

Influence of host genotype, parasite genotype and environmental conditions on the resistance of mosquitoes to *Plasmodium*

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Abstract

Any malaria control program based on the release of genetically modified mosquitoes engineered to resist infection by malaria will be effective only if (1) resistance is expressed against all of the parasite's genotypes and if (2) resistance is effective in field conditions. However, most studies on the resistance of mosquitoes do not consider these issues, but deal with a very limited number of mosquito and *Plasmodium* genotypes in good laboratory conditions.

- (1) To estimate the influence of the mosquito's genotype, the parasite's genotype and their interaction on the outcome of infection, we challenged different genetic backgrounds (F1 families) of the major African vector *Anopheles gambiae* with several natural isolates of the human malaria parasite *Plasmodium falciparum*. Both the prevalence and the intensity of the infection were determined by the specific combination of mosquito family and parasite isolate. No isolate was most infectious to all mosquito families and no mosquito family was most resistant to all isolates, suggesting that the level of resistance is determined by a genotype-by-genotype interaction.
- (2) To investigate the role of environmental conditions on the resistance of mosquitoes, we measured the influence of adult nutrition (2%, 4% and 6% glucose solutions) on the infection of the malaria vector *Anopheles stephensi* by the rodent malaria parasite *Plasmodium yoelii yoelii*. We found that the intensity of infection was highest at the intermediate concentration of glucose, revealing the environmental component of resistance.

These results suggest that the resistance of mosquitoes to *Plasmodium* is a complex trait that depends not only on the specific combination of mosquito and malaria genotypes, but also on the quality of the environment. Thus, we emphasize the need to take into account the range of genetic diversity exhibited by mosquito and malaria field populations and environmental heterogeneities in ideas and studies concerning the control of malaria.