Researchers identify that mosquitoes can sense toxins through their legs

December 25 2019

Credit: CC0 Public Domain

Researchers at LSTM have identified a completely new mechanism by which mosquitoes that carry malaria are becoming resistant to insecticide.

After studying both Anopheles gambiae and Anopheles coluzzii, two major malaria vectors in West Africa, they found that a particular family of binding proteins situated in the insect's legs were highly expressed in resistant populations.

First author on a paper published today in the journal *Nature*, Dr. Victoria Ingham, explains: "We have found a completely new insecticide resistance mechanism that we think is contributing to the lower than expected efficacy of bed nets. The protein, which is based in the legs, comes into direct contact with the insecticide as the insect lands on the net, making it an excellent potential target for future additives to nets to overcome this potent resistance mechanism."

Examining the Anopheline mosquitoes, the team demonstrated that the binding protein, SAP2, was found elevated in resistant populations and further elevated following contact with pyrethroids, the insecticide class used on all bed nets. They found that when levels of this protein were reduced, by partial silencing of the gene, susceptibility to pyrethroids were restored; conversely when the protein was expressed at elevated levels, previously susceptible mosquitoes became resistant to pyrethroids.

The increase in insecticide resistance across mosquito populations has led to the introduction of new insecticide treated bed nets containing the synergist piperonyl butoxide (PBO) as well as pyrethroid insecticides. The synergist targets one of the most widespread and previously most potent resistance mechanisms caused by the cytochrome P450s. However, mosquitoes are continually evolving new resistance mechanisms and the discovery of this new resistance mechanism provides an excellent opportunity to identify additional synergists that could be used to restore susceptibility

Professor Hilary Ranson is senior author on the paper. She said: "Long-

lasting insecticide treated bed nets remain one of the key interventions in malaria control. It is vital that we understand and mitigate for resistance within mosquito populations in order to ensure that the dramatic reductions in disease rates in previous decades are not reversed. This newly discovered resistance mechanism could provide us with an important target for both the monitoring of insecticide resistance and the development of novel compounds able to block pyrethroid resistance and prevent the spread of malaria."

More information: A sensory appendage protein protects malaria vectors from pyrethroids, *Nature* (2019). DOI: 10.1038/s41586-019-1864-1 , nature.com/articles/s41586-019-1864-1

Provided by Liverpool School of Tropical Medicine