Toxin in centipede venom identified

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A golden head centipede attacks a Kunming mouse. Credit: PNAS

A team of researchers from several institutions in China has identified the toxin in golden head centipede venom. In their paper published in *Proceedings of the National Academy of Sciences*, the group describes how they found the toxin that makes the venom so deadly to prey and

also identified a possible antidote for it.

Researchers have known for quite some time that golden head centipedes (aka the Chinese red-headed centipede), which live in Asia and Hawaii are able to subdue prey larger than its own size, in some cases, much larger—testing in a lab showed a centipede was able to take down a mouse, a creature 15 times its size. Until now, it was not known what was in the venom that made it so powerful. In this new effort, the researchers report that they have isolated the toxin in the venom, which they call Ssm Spooky Toxin—the Ssm comes from the scientific name of the centipede, Scolopendra subspinipes mutilans. The team found the toxin by testing the chemicals in the venom one by one—a laborious process. The toxin works, the team reports, by blocking potassium from moving in and out of cells. Such blockage prevents the brain from signaling the heart to beat, and the animal dies very quickly. Potassium movement is also important for cells in airways, which means the victim of a bite also starts having problems breathing.

When people are bitten by a golden head centipede, they experience a lot of pain, so much that many take themselves to a hospital for relief. It is actually quite common—in Hawaii, the researchers note, centipede bites accounted for approximately 1 in 10 emergency room visits due to natural causes over the years 2004 to 2008 (averaging approximately 400 a year). Deaths from such bites are rare, however.

Prior research has shown that a drug called retigabine is able to reestablish potassium channels—it is normally used as an anticonvulsant medicine for epilepsy patients. In this case, it might be used instead as an antidote for people bitten by the centipede.

More information: Lei Luo et al. Centipedes subdue giant prey by blocking KCNQ channels, *Proceedings of the National Academy of Sciences* (2018). DOI: 10.1073/pnas.1714760115

Abstract

Centipedes can subdue giant prey by using venom, which is metabolically expensive to synthesize and thus used frugally through efficiently disrupting essential physiological systems. Here, we show that a centipede (Scolopendra subspinipes mutilans, ~3 g) can subdue a mouse (~45 g) within 30 seconds. We found that this observation is largely due to a peptide toxin in the venom, SsTx, and further established that SsTx blocks KCNQ potassium channels to exert the lethal toxicity. We also demonstrated that a KCNQ opener, retigabine, neutralizes the toxicity of a centipede's venom. The study indicates that centipedes' venom has evolved to simultaneously disrupt cardiovascular, respiratory, muscular, and nervous systems by targeting the broadly distributed KCNQ channels, thus providing a therapeutic strategy for centipede envenomation.