**RADAR TRACKING UNCOVERS SECRET SEX LIVES OF HONEYBEES**

*Results hint at previously unknown type of mating system*

Scientists from Rothamsted and Queen Mary University of London have used radar technology to reveal a previously unknown mating behaviour in honeybees.

Their findings suggest that male bees swarm in specific locations in their attempts to mate with queens and that the males – also known as drones - move between these congregation areas during a single flight.

Beekeepers and some scientists have long believed that drones gather in huge numbers of up to 10,000 in locations known as ‘drone congregation areas’ – but previous research has used pheromone lures to attract drones, raising concerns that the lures could have inadvertently caused the gatherings.

This new study is the first ever attempt to track the flight paths of individual drones and observe them in the absence of lures.

Similar mating sites, in which large numbers of males gather, have been observed in other animals but this is the first time males have been observed to move between multiple locations, hinting at the discovery of a new type of animal mating system.

The research is published today in the journal iScience and coincides with the UN designated World Bee Day, which aims to raise awareness of the importance of pollinators, the threats they face and their contribution to sustainable development.

To track the flight paths of drones, the researchers attached a small antenna-like electronic device, known as a transponder, to the back of individual honeybees.

When the transponder received a radar signal from the transmitter, it absorbs its energy and converts it into a higher frequency signal, which is then detected by the radar antenna.

Using this system, the researchers were able to track the bee’s position relative to the radar every three seconds with an accuracy of around 2m.

The team then used the positions of known landmarks within the outdoor experimental field site to determine the true GPS position of each bee.

The scientists found that drones alternated between periods of straight and convoluted, looping flight patterns within a single flight. On further investigation they showed that phases of looping flight were associated with four distinct aerial locations where drones congregated, and these specific areas were consistent over a two year period.

The researchers propose that drone congregation areas could function like ‘leks’, mating systems in which large numbers of males gather solely in an attempt to mate.

Lek systems are most well known in vertebrates, like deer and grouse, and males are typically faithful to a single lek location.

Dr Joe Woodgate, a Postdoctoral Researcher at Queen Mary and lead author of the study, said: “By using harmonic radar technology to track the bees, we found that individual flight paths show a clear change of behaviour from straight flight to looping flight. Periods of looping flight were clustered in particular locations and repeatable over two years, confirming that stable drone congregation areas, similar to ‘leks’ in other species, do exist.

“We show that drones frequently visited more than one congregation area on a single flight. This is the first evidence for males of any species routinely moving between lek-like congregations and may represent a new form of lek-like mating system in honeybees.”

Interestingly, the study highlights similarities between the behaviour of drones within these congregation areas to swarms of midges or mosquitos. The researchers observed that when drones are making looping flight in one of these areas, the further they go from the centre, the harder they accelerate back towards it. This creates an apparent force, drawing bees toward the centre and leading to a stable, coherent swarm despite individual drones only spending a short time at each location.

However, the researchers still don’t understand how the drones find these congregation areas in the first place.

Drones are born in Summer and their average lifespan is only around 20 days, so new generations can’t find these areas by following older drones, and the results suggest drones locate congregation areas as early as their second ever flight, without any apparent extensive searching.

This implies that they must be able to get the information required to guide them to a congregation from observing the landscape close to their hive.

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