Recently published research targets malaria mosquito control woes

7 May 2013, by Steve Byrns

(Medical Xpress)—Malaria is responsible for about 700,000 deaths annually in sub-Saharan Africa alone, and a team of Texas A&M University researchers is doing their best to help stem this perpetual tide of human suffering.

Dr. Giridhar "Giri" Athrey, post-doctoral associate with Texas A&M's department of entomology vector biology group, is the lead author of a study recently published in the open-access journal *PloS Genetics*.

The research aims for the first time to accurately measure pre-and post-control mosquito populations using DNA technology.

The nine-member team is led by Dr. Michel Slotman in Texas A&M's department of entomology, and also includes Dr. Theresa Hodges of that department.

The team demonstrated for the first time through replicated studies that two vector control programs – spraying and pesticide-treated bed nets – have dramatically reduced malaria transmitting mosquito populations.

"Malaria is a disease transmitted by female mosquitoes in the genus Anopheles," Athrey said. "Several control strategies have been used over the past 40 to 50 years to combat mosquito populations with varying degrees of success. One of the reasons malaria is so difficult to defeat is that Anopheles gambiae, the primary carrier or 'vector,' has a high preference for human blood meals, and relatively low densities of this vector can maintain high rates of infection among humans."

Athrey said one of the main aims of anti-vector programs is to eventually eradicate mosquito populations, but more immediately to reduce them to very low numbers, translating into reduced malaria transmission. This is usually done with insecticides. The problem is assessing how well a control measure is actually working, and if several control measures are being tried, to determine which is the most effective.

"It's often very difficult using conventional population monitoring methods, such as counting trapped mosquitoes, to know to what extent the insecticide has had an impact," he said. "That's what this whole study centers around, accurately measuring mosquito populations to determine whether vector control has been effective and which control regimes are the most effective, thus saving the most lives."

Athrey said measuring mosquito populations is fraught with difficulties. Traditional counting and trapping methods can be difficult to compare, or may be subject to large fluctuations due to the weather. The insect's complex life cycle also complicates the issue, so populations can fluctuate wildly with changing seasonal conditions.

In contrast to previous attempts, this study demonstrates that the approach taken has the power to detect mosquito population size changes across relatively short time periods, he said. Importantly, two negative control populations from Cameroon and Mali, which experienced no vector control, showed constant or slightly increasing mosquito populations.

The paper stems from two malaria control programs in Equatorial Guinea. The first was initiated on Bioko Island in 2004. A second program was later started on the country's mainland in 2007. The programs included both spraying and pesticide-treated bed nets.

"We used DNA data from 1,500 mosquito samples taken from 2004-2010 for three species and seven sites spread across the country," he said. "We then integrated this data with recently developed computational approaches to accurately estimate

the effective population sizes both before and after widespread mosquito control was carried out."

They found that six of the seven sampled populations from different sites were reduced from 55-85 percent following the start of the control programs.

"This study provides key insights into how mosquito populations respond to indoor residual spraying and insecticide treated-bed nets over time, a hitherto poorly understood aspect of malaria mosquito biology," Athrey said. "That's important, because it not only informs ongoing field operations about the impact the control program is having, but also indicates the limits of what can be achieved with existing approaches. This study also demonstrates the utility of genetic approaches to rapidly assess the success of a vector control program.

"In the Equatorial Guinea study, we found that both spraying and insecticide-treated nets resulted in much reduced population sizes of mosquitoes, compared to population sizes before vector control programs began. And truthfully, reliable data like that is needed to improve existing vector control programs, which ultimately helps save more lives, and that is what we are interested in."

More information:
www.plosgenetics.org/doi/pgen.1003097

Provided by Texas A&M University