Photos: Stephen Fleming

In pursuit of the varroa-tolerant bee

Two days in the life of a research project

Stephen Fleming, co-editor

There is nothing like a beautiful May afternoon for beekeeping and it was nothing like a beautiful May afternoon for beekeeping when, on 30 May 2024, 32 colonies of bees were delivered to a relatively remote area in Lincolnshire. The skies were overcast, the rain was falling, the wind was blowing, and, as a temporary volunteer for the research team, I was being soaked to the skin and having the limits of my strength tested by helping move the hives.

With thanks to Professor Martin Bencsik and his team for enabling me to join the research for two days, and to Dr Harriet Hall for supplying background information on the Better-B project.

1 Dr Harriet Hall, Professor Martin Bencsik and bee farmer Paul Barton inspecting a colony, looking for the queen

A Nottingham Trent University research team, led by Professor Martin Bencsik, had brought 32 queenless colonies from an apiary just south east of Nottingham to a mating 'island' near Skegness, leaving them there for a few weeks to give them time to make emergency queen cells and release virgins that would mate locally with the drones of the colonies that had been brought. It was the early stages of the four-year Better-B pan-European project aiming to produce varroa-tolerant and generally more resilient honey bees.

While beekeepers in many parts of the UK and Europe are going varroa treatment-free and allowing colonies to fail in an attempt to breed varroa-tolerant bees (ultra-hygienic bees), this project is doing so in a very controlled and accelerated fashion, avoiding breeding with drones originating from non-locally adapted colonies, and adding additional elements to the research as it progresses.

The project began in June 2023 leading to beekeepers in reasonable proximity of Nottingham (including Manchester, the Peak District and Northamptonshire) being asked if they would be prepared to donate a colony to the project. The response from associations and beekeepers was excellent says Martin Bencsik and, after a lot of driving, they were able to collect 19 colonies to add to four of their own for the research. The aim was to obtain queens with wide genetic diversity so, for example, particular care was taken to ensure that no two queens were sisters.

These colonies were then stored at a temporary location at Nottingham Trent University to be inspected for disease by the local bee inspector – every colony received the all-clear. One requirement was that these colonies should be headed by a locally bred queen, not one that had been imported. The hope and expectation was that they would have a good spread of genetics, sufficiently diverse for them to be capable of producing at least some varroa-tolerant offspring.

At an apiary near Keyworth, Nottinghamshire, the colonies were expanded into double brood boxes (standard deep Nationals) and fed. Three weeks after the start of feeding, the team arrived to make the splits.

DAY 1

The task on Wednesday 29 May 2024 was to remove and cage the queens and split the colonies into as many reasonably strong and sustainable units as sensible, making sure that each had eggs from which emergency queen cells could be made. As *BeeCraft* readers will appreciate, finding a queen in one hive can be arduous, finding them at speed in so many colonies and then splitting the colonies is definitely a test of beekeeping skill. Fortunately, Paul Barton, experienced bee farmer and membership services officer of the Bee Farmers' Association, generously gave his time and expertise to lead in that task.

Also helping was Paul Smith, a retired teacher and local beekeeper, and Dr Harriet Hall undertaking one of her final research tasks for the university before leaving to take up a job promoting biodiversity with a local authority (readers can see some of her work on bee vibrations in *BeeCraft* October 2023).

In just a few hours on the Wednesday morning, Paul Barton went through each of the colonies, spotting the queen, caging her with a few workers and then splitting the colony according to its strength into two, three and, once, even four splits. Each split contained a minimum of one frame of stores, one frame with eggs and one frame with sealed brood. In total 32 splits were created from the 16 colonies. A few of the original colonies had to be eliminated because they had already created queen cells and had virgins running around – the team did not want to risk bringing a mated queen to the mating island.

Inspecting the colonies quickly revealed that their characteristics were indeed quite varied. There had been a hope that they would be genetically diverse, and in constructing the splits their differences in temperament, developmental speed and other attributes was soon apparent. Of course there is always one: at the end of one line of colonies had been placed the most defensive of all. It proved quite a nuisance even while splitting other colonies, but thankfully once its queen had been removed and the colony had been split, each of its subdivisions became relatively docile.

Under the roof of each colony to be transported to Lincolnshire was a printed laminated sheet detailing its specific ID and provenance.

The queens that had been removed were placed in cages with a few attendant workers ready for distribution to beekeepers in need. I hasten to add that the queen from the very defensive colony was not to be put up for adoption (despite my naughty suggestion that there must be a beekeeper somewhere thought to be deserving of it).

Even in the fairly miserable weather, the bees had been flying for most of the day and so it was Harriet's job to come along in the evening to block up the hive entrances with foam, ready for transportation the following day.

2 Splits ready for transportation
3 Splits to be loaded into the van
4 The splitting team: Paul Barton, Martin Bencsik, Harriet Hall, Paul Thorne
5 The removed queens ready for adoption

The BETTER-B Project – origins and aims

Following the success of the B-GOOD project (2019–23), which involved 12 countries and aimed to develop novel ways of remotely sensing and recording data from both inside and outside honey bee colonies to inform better beekeeping management, the Better-B project was established to build upon those findings to improve colony resilience.

Based on ideas of Darwinian beekeeping, a term coined by Professor Tom Seeley, the Better-B project aims to understand how free-living honey bee colonies survive in nature and to apply this knowledge to apiary management. A range of parameters influencing honey bee survivability will be investigated. The project has different strands. For example, teams in Poland, Portugal (Coimbra), Denmark and Germany aim to establish the maximum bee populations that different landscapes can sustain, while teams in France, Sweden, Portugal (Bragança) and Belgium will identify genes that are associated with heat stress resistance so that they can be incorporated into breeding programmes to tackle the effects of climate change on honey bees.

At Nottingham Trent University, Professor Martin Bencsik's team is running a breeding programme over four years to select bee colonies that are more resilient and better adapted to local conditions. This project is taking varroa as the main selection pressure on colonies and the aim of selecting those which are surviving well without treatment. Eight other countries in Better-B are following the same breeding protocol.

Better-B website: www.better-b.eu

A Better-B public online update event on 14 November 2024: www.better-b.eu

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DAY 2

On Thursday morning, we arrived with a transit van ready for the two-hour trip to the mating 'island' near Skegness.

Finding a mating island (ie, somewhere sufficiently far away from any other known managed bees to avoid mating with them) had been difficult. For logistical purposes, it had to be within a reasonable distance of Nottingham. One convenient site in the Peak District used by Professor Francis Ratnieks in the 1990s no longer met the requirements because some in the area had taken up beekeeping since then.

Eventually, a site was found in Lincolnshire. Paul Barton's search for apiary sites for his own bees had revealed a farmer who had suffered flooding in part of a field devoted to oilseed rape that would not be productive for the rest of the 2024 season. After several weeks of flooding, the water had subsided and a suitable flat apiary site measuring about 30m by 20m had emerged. There were no known beekeepers within 3km and even if there were some free-living colonies in the area that was not a concern to the project because their queens would likely have been locally mated (and not imports).

Finding the site was a win-win for both the farmer and project because just across the track was a huge field of field beans that would soon come into flower, thereby providing the farmer with pollination services and the project with nectar and pollen for the developing splits. In the meantime, in the same field as the mating island, there was oilseed rape that was just going over but probably capable of providing some nectar and pollen for a while.

Having carefully stacked the single-brood split colonies into the transit van, Ellen Walker and Martin of Nottingham Trent University set off for deepest Lincolnshire, appropriately enough passing EH Thorne's headquarters on the way.

On arrival at the mating island, in weather more akin to November than May, and in the corner of the once-flooded field (it might legitimately have been called a honey field because it was so gloopy) we set up the pallets in a near-random pattern to accommodate the split colonies. It was important that the layout would enable bees to correctly identify their own hive entrances and inhibit drifting between colonies, so there were to be no convenient straight lines of hives. On each pallet at least two colonies could be accommodated and faced in opposite directions.

Having put the 32 colonies in position, the job was not complete. The team then had to put feeders on each hive and pour in sufficient sugar syrup so that there would be no immediate risk of starvation as they began making queen cells – even if the weather didn't improve.

That just left the final task of releasing the bees by removing the foam entrances. Because of the vile weather, they were not in too great a hurry to explore their new environment – an unexpected if slightly unwelcome bonus – helping the bees to realise that they had been relocated.

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Next stages

In 13 days (in mid-June), Martin and his team were to return to see how many queen cells had been successfully created. Any surplus queen cells will be carefully transferred into pre-loaded Apideas or mini-nucs and left for another two weeks for queens to emerge and mate.

A few weeks after that, the team will visit to look for the presence of eggs as an indicator of successful mating. At this point varroa populations will also be determined with a mite-wash procedure.

Any hives that have no eggs will be left for a further seven days in case the queen has been slower to begin laying. Colonies with laying queens will be carefully transported back to the apiary in Nottinghamshire and be joined by any late layers sometime later.

There should be minimal danger of any further mating at the Nottinghamshire site late in the season, but that is something that the team will have to be alert to. The colonies will not be treated for varroa and it is accepted that a proportion will not survive through to next spring. Small or weak colonies will also be removed from the experiment. It is the survivors that will be of interest and proceed to the next year of the project. Eight of the colonies will be randomly selected for monitoring with accelerometers, weighing scales and knocking experiments* to see if a 'signature' of a resilient colony can be identified from the data.

Next season, the same overall procedure is planned – and, with luck, the same mating island will be used. The number of colonies is expected to hold at about 25 year-on-year, and the survivors will be those that are better locally adapted and more resilient to the effects of varroa and other stressors without the need for treatments.

BeeCraft will be following the various elements of the study.

Standardising the research across different countries

As with every aspect of the project, there is a protocol to be followed in each country. Below is the nuc creation protocol.

- Divide all brood frames of the mother colony (mother colony will leave experiment)
- Divide all frames as equally as possible between the nucs
- Each nuc to have 5 frames including:
  - a minimum of 1 frame with eggs to produce new queens
  - a minimum of 2 frames with brood and bees (if possible)
  - preferably 1 frame with nectar/honey
- Try to also split drone brood equally across the 4 nucs.

6 The mating 'island' near Skegness

7 Ellen Walker revisits the Skegness Jolly Sailor, beekeeper-style

FOOTNOTE

* For an explanation of the 'knocking' research. See Interview with Martin Bencsik in *BeeCraft* May 2024, page 12