Tick spit protein may trigger allergic reactions

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Female *Rhipicephalus bursa* tick. Credit: Courtesy of Jose de la Fuente

Ticks have had millions of years to figure out how to bite without

triggering their victims' immune response. Proteins in the arachnids' spit evolved to manipulate immune cells so that the bloodsuckers can suck blood and transmit pathogens in peace. But these measures may not always have the desired effect when ticks bite humans, leading to severe allergic reactions, argue infectious disease specialists in an Opinion published on September 25 in *Trends in Parasitology*. The researchers believe a vaccine for tick bite allergies could be developed from the spit allergen, once it is identified.

Only recently has it been known that tick bites even cause allergic reactions. Thousands of people are affected each year—particularly in the United States and Australia, with more and more diagnosed as doctors learn of the allergy, and as tick and human contact increases as a result of climate change and habitat loss. Depending on the tick species and the person, bites can result in allergic reactions ranging from an itch to full anaphylactic shock. Tick bites might also induce the development of red meat or gelatin allergies.

"We understand that these allergies are produced by tick bites, but we need to know the precise molecules produced by the tick in the saliva that cause this effect when they bite a vertebrate host," says senior author Jose de la Fuente, of Group SaBio at the Instituto de Investigación en Recursos Cinegéticos IREC (CSIC-UCLM-JCCM) in Spain and CVHS, Oklahoma State University, USA. "We believe that there are proteins in the tick saliva modified by a compound called alpha-gal that changes the immune response in humans, so that it is possible to have these allergic reactions."

The alpha-gal modified proteins are de la Fuente's prime suspect because alpha-gal is not synthesized by humans and apes, and so it could be that when a tick bites us and introduces the protein into the skin, our immune system's natural response is to label it as "foreign" and attack. This would explain why later exposure to red meat, which possesses a

variation of alpha-gal, can cause an immune reaction. An immune memory against alpha-gal may also have a protective effect as people previously exposed to the molecule are less likely to get malaria, a mosquito-borne disease, indicating that other insects could carry alpha-gal in their bites.

Whether the tick saliva allergen is alpha-gal or something else, knowing the culprit can lead to the production of an antivenom-like product that minimizes the bite immune response. Another strategy would be to create a vaccine that could numb the immune system to the presence of what is causing the allergy.

"No specific treatment for a tick bite allergy is currently available," de la Fuente says. "Anyone who lives in a risk area or is moving to a region with many reported cases would benefit from such a vaccine."

More information: Trends in Parasitology, Cabezas-Cruz et al.: "Regulation of the immune response to α-gal and vector-borne diseases" dx.doi.org/10.1016/j.pt.2015.06.016

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