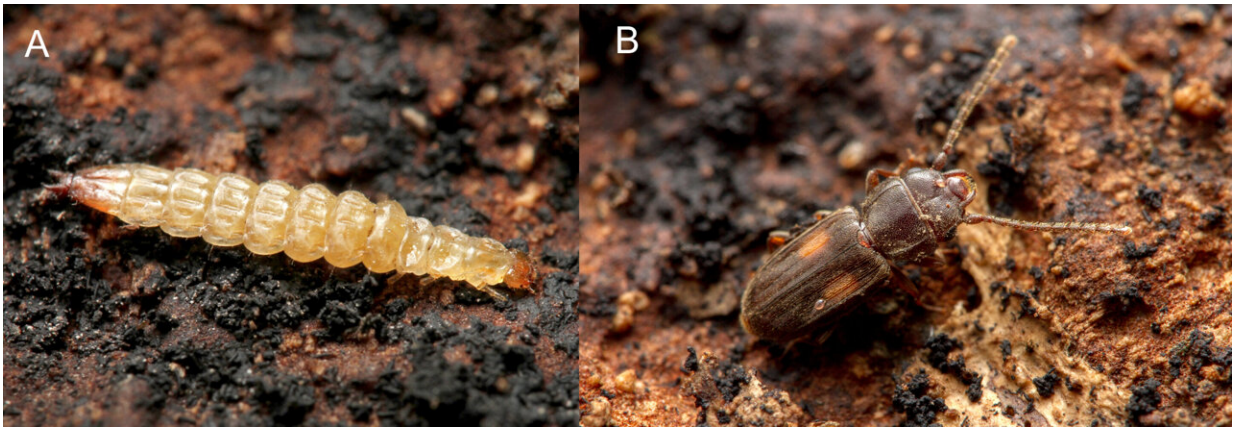
Scientists find previously unknown jumping behavior in insects

January 19 2022



A team of researchers has discovered a previously unrecorded jumping behavior in the larvae of a species of lined flat bark beetle (Laemophloeus biguttatus). This image shows the larval stage of the species on the left and the adult stage on the right. Credit: Matt Bertone, NC State University

A team of researchers has discovered a jumping behavior that is entirely new to insect larvae, and there is evidence that it is occurring in a range of species—we just haven't noticed it before.

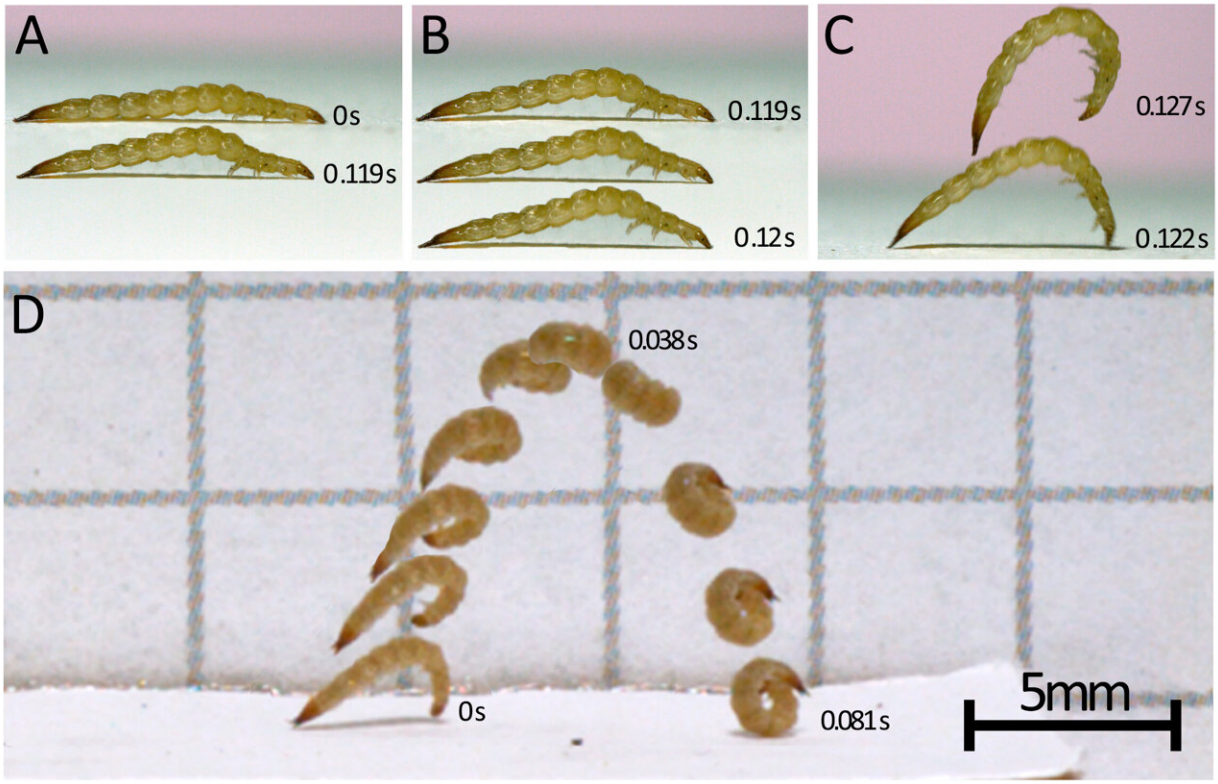
The previously unrecorded behavior occurs in the larvae of a species of lined flat bark beetle (*Laemophloeus biguttatus*). Specifically, the larvae are able to spring into the air, with each larva curling itself into a loop as it leaps forward. What makes these leaps unique is how the larvae are

able to pull it off.

"Jumping at all is exceedingly rare in the larvae of beetle species, and the mechanism they use to execute their leaps is—as far as we can tell—previously unrecorded in any insect larvae," says Matt Bertone, corresponding author of a paper on the discovery and director of North Carolina State University's Plant Disease and Insect Clinic.

While there are other insect species that are capable of making prodigious leaps, they rely on something called a "latch-mediated spring actuation mechanism." This means that they essentially have two parts of their body latch onto each other while the insect exerts force, building up a significant amount of energy. The insect then unlatches the two parts, releasing all of that energy at once, allowing it to spring off the ground.

"What makes the *L. biguttatus* so remarkable is that it makes these leaps without latching two parts of its body together," Bertone says. "Instead, it uses claws on its legs to grip the ground while it builds up that potential energy—and once those claws release their hold on the ground, that potential energy is converted into kinetic energy, launching it skyward."



A team of researchers has discovered a jumping behavior that is entirely new to insect larvae, and there is evidence that it is occurring in a range of species – we just haven't noticed it before. The previously unrecorded behavior occurs in the larvae of a species of lined flat bark beetle (Laemophloeus biguttatus). Specifically, the larvae are able to spring into the air, with each larva curling itself into a loop as it leaps forward. What makes these leaps unique is how the larvae are able to pull it off. Credit: Matt Bertone, NC State University

The discovery of the behavior was somewhat serendipitous. Bertone had collected a variety of insect samples from a rotting tree near his lab in order to photograph them when he noticed that these beetle larvae appeared to be hopping.

Bertone and paper co-author Adrian Smith then decided to film the behavior in order to get a better look at what was going on. That's when

they began to understand just how peculiar the behavior was. Smith is a research assistant professor of biological sciences at NC State and head of the Evolutionary Biology & Behavior Research Lab at the North Carolina Museum of Natural Sciences.

"The way these larvae were jumping was impressive at first, but we didn't immediately understand how unique it was," Bertone says. "We then shared it with a number of beetle experts around the country, and none of them had seen the jumping behavior before. That's when we realized we needed to take a closer look at just how the larvae was doing what it was doing."

To determine how *L. biguttatus* was able to execute its acrobatics, the researchers filmed the jumps at speeds of up to 60,000 frames per second. This allowed them to capture all of the external movements associated with the jumps, and suggested that the legs were essentially creating a latching mechanism with the ground.

The researchers also conducted a muscle mass assessment to determine whether it was possible for the larvae to make their leaps using just their muscles, as opposed to using a latch mechanism to store energy. They found that the larvae lacked sufficient muscle to hurl themselves into the air as far or as fast as they had been filmed jumping. Ergo, latching onto the ground was the only way the larvae could pull off their aerial feats.

Meanwhile, in an unrelated video about jumping maggots, Smith had included a short clip of the jumping behavior in *L. biguttatus*. That video was seen by a researcher in Japan named Takahiro Yoshida, who had witnessed similar jumps in the larvae of another beetle species called *Placonotus testaceus*, but had not published anything related to the behavior.

"We don't have high-speed footage of *P. testaceus*, but the video

evidence we do have from Yoshida's lab suggests that this previously unknown behavior is found in two different genera which are not even closely related," Bertone says.

"This raises a lot of questions. Has this behavior evolved separately? Is it found in other beetle species? Are these genera more closely related than we previously suspected? There's a lot of interesting work to be done here."

The paper, "A Novel Power-Amplified Jumping Behavior in Larval Beetles (Coleoptera: Laemophloeidae)," will be published open access in the journal *PLOS ONE* on Jan. 19. The paper was co-authored by Yoshida, of Tokyo Metropolitan University; Joshua Gibson, of the University of Illinois at Urbana-Champaign; and Ainsley Seago, of the Carnegie Museum of Natural History.

More information: A Novel Power-Amplified Jumping Behavior in Larval Beetles (Coleoptera: Laemophloeidae), *PLOS ONE* (2022).

Provided by North Carolina State University