Small jumping spiders illuminate physical actions that propel animals from one place to another

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Adult male Habronattus conjunctus jumping spider from the Santa Rita Mountains, Arizona. Credit: Kaldari (Wikimedia Commons)

Everyone hates spiders. This is a sweeping (and swinging) generalization, obviously, but nonetheless the stereotype exists for a reason. Western postdoctoral associate Erin Brandt doesn't mind the creepy crawlers though, especially when they're leaping through the air like a young

Peter Parker.

In a study published by *Journal of Comparative Physiology A*, Brandt and Natasha Mhatre, Western's Canada Research Chair in Invertebrate Neurobiology, examined jumping performance of Habronattus conjunctus—a small jumping spider with a body length of approximately 4.5 mm—to better understand locomotor (physical action that propels something from one place to another) skills in the animal kingdom.

Specifically, the Western Science biophysicists explored how jumping spider employ their legs during takeoff using state-of-the-art tracking software highly customized for this study by undergraduate student Yoshan Sasiharan. They found evidence that H. conjunctus primarily uses its third legs to power jumps, which is different than most larger spiders.

"We found that these small spiders primarily use their third legs for jumping and we were able to infer that by looking at the video and looking at the ways that the legs extend and the angles of their legs," said Brandt. "This appears to be the major difference between how large and small spiders jump."

The researchers also discovered that H. conjunctus jumps have lower takeoff speeds and accelerations than most other jumping arthropods, including other jumping spiders.

"These spiders, that jump all the time, aren't actually super great jumpers," said Mhatre, a professor in Western's department of biology. "They don't go super-fast. They don't they don't generate super high forces or do anything spectacular that you might expect for something that jumps all the time."

These findings not only answer central questions about how small animals generate enough lift to project their bodies through the air, but also produce imperative detail and data for scientists and engineers attempting to emulate organic movement for designing and developing inorganic machines.

"If you want to make something that jumps, it's really important to study animals that jump routinely well in nature," said Mhatre. "If you want to make a robot that covers terrain, walking isn't always great. You might want to make a jumping robot that gets across barriers more easily."

Brandt says it is also essential not to underestimate the importance of scale when studying animals, especially 'itsy bitsy' spiders.

"Humans can replicate various aspects of animal in large scale, but there is no way we could make something that is four millimeters long and can move like this," said Brandt. "We just don't have the technology to do it. And these spiders are doing it with brains the size of a poppy seed. They're amazing."

More information: Erin E. Brandt et al. Jump takeoff in a small jumping spider, *Journal of Comparative Physiology A* (2021). DOI: 10.1007/s00359-021-01473-7

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