Tarantulas shoot silk from feet

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Tarantula spider. Credit: International Society of Arachnology

Climbing is possibly one of the riskiest things an adult tarantula can do. Weighing in at anything up to 50gm, the dry attachment systems that keep daintier spiders firmly anchored are on the verge of failure in these colossal arachnids. 'The animals are very delicate. They wouldn't survive a fall from any height,' explains Claire Rind from the University of Newcastle, UK. In 2006, Stanislav Gorb and his colleagues published a paper in Nature suggesting that tarantulas may save themselves from falling by releasing silk threads from their feet. However, this was quickly refuted by another group that could find no evidence of the silk. Fascinated by spiders and intrigued by the scientific controversy, Rind decided this was too good a challenge to pass up and discovered that tarantulas shoot silk from their feet when they lose their footing. She publishes her results in The *Journal of Experimental Biology*.

Teaming up with undergraduate Luke Birkett, Rind tested how well three ground-dwelling Chilean rose tarantulas kept their footing on a vertical surface. Gently placing one of the animals in a very clean aquarium with microscope slides on the floor, the duo cautiously upended the aquarium to see if the tarantula could hang on. 'Given that people said tarantulas couldn't stay on a vertical surface, we didn't want to find that they were right,' remembers Rind. But the spider didn't fall, so the duo gave the aquarium a gentle shake. The tarantula slipped slightly, but soon regained its footing. So the spider had held on against the odds, but would Rind find silk on the microscope slides?

Looking at the glass by eye, Rind couldn't see anything, but when she and Birkett looked closely under a microscope, they found minute threads of silk attached to the microscope slide where the spider had stood before slipping.

Next, Rind had to prove that the silk had come from the spiders' feet and not their web-spinning spinnerets. Filming the Chilean rose tarantulas as they were rotated vertically, Rind, Benjamin-James Duncan and Alexander Ranken disregarded any tests where other parts of the spiders' bodies contacted the glass and confirmed that the feet were the source of the silk. Also, the arachnids only produced their safety threads when they slipped.

But where on the spiders' feet was the silk coming from? Having collected all of the moulted exoskeletons from her Mexican flame knee tarantula, Fluffy, when she was young, Rind looked at them with a microscope and could see minute threads of silk protruding from microscopic hairs on Fluffy's feet. Next, the team took a closer look at moults from Fluffy, the Chilean rose tarantulas and Indian ornamental tarantulas with scanning electron microscopy and saw minute reinforced silk-producing spigots, which extended beyond the microscopic attachment hairs on the spiders' feet, widely distributed across the foot's

surface. Rind also looked at the tarantula family tree, and found that all three species were only distantly related, so probably all tarantula feet produce the life-saving silk threads.

Finally, having noticed the distribution of the spigots, Rind realised that tarantulas could be the missing link between the first silk-producing spiders and modern web spinners. She explains that the spread of spigots on the tarantula's foot resembled the distribution of the silk spigots on the abdomen of the first silk spinner, the extinct Attercopus spider from 386 million years ago. The modern tarantula's spigots also looked more similar to mechanosensory hairs that are distributed over the spider's entire body, possibly making them an evolutionary intermediate in the development of silk spinning. So, not only has Fluffy settled a heated scientific debate but she also may be a link to the silk spinners of the past.

More information: Rind, C., Birkett, C. L., Duncan, B.-J. A. and Ranken, A. J. (2011). Tarantulas cling to smooth vertical surfaces by secreting silk from their feet. *J. Exp. Biol.* 214, 1874-1879. jeb.biologists.org/content/214/11/1874.abstract

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