Researchers discover daddy longlegs spiders capture prey using glue

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Mitostoma chrysomelas. Credit: Wikipedia/CC BY 3.0

A team of researchers in Germany has finally figured out what the gooey-covered hairs on a daddy longlegs' pedipalps are for—they hold a type of glue that is used to prevent prey from escaping. The team describes how they made this discovery in their paper published in *The Journal of Experimental Biology*—by filming the spiders with high-speed cameras,

testing the fluid and looking at them under a scanning microscope.

We all know about daddy longlegs (known more scientifically as harvestmen), they're spiders with tiny bodies and really long legs, and even though we know they can't hurt us, many are still a little bit afraid of them. At any rate, for many years, biologists have wondered about the bobs on the ends of some of their pedipalps (forelegs). They appeared to be moist, even glue-like—but it wasn't clear what the liquid was for—to help with climbing? To help with catching food? No one knew, until now.

To find out, the researchers captured several specimens and brought them into their lab, along with some of their favorite prey, tiny arthropods called springtails (because they have a biomechanical spring on their underside that helps them leap away from predators). The team used high-speed cameras to film what happened when the spider tried to catch the springtail, then reviewed the results. They found that when it came time to grab the springtail, the spider squirted a tiny bit of "glue" onto it, preventing it from escaping.

But that wasn't the end of the study, the team also cut off some of the spider's pedipalps to get a closer look at the fluid—they found the adhesive strength of the glue was sufficient to hold an entire springtail when suspended. Taking an even closer look, the researches froze (using liquid nitrogen) one spider that had glued a springtail and placed them both under a cryo-scanning microscope to see how it was that the glue worked so well. They found that the glue completely wetted the cuticle on the springtail, which overcame liquid repelling microstructures and removable scales allowing for a very good grip—strong enough to hold on even as the springtail tried using its spring to zip away.

More information: Gluing the 'unwettable': soil-dwelling harvestmen

use viscoelastic fluids for capturing springtails, *J Exp Biol* 217, 3535-3544. DOI: 10.1242/jeb.108852

Abstract
Gluing can be a highly efficient mechanism of prey capture, as it should require less complex sensory–muscular feedback. Whereas it is well known in insects, this mechanism is much less studied in arachnids, except spiders. Soil-dwelling harvestmen (Opiliones, Nemastomatidae) bear drumstick-like glandular hairs (clavate setae) at their pedipalps, which were previously hypothesized to be sticky and used in prey capture. However, clear evidence for this was lacking to date. Using high-speed videography, we found that the harvestman Mitostoma chrysomelas was able to capture fast-moving springtails (Collembola) just by a slight touch of the pedipalp. Adhesion of single clavate setae increased proportionally with pull-off velocity, from 1 μN at 1 μm s−1 up to 7 μN at 1 mm s−1, which corresponds to the typical weight of springtails. Stretched glue droplets exhibited characteristics of a viscoelastic fluid forming beads-on-a-string morphology over time, similar to spider capture threads and the sticky tentacles of carnivorous plants. These analogies indicate that viscoelasticity is a highly efficient mechanism for prey capture, as it holds stronger the faster the struggling prey moves. Cryo-scanning electron microscopy of snap-frozen harvestmen with glued springtails revealed that the gluey secretions have a high affinity to wet the microstructured cuticle of collembolans, which was previously reported to be barely wettable for both polar and non-polar liquids. Glue droplets can be contaminated with the detached scaly setae of collembolans, which may represent a counter-adaptation against entrapment by the glue, similar to the scaly surfaces of Lepidoptera and Trichoptera (Insecta) facilitating escape from spider webs.