Bacterial infection in mosquitoes renders them immune to malaria parasites

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Scientists funded by the National Institute of Allergy and Infectious Diseases (NIAID), part of the National Institutes of Health, have established an inheritable bacterial infection in malaria-transmitting *Anopheles* mosquitoes that renders them immune to malaria parasites.

Specifically, the scientists infected the mosquitoes with *Wolbachia*, a bacterium common among insects that previously has been shown to prevent malaria-inducing *Plasmodium* parasites from developing in *Anopheles* mosquitoes. Before now, researchers had been unable to create mosquitoes with a stable *Wolbachia* infection that passed consistently from mother to offspring.

In this study, led by Zhiyong Xi, Ph.D., at Michigan State University, the researchers focused on *Anopheles stephensi* mosquitoes, the primary malaria carrier in the Middle East and South Asia. The scientists injected *Wolbachia* into male and female embryos of *A. stephensi* and, once they matured, mated the adult females with uninfected male mosquitoes. A stable *Wolbachia* infection was maintained for 34 generations of mosquitoes, at which time the study ended. The researchers also introduced *Wolbachia* infection into uninfected adult mosquitoes in a series of experiments in which infected female mosquitoes comprised 5 percent, 10 percent or 20 percent of the mosquito population. In all three experiments, 100 percent of the mosquitoes were infected within eight generations, supporting the potential of *Wolbachia*-infected mosquitoes as a malaria control strategy. Similar approaches have been used successfully to control dengue,

another mosquito-borne disease, in certain settings.

In their examination of how *Wolbachia* affects *Plasmodium* parasites, the researchers found that the bacterium kills the parasites both in the mosquito midgut, where the parasites mature, and in the salivary glands, from which the parasites are transmitted to humans via mosquito bites. The scientists hypothesize that *Wolbachia* infection causes the formation of unstable compounds known as reactive oxygen species (ROS), which inhibit the development of the parasites. Future studies might examine whether *Plasmodium* can become resistant to ROS and explore ways to integrate *Wolbachia*-infected mosquitoes with existing malaria control strategies, the researchers write.

More information: Bian G et al. Wolbachia invades Anopheles stephensi populations and induces refractoriness to Plasmodium infection. *Science*. DOI: 10.1126/science.1236192 (2013).

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