NEWS RELEASE

New research shows mosquitoes borrow genes from plants to improve their survival

Scientists investigating the unusual feeding habits of one species of mosquito claim that the insect has hijacked hundreds of useful genes from plants during its evolution.

The researchers, led by Rajnikant Dixit at India's National Institute of Malaria Research (NIMR), suggest that their findings provide new evidence that a process known as horizontal gene transfer, or HGT, occurs in complex organisms. HGT is a well-recognized mechanism by which single-celled bacteria pass useful genes to each other, but the scientific community is divided on whether it occurs in higher organisms during evolution.

The scientists have found that the female *Anopheles culicifacies* mosquito produces a range of plant proteins that give it a competitive advantage in a number of different ways, such as metabolising the nectar that it feeds on, and surviving adverse environmental conditions.

The team from the NIMR, together with colleagues at Guru Jambheshwar University and NxGenBio Lifesciences, have published their findings from the mosquito studies on the open science platform, F1000Research. http://f1000research.com/articles/4-1523/v1

The *Anopheles culicifacies* mosquito lives in rural agricultural India, where it is responsible for transmitting about 65% of malaria cases. The male and female mosquitoes feed on nectar, but the female also feeds on blood, which is how the malaria parasite is passed to an animal host. The NIMR researchers were interested in the female’s dual feeding ability and set out to investigate whether different proteins were produced in its saliva, dependent on whether the meal was nectar or blood.

The surprising results from a range of sensitive molecular analyses identified 537 gene sequences that were similar to plant genes, expressed in the
salivary glands of the sugar fed mosquitoes. None of these stretches of genetic code, which the researchers termed plant-like transcripts (PLTs), were present when the mosquito was fed on blood, and tests confirmed that their results weren’t because of contamination with plant cells.

The team next confirmed that the insect uses some of these PLTs as the instructions to produce proteins that are normally only made by plants to process different biomolecules. In terms of complex evolution, this finding suggests that the acquisition of different PLTs may facilitate mosquitoes to feed and adapt from plants, direct evidence of mosquito-plant interaction. Another of the PLTs codes for a protein called dehydrin, which is produced in plants to help protect against cold and drought. This molecule was also found in mosquito eggs and in the adult male and female mosquitoes, indicating that it may help the insect to survive adverse conditions.

HGT is an important survival mechanism in bacteria. We are all familiar with the very real problems of antibiotic resistance, which occurs when a few bacteria that are naturally resistant to certain antibiotics pass on their ‘resistance genes’ to other bacteria. Genetic evidence is building to suggest that many other complex organisms, including humans, may have added useful genes from other species into their own genetic codes during their evolution. The study by Rajnikant Dixit’s team indicates that in the mosquito at least, acquisition of huge numbers of foreign genes from local plants, and symbiotic associations with the diverse nature of microbes, might have provided survival advantages.

The authors state: “Our findings further support the similar questionable observation of HGTs in other higher organisms, which is still a controversial and debatable issue in the community of evolutionists … From these studies, we concluded that mosquito feeding-associated genes are not only evolving actively, but also acquiring new genes (e.g. dehydrin), to adapt successfully over the plant host …

“With the current available data, including the present investigation, we hypothesize that HGTs in metazoans may also play an important role in the evolution and acquisition of beneficial traits that facilitate feeding and survival adaptation over diverse ecologies.”

Rebecca Lawrence, Managing Director of F1000 Group, said: “This study makes an exciting contribution to the debate about whether HGT occurs in complex organisms and it will be of immense interest to the scientific community.

“We believe it is essential that valuable, new findings like these reach the public domain as quickly as possible so that other scientists can evaluate them and build upon them. We are, therefore, very pleased to be able to make this possible through our open science publishing platform.”

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