

INSIDE JEB

Waterproofing prevents antlion jaws from getting clogged



An antlion (*Myrmeleon crudelis*) using its large mouthparts to feed on blue fluids from a fruit fly. Photo credit: Matthew Lehnert.

Sitting at the bottom of a sandy pit with only their head exposed, waiting for prey to tumble in, larval antlions (*Myrmeleon crudelis*) are reminiscent of a monster straight out of science fiction. Looks aside, these young antlions have a potential problem caused by their sandy surroundings: how do they consume their liquified prey without their mouthparts becoming blocked with sand? Matthew Lehnert, from Kent State University, USA, thought that parts of their jaws must naturally repel water and dirt, while other parts attract their fluid feast towards their mouth, which would allow antlions to eat without getting sand-clogged mouthparts.

But first, Lehnert needed to see just how the juvenile antlions fed on the pre-digested dinner. Working with Kristen Reiter, Rena Fonseca and Jordan Minninger, also from Kent State University, Lehnert videoed the antlions eating some blue-dyed fruit flies to track where the liquid meal was going; the fluid

seemed to be moving up the inside of the antlions' large jaws. Lehnert and Asheesh Lanba, Benjamin Hall and Wesley Huff, from Lasers for Innovative Solutions, USA, then used lasers to help them reconstruct the internal three-dimensional head structures and discovered a small, C-shaped canal between the upper and lower part of the jaws that fluid passes through on its way towards the mouth. To make sure that the food was passing through this 'food canal', the researchers placed the tip of the upper jaw at the surface of some blue-tinted water and watched as the fluid flowed up the canal like a drink through a straw.

Surely this is how the antlions are eating, but having this canal exposed to the elements all the time could cause the canals to clog when living in such sandy conditions. Watching the videos, Lehnert noticed that the upper and lower jaws rapidly slide past one another, exposing the food canal for only short periods of time, preventing sand from getting in.

This had Lehnert and the team wondering what would happen if some of the liquid food escaped the food canal and got the outside of the mouthparts wet; would they just get covered in sand?

To test this, Lehnert and colleagues sprayed the antlion's jaws with small droplets of water and measured how waterproof the jaws were. The researchers noticed that these appendages had a waxy waterproof coating which was causing the water to bead up along the length of the jaws. The team also noted that sand had trouble sticking to the mouthparts (only about 5% of the top jaw had sand on it) but had no problem sticking to other parts of the antlion, such as the top of its head – 45% of which got covered in sand when the researchers shook the head in the sand. The waxy coating essentially makes the mouthparts self-cleaning. And Lehnert adds, 'Unlike other fluid-feeding insects [such as bees or flies], antlion larvae are unable to use their legs to clean their mouthparts', going on to discuss why having self-cleaning jaws is important for larval antlions.

Clearly, being a predator at the bottom of a sandy funnel comes with some challenges; and that's without factoring in the challenge of feeding exclusively on a liquid diet and the need for self-cleaning mouthparts. But larval antlions seem to have mastered this particular problem in a way that allows them to rest easy at the bottom of their pit, waiting for their next meal to come tumbling in.

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Lehnert, M. S., Lanba, A., Reiter, K. E., Fonseca, R. J., Minninger, J., Hall, B. and Huff, W. (2022). Mouthpart adaptations of antlion larvae facilitate prey handling and fluid feeding in sandy habitats. *J. Exp. Biol.* **225**, jeb244220. doi:10.1242/jeb.244220

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