A gene that makes male mosquitoes more fertile could also increase malaria transmission

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Credit: CDC

Malaria is a deadly disease transmitted by the bite of an infected mosquito. Curiously, only female mosquitoes bite – male mosquitoes only feed on sugar, not on blood. That is because male mosquitoes do not need an extra dose of nutrients to produce eggs, which is a job for the females. But even if male mosquitoes do not feed on you, and thus,

cannot transmit malaria, it does not mean they don't matter. In fact, researchers from the Max Planck Institute of Infection Biology in Berlin and the CNRS in Strasbourg have discovered that male mosquitoes are probably more important than previously thought.

For a female mosquito to transmit malaria, it has to first bite an infected person, and then bite a healthy one a couple of weeks later. Just like humans, though, mosquitoes also have an immune system. That means that some of the female mosquitoes that acquire malaria may not transmit it because they manage to clear infection. Julien Pompon and Elena Levashina uncovered a new function for a gene known to be important for mosquito resistance to malaria.

Levashina identified this gene, called TEP1 first in 2001 as an immune gene and a major malaria killing factor in female mosquitoes. Her research group has now discovered that TEP1 is also implicated in sperm development in male mosquitoes. The scientists found TEP1 in mosquito testes and showed that it promotes removal of damaged cells during production of spermatozoa, analogous to how discarding bad fruits helps the growing of healthy ones. In the absence of TEP1, male fertility rates (number of offspring born per male) were also decreased, indicating that TEP1 is necessary for optimal reproduction. The mechanism by which TEP1 controls sperm production in males is also similar to how it can help female mosquitoes to resist malaria.

Though it is definitely good to have figured out what could make mosquito reproduce less, there is a catch. TEP1 is a variable gene, i.e. there are different "versions" (or alleles) of it all over the world. Different alleles can be inherited by the mosquito offspring after mating, with one always coming from the mother and another from the father. The scientists have also shown that a specific TEP1 version, the S2 allele, can make male mosquitoes better equipped at removing dead cells during sperm production.

The S2 allele is one of the two alleles that confer susceptibility to malaria. Simply put, the same allele that renders mosquito males more fertile, makes females vulnerable to malaria. That could mean that male mosquitoes that can pass on to their offspring a version of TEP1 that is susceptible to malaria could also be better at reproducing. Thus, TEP1 could increase the rate of malaria transmission.

More information: "A New Role of the Mosquito Complement-like Cascade in Male Fertility in Anopheles gambiae." *PLoS Biol* 13(9): e1002255. DOI: 10.1371/journal.pbio.1002255

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