Vampire jumping spiders identify victims by their antennae

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Evarcha culicivora jumping spiders, also known as vampire spiders, are picky eaters by any standards. Explaining that the arachnid's environment is swamped with insects, Ximena Nelson from the University of Canterbury, New Zealand, says, "You can see from the diet when you find them in the field that there is a high number of mosquitoes in what they eat." And when Robert Jackson investigated their diet further, he found that the spiders were even more selective. The delicacy that *E. culicivora* prize above all others is female blood-fed *Anopheles* mosquitoes, which puzzled Nelson. How could these picky spiders pick out blood-engorged *Anopheles* mosquitoes from the swarms of similarly sized insects infesting the area? Nelson and Jackson decided to do some jumping spider psychology to find out how the arachnids pick out blood-fed female *Anopheles* mosquitoes from the crowd and they publish their discovery that the spiders identify the females by their antennae in The *Journal of Experimental Biology*.

According to Nelson, identifying *Anopheles* mosquitoes (males and females) is quite straightforward. 'The bodies of *Anopheles* mosquitoes rest on a 45deg angle from the substrate but most others rest parallel', she explains. But what other distinguishing features could the famished spiders use when selecting the females specifically? 'Obviously, blood-fed females have an engorged red abdomen and the other difference that comes to mind between males and females is the antennae', says Nelson. Explaining that male *Anopheles* have luxuriant fluffy antennae, while the female's are less elaborate, Nelson decided to see which mosquito features *E. culicivora* fixate on.

Collecting male and female *Anopheles* and *Culex* mosquitoes at the International Centre for Insect Physiology and Ecology in Kenya, Nelson, Godfrey Sune and other helpers painstakingly constructed hybrid mosquitoes. Combining the head and thorax of one insect with the abdomen of another, the team was able to produce Frankenstein mosquitoes with blood-engorged female abdomens and male antennae, slender male abdomens and female antennae, and every other combination in between. Then, they mounted the hybrid mosquitoes in their correct postures and tested the spiders' preferences.

'The great thing about jumping spiders is they're very decisive', recalls Nelson, who could clearly see that the spiders preferred intact blood-engorged females over everything else, even females engorged with transparent sugar solution. And, when Nelson offered the spiders the choice between a Frankenstein female (made from the head and thorax of one female fused to the blood-engorged abdomen of a second female) and a hybrid constructed from a male head-and-thorax and a blood-engorged female abdomen, the spiders usually selected the hybrid with the female antennae, even though both hybrids were packed with blood. Also, when she tempted the spiders with animated simulations of blood-engorged mosquitoes with either male or female antennae, the spiders consistently pounced on the simulated female.

The spiders weren't just picking out *Anopheles* mosquitoes with abdomens full of blood; they were able to identify the mosquitoes by their antennae. 'The thing that really amazed me is that I couldn't actually see the difference when I was looking at the screen', recalls Nelson. Even when she got down to the spider's level, the mosquitoes were too small for Nelson to discern the insects' minute antennae.

Having found that picky *E. culicivora* can identify the tastiest mosquitoes by their antennae, Nelson is curious to find out how they process this visual information: whether they assess all of the mosquito's

characteristics simultaneously or systematically tick features off a check list before deciding to attack. Nelson also adds that she is baffled by how the spider's tiny brain processes all of the sensory information that they must handle when making their decision.

More information: Nelson, X. J. and Jackson, R. R. (2012). The discerning predator: decision rules underlying prey classification by a mosquito-eating jumping spider. *J. Exp. Biol.* 215, 2255-2261. jeb.biologists.org/content/215/13/2255.abstract

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