Bees' buzz is more powerful for pollination than for defense or flight

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Buzzing by bees during flower pollination is significantly more powerful than that used for defense or flight, according to a new study from experts at the University of Stirling.

The research found that flower buzzing produced forces of more than 50G—five times that experienced by fighter jet pilots—and provides an important insight into the pollination process.

Dr. David Pritchard, of the University's Faculty of Natural Sciences, led the study and believes the findings suggest that bees use specific types of buzzing vibrations for certain tasks.

Dr. Pritchard said: "We know that bees use their distinctive buzzing vibrations for lots of different tasks and, for this study, we wanted to understand whether buzzes differed by task—or if variations in buzzing were caused by drag on the wings. We found that flower buzzes were much more powerful than those used for defense or flight—suggesting that, rather than being due to drag, bees might have evolved different types of buzzes for different tasks. Buzz-pollinated flowers represent some of our most important economic crops—such as potatoes, tomatoes, aubergines and blueberries—and understanding how bees buzz these flowers also provides an important insight into how these flowers coevolved with bees. This is important because it helps us better understand what these flowers need in order to be pollinated."

Previous studies have identified variations between flight buzzing and defensive buzzing. During flight buzzing, bees' wings flap, however, during defensive buzzing they do not—therefore, it was not clear whether buzzing variations were caused by flapping wings, or not.

To further understand the issue, Dr. Pritchard—working with Stirling colleague Dr. Mario Vallejo-Marin—looked at flower buzzing, during which the bees' wings do not flap. Flower buzzing occurs when bees vibrate flowers to shake pollen onto their bodies.

During the experiment, bees foraged on a buzz-pollinated flower, performed a tethered flight, or were encouraged to perform a defensive

buzz through a gentle stroke of their body. The team used a laser to scan a reflective tag on the bees' bodies to measure the speed of movement 10,000 times per second, with the data analyzed by computer.

Evolved

"We wanted to understand whether defensive buzzing and flower buzzing were similar—and if buzzing variation could be attributed to wing flapping or if bees adapt depending on the task in hand," Dr. Pritchard said. "We found that flower buzzes were much more powerful than buzzes used for defense or for flight—suggesting that, rather than being due to drag on the wings, bees might have evolved different types of buzzes for different tasks."

He added: "Flower buzzing is important to understand because not all bees can buzz flowers. For example, we still do not understand why honeybees do not buzz flowers. By better understanding how flower buzzes appear and differ from the other vibrations bees produce, it may shed light on the reasons why some bees buzz flowers and some do not."

The paper, "Floral vibrations by buzz-pollinating bees achieve higher frequency, velocity and acceleration than flight and defense vibrations," is published in the *Journal of Experimental Biology*.

More information: David J. Pritchard et al. Floral vibrations by buzz-pollinating bees achieve higher frequency, velocity and acceleration than flight and defense vibrations, *The Journal of Experimental Biology* (2020). DOI: 10.1242/jeb.220541

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