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The latest buzz – smart hives and dancing robot bees boost sustainable beekeeping

EU-funded researchers are using big data and smart technologies to improve conditions for bees and guide beekeepers.

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With an electronic ‘ping’, Professor Dirk de Graaf gets an alert on his smartphone. It’s a message from a beehive that’s in trouble.

De Graaf, a professor of biomedical physiology and insect physiology and head of the Laboratory of Molecular Entomology and Bee Pathology at the University of Ghent, Belgium, has spent the last five years developing a data collection system for beehives that he hopes can greatly improve survival rates.

Smart hives

As part of a Europe-wide research initiative funded by the EU, the B-GOOD project, de Graaf and a team of researchers from 13 European countries joined forces between mid-2019 and November last year to explore how new technologies could help support both the health of bees and the sustainability of beekeeping.

The researchers have created a monitoring system that can identify problems in a hive and give tailored advice to the beekeeper on how to intervene. This system is a potentially crucial ally for beekeepers, of which there were an estimated 615 000 in the EU in 2021.

They developed a digital comb – a thin circuit board equipped with various sensors around which bees build their combs. Several of these in each hive can then transmit data to researchers, providing real-time monitoring.

The next step was to work out how best to interpret the data. ‘The challenge was to figure out which parameters contribute most to the health status of a colony,’ said de Graaf.

Over three seasons, the team monitored close to 400 colonies, spread across the 13 participating countries, allowing them to build algorithms to help interpret the data gathered by the digital combs.

‘It turns out that weight is a good indicator of whether a colony will survive in the winter,’ said de Graaf. ‘Using our technology, we can now identify colonies that need intervention. This is then communicated to the beekeepers via tailored alerts with specific instructions.’

Tech-savvy beekeeping

Bees are a keystone species, essential for pollinating wild plants and many cultivated food crops, including chocolate, coffee, tomatoes and blueberries. It is estimated that around four in five crop and wild-flowering plant species in Europe depend, at least to some extent, on insect pollination.

Yet, the numbers of wild pollinators in Europe, and the world, are declining rapidly due to the combined impact of climate change, habitat loss and widespread pesticide use. According to the European Red List, the populations of around one in three bee, butterfly and hoverfly species are threatened. For de Graaf, the effects of pesticides are particularly detrimental.

‘Very often the bees don’t die immediately when they are exposed to pesticides, but they develop memory issues and eventually fail to return to their hive,’ said de Graaf.

Automatic hive data collection is already being used by some beekeepers, mostly younger ones who are tech-savvy. Now the aim is to promote the use of these tools throughout the beekeeping community, which will allow larger scale data gathering. To this end, the researchers are working closely with the EU Bee Partnership , an EU-wide bee health and data management platform created in 2017.

‘More beekeepers relying on this would be a complete game changer; it would help us to look at bee health from a different angle,’ said de Graaf.

The technology developed may also be able to help beekeepers plan future hives. The B-GOOD team have used the data to create virtual landscapes that predict how a hive will respond to certain environmental conditions. ‘This works a bit like a flight simulator, but for beekeepers,’ he said.

Ongoing funding from the EU will allow the B-GOOD researchers to continue their valuable work through the BETTER-B research initiative which will continue until May 2027.

Inside view

Professor Thomas Schmickl, professor of zoology at the University of Graz, Austria, has also spent the past five years exploring the use of cutting-edge technology to support honeybee health as part of another EU-

More info

- B-GOOD
- HIVEOPOLIS
- EU Protection of bees
- EU Biodiversity strategy 2030