likely that new queens had been produced. None of the nests studied had produced the next generation of queens.

Analysis of the DNA of the individuals found (using microsatellite analysis) was also undertaken to establish genetic relatedness. This helps us to understand whether a nest was likely to be the result of an incursion from Europe or a new arrival from Asia (where this species is native), whether the individuals were related to other nests found in the UK and whether individuals caught away from the nest were related to those in the nest.

To date, all UK nests have derived from the European zone of secondary colonisation, rather than from Asia. None of the nests discovered so far have been direct offspring of another UK nest. Further details of the nests and the genetic analyses can be found in the recent publication by Jones et al<sup>(2)</sup>.

Further Asian hornet work is being done investigating the diet of Asian hornets in the UK, as well as developing an app to assist the inspectors with the track and trace phase of Asian hornet responses.

## Varroa

In addition to the research on invasive species, we have recently carried out a study looking at management options for *Varroa destructor*. Recent results from the NBU annual husbandry survey have



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shown that approximately six per cent of beekeepers report using no treatment for varroa mites. Most beekeepers responding to the annual husbandry survey reported using thymol-based products for control of varroa.

Guidance on effective methods for controlling varroa mites that considers the efficacy of products, frequency of use, and how application methods and storage may impact on efficacy is needed.

Researchers at Fera undertook a review of products currently available for control of varroa. Based on this review and a consideration of beekeepers' needs regarding scale, cost, ease of application and beekeeper opinions on the use of chemicals, a trial was designed to examine different approaches for the control of varroa. This study aimed to compare the effect of no treatment for varroa with treatment methods commonly used by small-scale beekeepers, large-scale beekeepers and a chemical-free approach. The study commenced in October 2019 and will be completed this spring, with publication of results expected in late 2021.

## Research Funded by Defra Outside of the LTSA

Projects funded by Defra outside of the LTSA are usually larger projects and are often put out to tender. Recently, these have been focused around gaining information to support the implementation of the *Healthy Bees Plan 2030*<sup>(3)</sup>.

Over the time of the Healthy Bees Plan (2009–2019), the number of beekeepers and apiaries registered on BeeBase has increased consistently, while the workforce available within the inspectorate has not increased in proportion. However, the data from inspections has consistently been gathered by inspectors and recorded on BeeBase.

In 2018, a team from Newcastle University led by Professor Giles Budge analysed the data and the key findings from this analysis can be found in the

*Healthy Bees Plan Review*<sup>(4)</sup>. Subsequently this has led to review of the BeeBase rules used to prioritise visits to apiaries that are at greater risk of disease.

Since April 2020, changes have been implemented that increase the effectiveness of disease detection for both American and European foulbrood (AFB, EFB), as well as improving the coverage of visits to locations with increased risk of new threats from abroad.

## Social Science Study

In 2021, Defra and Welsh Government have commissioned a social science study to gather information about different aspects of education and training to ensure that beekeepers and bee farmers have access to training and information that can help them implement effective biosecurity and maintain good standards of husbandry, so as to minimise pest and disease risks and improve the sustainability of honey bee populations.

The study includes getting a better understanding of how the turnover of beekeepers can be managed. It will also review information sources, learning methods and use of social media to help develop resources to support the beekeeping sector. The third part of the project will evaluate current continuous professional development schemes and resources to support bee farmers.

The study has been contracted to ICF Consulting who have carried out several research projects in other areas for Defra. This project is due to finish in July 2021 and subsequently the results will be shared.

## Funded by Grant Awarding Body and Requires Data or Sample Collection from NBU

Historically, the data collected during inspections and/or the sample gathering abilities of the NBU inspectorate have been used for many studies. In general, we are happy to participate. However, we do have to comply with data protection regulations as well as ensuring the additional work does not hamper the NBU's statutory responsibilities.

One such project, recently completed, was the chronic bee paralysis virus (CBPV) study at Newcastle University<sup>(5)</sup> for which the inspectors gathered samples and additional data on where paralysis had been seen during our inspections. This study shows CBPV is an emerging infectious disease with a link to the international movement of bees and further studies investigating this are underway.

## European Foulbrood

Another example is a link with Imperial College London, where Monika Yordanova has just started a study to identify stressors which relate to the development of EFB in honey bee colonies. This is under academic supervision with Dr Peter Graystock and Dr Richard Gill from Imperial College London and Dr Sophie Evison from the University of Nottingham.

The NBU bee inspectors will help gather some samples and data which will be used in this PhD which focuses on investigating how the bacteria responsible for causing EFB, *Melissococcus plutonius*, is transmitted. Additionally, Monika will explore some of the factors that may enhance the bacterium's virulence and confirm the conditions that favour and disfavour its growth in honey bee larvae.

## Collaborative Projects Without Additional Funding

The NBU also takes part in practical research where appropriate and a current example of this is the two-year whole apiary shook swarm trial in collaboration with Bee Diseases Insurance (BDI).

This trial encourages the use of whole apiary shook swarm as a means of reducing the reoccurrence of EFB and was originally due to start last year, but was postponed because of the coronavirus pandemic.

EFB frequently reoccurs within an infected apiary and, to break the cycle, the two organisations are working together to encourage the use of shook swarming of non-infected colonies. BDI is offering greater cover for the duration of the trial period 2021–22 which includes additional compensation for beekeepers who shook swarm the non-infected colonies in their infected apiary and similar compensation if the beekeeper is willing to accept the destruction of combs in empty equipment located within the same apiary. At the end of the study, the reoccurrence rates will be analysed and this analysis will be used to assist in improving the guidance issued for dealing with EFB in the future.

## Summary

Although the above is not a full list of all the projects the NBU and Fera Science Limited are involved in, we hope it gives you a good flavour. □

## Further Details

### Website (BeeBase)

[www.nationalbeeunit.com](http://www.nationalbeeunit.com)

## References

1. Gray, S, Parker, J (2021). The National Bee Unit Organisation and Roles. *BBKA News*, 228, p 164.
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3. Clarkson, R (2020). Healthy Bees Plan 2030. *Bee Farmer*, **6**(6), pp 10–11.
4. Defra and Welsh Government (2020). *Healthy Bees Plan Review*. [www.nationalbeeunit.com/index.cfm?sectionid=41](http://www.nationalbeeunit.com/index.cfm?sectionid=41) pp 48–59
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