To a mosquito, matchmaking means 'singing' in perfect harmony

January 1 2010

A female mosquito of the Culicidae family (Culiseta longiareolata). Image: Wikipedia

Researchers have new insight into the sex lives of the much-maligned mosquitoes that are responsible for the vast majority of malaria deaths, according to a report published online on December 31st in *Current Biology*. In finding a partner of the right species type, male and female mosquitoes depend on their ability to "sing" in perfect harmony. Those tones are produced and varied based on the frequency of their wing beats in flight.

"Everyone must be familiar with the maddening whine a mosquito makes as it hones in for a bite," said Gabriella Gibson of the University

of Greenwich at Medway. "There's no doubt many of us have wondered why it makes its presence so obvious—surely, after all of these centuries of blood-feeding, selection should have favored a more stealthy approach that would leave mosquitoes less vulnerable to the defensive attacks of its unsettled host. Our findings suggest that mosquitoes rely on the sounds they make to attract a mate of the right species, a behavior that is far more vulnerable to selection than avoiding the risk of being squashed by the rare host that is still awake at feeding time."

The Anopheles gambiae mosquitoes in fact include a considerable amount of genetic diversity, representing a complex of seven species and several chromosomal forms. And that diversity comes with real consequences for humans, explained Gibson and Ian Russell of the University of Sussex. The complexity of malaria epidemiology and control is due in part to the mosquito's remarkable genetic plasticity, enabling its adaptation to a widening range of human-influenced habitats.

The new results help to explain how those different mosquito forms manage to reproductively isolate themselves and maintain that genetic diversity, even while some, including the "M" and "S" forms found in Burkina Faso that were the subject of the current study, can be found traveling together in the very same swarms.

Gibson and Russell's team first discovered that male and female mosquitoes harmonize with each other. Gibson said that this is analogous to two partially deaf singers—one alto and the other soprano—who can hear low frequencies, but perhaps not their own or each other's songs. Instead, they listen to the terrible dissonance if one or the other goes a bit sharp or flat, which they can get rid of by adjusting their respective tones until the dissonance diminishes to nothing.

"They can do this even if they each sing a different note, say a 'middle C'

and a 'G' four tones higher," Russell said. "By listening and subtly altering their pitch to minimize the dissonance, they achieve their goal of 'singing' in a perfect harmony that we, but not they, can hear."

The researchers have now shown that two mosquitoes don't harmonize successfully if they are of the same sex or if they are not the same type of mosquito. They might try for a while, Gibson explained, but they never find that harmony and eventually give up trying.

And that leads Gibson to another take-home of the study. "Even the most 'lowly creatures,' such as mosquitoes, have highly evolved neurosensory systems that can process relatively simple auditory inputs to produce motor outputs enabling them to distinguish between other types of mosquito that are so closely related we need to analyze their DNA to tell them apart."

More information: Pennetier et al.: “Singing on the wing’ as a mechanism for species recognition in the malarial mosquito Anopheles gambiae.” Publishing in Current Biology 20, January, 2010. www.current-biology.com

Provided by Cell Press