Hybrid 'super mosquito' resistant to insecticide-treated bed nets

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Anopheles gambiae mosquito by James D. Gathany. The Public Health Image Library , ID#444.

Interbreeding of two malaria mosquito species in the West African country of Mali has resulted in a "super mosquito" hybrid that's resistant to insecticide-treated bed nets.

"It's 'super' with respect to its ability to survive exposure to the insecticides on treated bed nets," said medical entomologist Gregory

Lanzaro of UC Davis, who led the research team.

The research, published Jan. 6 in the *Proceedings of the National Academy of Sciences*, "provides convincing evidence indicating that a man-made change in the environment—the introduction of insecticides—has altered the evolutionary relationship between two species, in this case a breakdown in the reproductive isolation that separates them," said Lanzaro, who is director of the Vector Genetics Laboratory and professor in the Department of Pathology, Microbiology and Immunology in the School of Veterinary Medicine.

"What we provide in this new paper is an example of one unusual mechanism that has promoted the rapid evolution of insecticide resistance in one of the major malaria mosquito species."

Anopheles gambiae, a major malaria vector, is interbreeding with isolated pockets of another malaria mosquito, A. coluzzii. Entomologists initially considered them as the "M and S forms" of Anopheles gambiae. They are now recognized as separate species.

The insecticide resistance came as no surprise. "Growing resistance has been observed for some time," Lanzaro said. "Recently it has reached a level at some localities in Africa where it is resulting in the failure of the nets to provide meaningful control, and it is my opinion that this will increase."

Lanzaro credits insecticide-treated nets with saving many thousands, probably tens of thousands of lives in Mali alone. The World Health Organization's World Malaria Report indicates that deaths from malaria worldwide have decreased by 47 percent since 2000. Much of that is attributed to the insecticide-treated bed nets.

However, it was just a matter of time for insecticide resistance to

emerge, medical entomologists and epidemiologist agree. Now there's "an urgent need to develop new and effective malaria vector control strategies," Lanzaro said. A number of new strategies are in development, including new insecticides, biological agents—including mosquito-killing bacteria and fungi—and genetic manipulation of mosquitoes aimed at either killing them or altering their ability to transmit the malaria parasite.

First author on the paper is Laura Norris, a postdoctoral scholar in the UC Davis Department of Entomology and Nematology who was supported by a National Institutes of Health training grant awarded to Lanzaro. She has since accepted a position with the President's Malaria Initiative in Washington, D.C.

Other co-authors include, at UC Davis, Anthony Cornel, Yoosook Lee, Bradley Main and Travis Collier; and Abdrahamane Fofana of the Malaria Research and Training Center at the University of Bamako, Mali. Three grants from the National Institutes of Health funded the research.

Lanzaro has researched mosquitos in Mali for 24 years with Cornel, who is an associate professor in the UC Davis Department of Entomology and Nematology and headquartered at the UC Kearney Agriculture and Research Center, Parlier. Both are graduate student advisors in the department, training medical entomologists of tomorrow.

More information: *PNAS*, www.pnas.org/content/early/2015/01/02/1418892112

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