Do spiders use their vision or vibration sense to catch crickets?

The BugFest Community Experiment Team

Introduction (What is our question?)

Wolf spiders are efficient foragers, stalking and eating small insects like crickets. For spiders, they have surprisingly good eyesight. In addition to four smaller eyes, they have two pairs of large eyes; one pair faces forward, and the other is farther back on their heads. Wolf spiders are also really sensitive to vibrations that move through the ground. In fact, wolf spiders use vibrations to communicate. Males produce vibratory "songs" to attract females.

Figure 1. A female *Rabidosa punctulata*

We know that wolf spiders have all these different senses, and that they are good hunters. In this study, we were interested in finding out whether spiders use their vision or vibration sense when they are hunting for prey.

For this experiment, we used *Rabidosa punctulata*, a species of wolf spider native to Nebraska (**Figure 1**). We expect that if *R. punctulata* uses its vibration sense to locate and catch prey, it will be able to catch prey more quickly when it can hear the vibrations of prey than when it can't. We also expect that if *R. punctulata* uses its visual sense to locate and catch prey, we expect that it will be able to catch prey more quickly when it can see its prey clearly than when it can't.

Methods (What did we do?)

To test what senses *R. punctulata* uses to catch prey, we observed spiders in one of three types of arena: (1) Visual + / Vibration +, these arenas have white filter paper floors and are surrounded by a white paper background, so crickets are easy to see and hear. (2) Visual + / Vibration -, these arenas have granite floors and are surrounded by a white paper background, so crickets are easy to see, but the granite makes them hard to hear. (3) Visual - / Vibration +, these arenas have brown paper floors and are surrounded by paper with a leaf-litter pattern. The complicated background makes crickets hard to see, but the paper bottom makes them easy to hear.

We let the spider get used to the new environment for 2 minutes, then we added a cricket and started a stopwatch. We stopped the stopwatch as soon as the spider attacked the cricket. We recorded the data from the stopwatch, recaptured the spider, and cleaned out the arena.

Together we collected data from *fifty-eight* spiders! We observed twenty-one spiders hunting crickets in a Visual +/ Vibration + environment, sixteen spiders hunting in a Visual +/ Vibration - environment, and twenty-one spiders hunting in a Visual -/ Vibration + environment. Everybody's data was entered into the computer, and we used this information to calculate the number of spiders that attacked crickets, and the average amount of time it took spiders to catch a cricket. We then compared these numbers for the three treatments.

Results (What did we find?)

First, we found that the percentage of spiders that attacked a cricket during the first two minutes of observation differed significantly between environmental treatments ($X^2 = 6.9$, $p = 0.03$, **Figure 2**). Looking more closely, we found that spiders were more likely to attack crickets if they were in the Visual – environment ($X^2 = 4.2$, $p = 0.04$, **Figure 3a**). We also found that spiders were more likely to attack crickets if they were in the Vibration + environment ($X^2 = 5.7$, $p = 0.017$, **Figure 3b**).

Discussion (What does it mean?)

We predicted that if wolf spiders use vision to detect prey, spiders in simple environments (white backgrounds, against which crickets are more visible) would catch more prey than spiders in complex environments (brown/leaf litter backgrounds). We also predicted that if wolf spiders use vibrations to detect prey, spiders on filter paper (which transmits

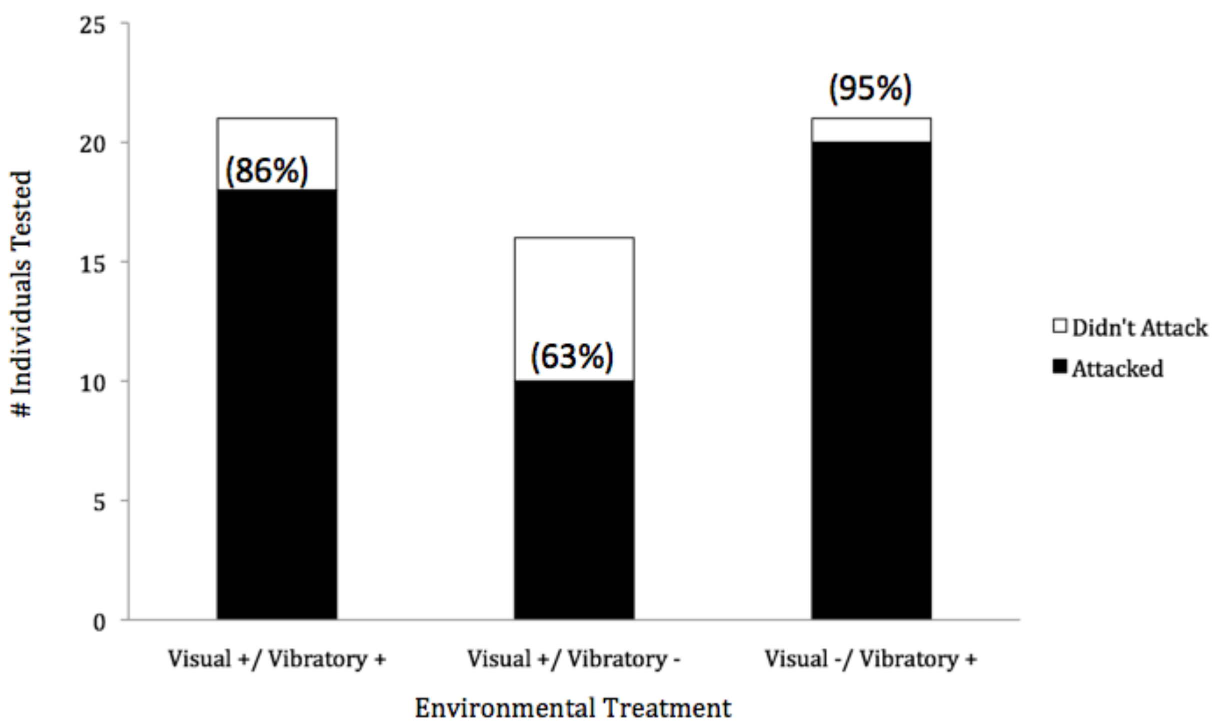

Figure 2. Number of spiders that attacked versus did not attack during the first two minutes of observation. Spiders were each tested in one of three different environments: *Visual +/ Vibration+:* white background and white filter paper substrate; *Visual +/ Vibratory -:* white background and granite substrate; *Visual -/Vibratory +*: leaf litter background and brown paper substrate. There was a significant influence of the environmental treatment on likelihood of attacking the cricket ($X^2 = 6.9$, $p = 0.03$).

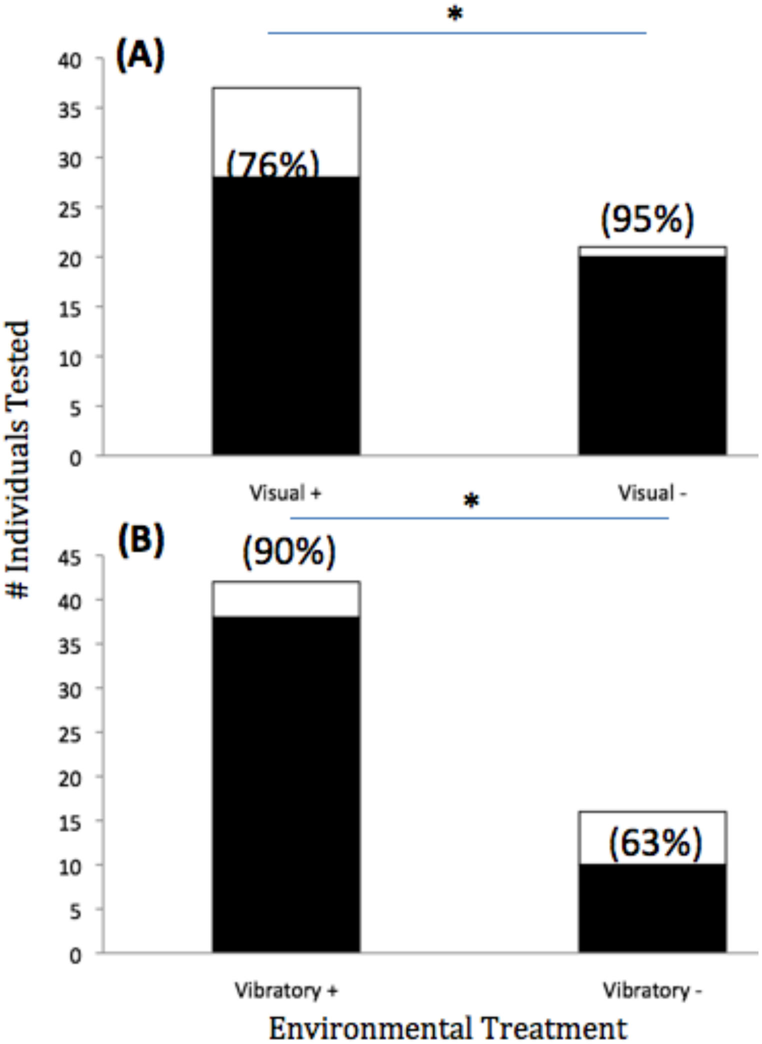

Figure 3. Number of spiders that attacked versus did not attack during the first two minutes of observation comparing **(A)** all Visual + versus Visual – and **(B)** all Vibratory + versus Vibratory -.

vibrations) would catch more prey than spiders on granite (which does not transmit vibrations).

Like we expected, we found that the environment did effect how many spiders caught crickets. Spiders that could sense the crickets' vibrations caught more crickets than spiders that couldn't, which suggests that the vibration sense is important for catching prey. However, we also found that spiders in the complex visual environment caught more crickets than spiders in the simple visual environment, which is the opposite of what we expected. It's strange that spiders were better at catching crickets when the crickets were supposedly harder to see. It's difficult to say what this means. Maybe crickets are actually easier to see against a complex background. One thing that this experiment shows us is that we have a lot to learn about how spider vision works.

In conclusion, this experiment provides evidence to support the hypothesis that wolf spiders use their vibratory sense to hunt for prey. The results of this experiment also suggest that spider vision plays a role in hunting, but more study is needed to fully understand what is going on.