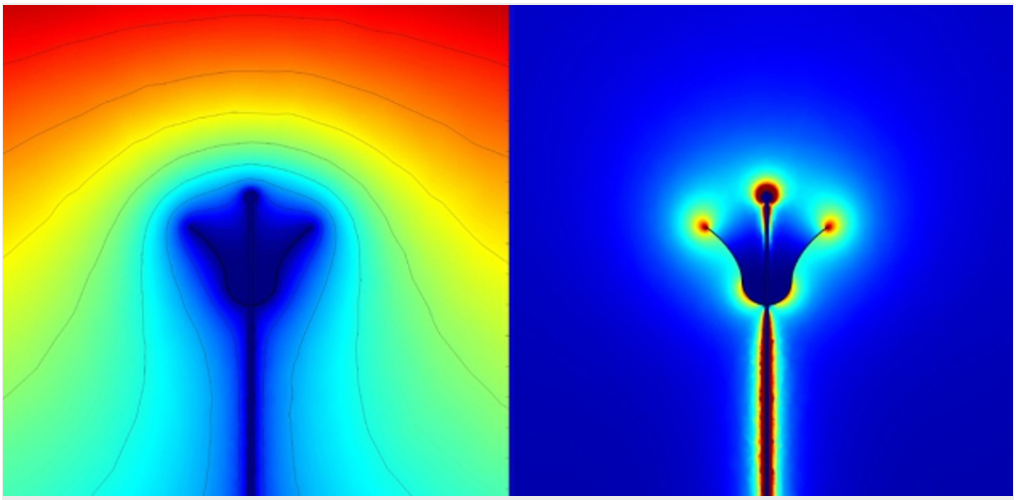
Bumblebees sense electric fields in flowers

Electroreception may help pollinators to guess where others have already fed on nectar.

Matt Kaplan

21 February 2013



Dominic Clarke / Ref. 1

A flower's electric field (right, with associated electric potential on the left) helps bumblebees predict where to find the most nectar.

As they zero in on their sugary reward, foraging bumblebees follow an invisible clue: electric fields. Although some animals, including sharks, are known to have an electric sense, this is the first time the ability has been documented in insects.

Pollinating insects take in a large number of sensory cues, from colours and fragrances to petal textures and air humidity. Being able to judge which flowers will provide the most nectar, and which have already been plundered by other pollinators, helps them to use their energy more efficiently.

It has long been known that bumblebees build up a positive electrical charge as they rapidly flap their wings; when they land on flowers, this charge helps pollen to stick to their hairs. Daniel Robert, a biologist at the University of Bristol, UK, knew that such electrical interactions would temporarily change the electrical status of the flowers — but he did not know whether bumblebees were picking up on this.

Flower power

Keen to find out, he and a team of colleagues measured the net charges of individuals of *Bombus terrestris*, a common species of bumblebee, by using sucrose to lure them into a Faraday pail — an

electrically shielded bucket that reacts to the charge of anything inside it. As expected, most bumblebees were carrying a positive charge.

Next, the team placed the insects into an arena with petunias (*Petunia integrifolia*) and measured the flowers' electrical potentials. Sure enough, when the bees landed, the flowers became a little more positively charged.

Finally, the team released bumblebees into an arena with artificial flowers, half of which were positively charged and carried a sucrose reward, and the other half of which were grounded and carried a bitter solution. Over time, the bees increasingly visited the rewarding charged flowers.

But when the researchers turned off the electrical charge on the flowers and re-released the trained bees, the insects visited rewarding flowers only about half of the time, as they would have by random chance. That suggested that the bees were detecting the electric fields and using them to guide their activities, rather than relying on other clues such as fragrance. The team reports its results in this week's *Science*[1].

“We think bumblebees are using this ability to perceive electrical fields to determine if flowers were recently visited by other bumblebees and are therefore worth visiting,” says Robert.

“We had no idea that this sense even existed," says Thomas Seeley, a behavioural biologist at Cornell University in Ithaca, New York. "Assuming we can replicate the findings, this is going to open up a whole new window on insect sensory systems for us to study.”

Some experts suggest that the study has implications for insects other than bees. “If you think about it, these discoveries could also apply to hoverflies and moths," says Robert Raguso, a chemical ecologist also at Cornell. "We don’t know if they can perceive charge differentials, but they burn a lot of energy while hovering around looking for pollen or nectar. So it would make sense for them to attend to such cues."

Nature | doi:10.1038/nature.2013.12480

References

1. Clarke, D., Whitney, H., Sutton, G. & Robert, D. *Science* http://dx.doi.org/10.1126/science.1230883 (2013).

Nature ISSN 0028-0836 EISSN 1476-4687

SPRINGER NATURE