

INSIDE JEB

Desert grassland scorpions might navigate by touch and taste



A fluorescing desert grassland scorpion (*Paruroctonus utahensis*) with a crystal on its back. Photo credit: Mariëlle Hoefnagels.

Since the advent of satellites and Google Maps, most of us just plug in to find our way home. But not the intrepid birds, bees and ants that negotiate the planet. They depend on more traditional means of navigation, orienting by the stars, sun and local views. But Douglas Gaffin from the University of Oklahoma, USA, suspects that scorpions may use another strategy. The arachnids are equipped with a pair of touch- and taste-sensitive brushes, known as pectines, located beneath their abdomens, which can rub along the ground as the animals tour around. Could the fearsome creatures be tasting the ground and reading the surface by touch with their pectines to navigate home? To find out, Gaffin with colleagues Maria Muñoz and Mariëlle Hoefnagels (both from the University of Oklahoma) visited the University of New Mexico Sevilleta Field Station to gather desert grassland scorpions (*Paruroctonus utahensis*) to bring back to the lab, to find out how the animals navigate when they have to depend on their pectines alone.

‘We tested various combinations of sand, soil and arena configurations before we settled on our final design of water heater drainage pans surrounded with blackout curtains to prevent the scorpions from seeing landmarks for visual navigation’, says Gaffin, who also provided the scorpions with a mound of sand to burrow in. Then, the team glued a small crystal to the back of each animal that would reflect light during the day and infrared light at night, to allow the team to film and keep track of each individual as it ambled around an enclosure after dark. If the animals were able to navigate using their pectines alone for guidance, Gaffin reasoned that the scorpions would circulate in ever expanding circles around their new homes to define the lie of the land to build a map of their surroundings for later use.

Collecting 1500 h of movies as 23 scorpions constructed burrows in the mound of sand and in a featureless flat arena, Gaffin, Muñoz and Hoefnagels saw

18 of the arachnids emerge from their new burrows and begin exploring the region around their home, looping and completing up to 10 exploratory circuits. The scorpions appeared to be performing learning walks, just like navigating ants that depend on local knowledge, learned when they first emerge from their home and circulate around their burrow. The scorpions were probably gleaned information about their surroundings from their touch- and taste-sensitive pectines alone, as they were unable to see any landmarks. And, when the trio cunningly rotated the scorpions’ arenas – first by 90 deg, and then a day later by a further 90 deg – the pioneering arachnids successfully found their repositioned burrows, instead of sticking stubbornly to exploring the burrows’ original location. They were tasting and reading the feel of the sand with their pectines to return continually to their burrow homes, even though the homes had moved by ~15 cm when the scientists rotated the desert arenas.

So, the desert scorpions’ pectines appear to provide the animals with their sense of place, but that does not rule out the possibility that the arachnids also depend on vision for navigation when provided with a more informative view. And Gaffin suspects that scorpions also use their own internally calibrated odometer to keep track of their location relative to home when they venture out, once they have a sense of the lie of the land.

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