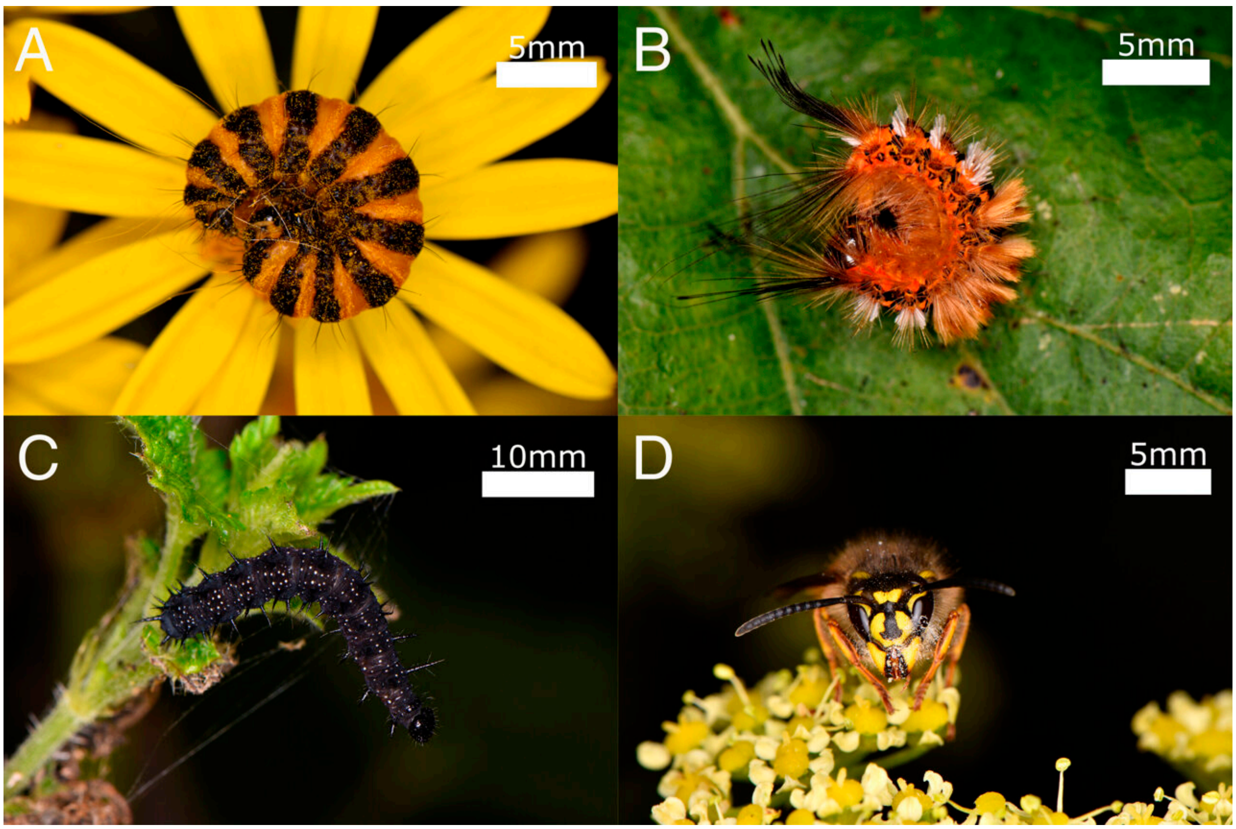
Biologists discover caterpillars are able to sense electrostatic fields generated by predators

May 21 2024, by Bob Yirka



Photographs of the four species investigated in this study. (A) The caterpillar of the cinnabar moth (T. jacobaeae) assuming a defensive coiling posture. (B) The caterpillar of the scarce vapourer moth (T. recens) assuming a defensive coiling posture. (C) The caterpillar of the European peacock butterfly (A. io), midway through a defensive flailing motion. (D) The predatory common wasp (V. vulgaris). Credit: *Proceedings of the National Academy of Sciences* (2024). DOI:

10.1073/pnas.2322674121

Sam England and Daniel Robert, biologists at the University of Bristol, report that at least three types of caterpillars are capable of sensing and responding to an electrostatic field generated by a predator.

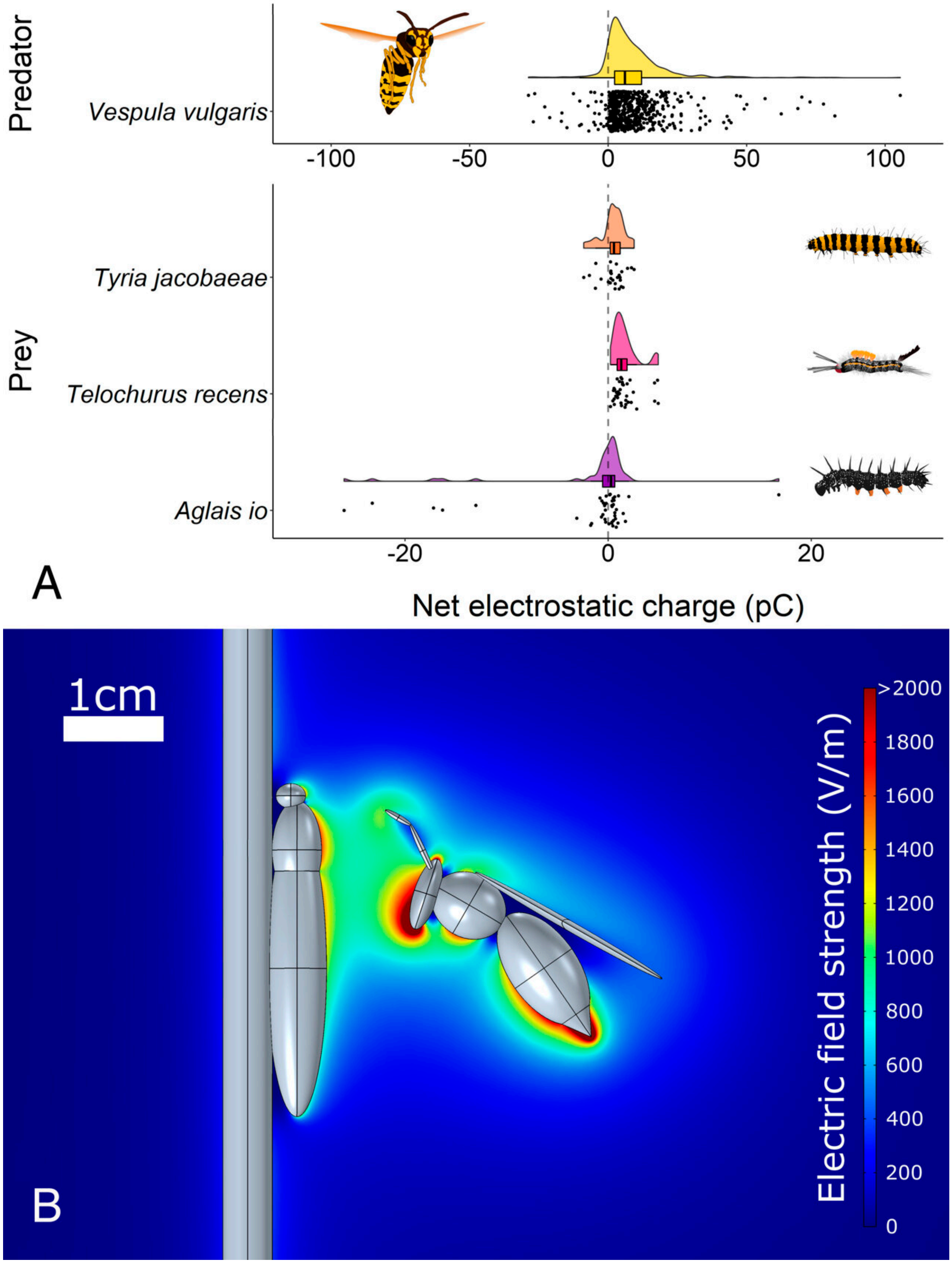
For their study, published in the *Proceedings of the National Academy of Sciences*, they captured more than 200 caterpillars over two years and tested their response to an electrostatic field.

Electrostatic charges are generated by friction. Rubbing a balloon against a rug or tumbling clothing in a drier produces a charge, for example. Prior research has suggested that many animals emit an electrostatic charge as they move and that some creatures, such as flies, spiders and bees, are able to sense them.

In this new study, the researchers wondered if some animals detect electrostatic fields to sense the presence of predators. To find out if that might be the case, the team focused on caterpillars, which have abundant hairs that might serve as electrostatic sensing devices, and wasps, which feed on caterpillars and likely generate an electrostatic charge as they rapidly move their wings through the air.

To test the species, the researchers first captured wasps and found that they did indeed generate an electrostatic field as they beat their wings and that the amount of charge could be easily measured as it changed based on wing activity.

The researchers then captured more than 200 caterpillars, all of just three types: larvae of the cinnabar moth, the scarce vapourer moth and the European peacock butterfly. In the lab, they tested specimens for the ability to sense and react to an artificially generated electrostatic field that matched the output of that generated by a wasp.


Predator
Vespula vulgaris
-100
-50
0
50
100
Prey
Tyria jacobaeae
Telochurus recens
Aglais io
-20
0
20
A
Net electrostatic charge (pC)
1cm
B
Electric field strength (V/m)
>2000
1800
1600
1400
1200
1000
800
600
400
200
0

Characterization of the physical electrical forces acting between predatory wasps and prey caterpillars. The dashed line denotes transition from negative to positive charge values. (B) Two-dimensional slice through the center of a three-dimensional computational model of the electric field strength between a wasp and a caterpillar situated on the stem of a plant. Credit: *Proceedings of the National Academy of Sciences* (2024). DOI: 10.1073/pnas.2322674121

In testing the caterpillars, the researchers found that all three species responded very clearly to an electrostatic charge—some flailed their bodies, others coiled in a defensive posture. They also found that the caterpillar's setae responded most enthusiastically when the electric field matched that typically generated by a wasp. The researchers suggest that caterpillar's setae have evolved to sense the electrostatic field of wasps and likely other predators.

More information: Sam J. England et al, Prey can detect predators via electroreception in air, *Proceedings of the National Academy of Sciences* (2024). DOI: 10.1073/pnas.2322674121