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INSIDE JEB

When hungry, spiders boost web stickiness

St Andrew's Cross spider. Photo credit: Sean Blamires.

Spider webs are architectural masterpieces – delicate silken threads spiraling into elaborate expanses of sticky, stretchy and incredibly strong tapestries. These masterpieces are not only stunning, they're also critical for survival. If a spider's web doesn't help the spider catch prey, the spider will starve. Fortunately for spiders, they are able to adapt the architecture of their web, as well as the combination of silks they use, depending on environmental conditions and their diet. Though it may seem obvious, given the function of the spider's web, no one had tested what the end game of all these variations in web design was for the spider, according to Sean Blamires at The University of New South Wales in Australia. Would spider web-weaving versatility mean more hapless victims in the web when spiders were in need? 'We assumed it would', says Blamires.

He and his colleagues set out to see whether putting spiders on a protein-restricted diet would affect the spiders' web construction in a way that allowed them to catch more prey to improve their diet. The team caught female St Andrew's Cross and golden orb weaver spiders in the wild and brought them back to the lab. They fed all of the spiders the same diet for a few days and allowed them to build webs. They then separated the spiders into two groups – one group got extra protein in their diet, and the other was fed a low-protein diet – and then, after more than a week, the two groups made webs again.

Blamires and his group looked at how the spirals within the web were spaced and examined the stickiness and size of the web threads. They also measured how well the webs could hold prey by placing live and dead crickets in the webs and waiting for the crickets to fall out. Blamires admits that this had not been the original experimental design. 'We had planned to perform a ballistic experiment where we fired insect bodies at the webs to simulate the capture of prey in flight', explains Blamires, 'but the machinery proved too difficult to control and, because of the speed of the flight (and a lack of a high-speed camera), the measurements were very difficult to accurately perform'. So, no high-speed ballistic crickets this go-around.

Although the team found that there were no differences in architecture when they compared the high- and low-protein diet webs, the spiders given the low-protein diets spun stickier threads. Blamires says, 'Although we expected, based on previous experience, that there was going to be a change in the glue stickiness between treatments for both spiders, the increase in stickiness was larger than we expected'. These differences in stickiness even extended to how long the crickets stayed in the webs. He says showing that the stickier webs made by the spiders deprived of protein are better able to hold 'live, struggling' prey longer is key to understanding the benefits of web-making adaptability.

'This means there is an evolutionary advantage in having silk and webs that can vary in property as nutrient intake varies', Blamires explains; before now they couldn't be sure that it wasn't the result of natural changes caused by the spiders' diet. The team has also pounced eagerly on the implications of their findings. 'Right now, we are examining the genetic and biochemical mechanisms of the plastic response in spider gluey silks', he says, and he hopes that these new discoveries could inspire the next generation of stickier, stretchier glues. 'We think the theoretical and practical applications are very broad', he smiles.

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