Mosquito Fecundity and Parasite Transmission: Influence of TOR Pathway

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The anautogenous mosquitoes must consume at least one vertebrate blood meal to initiate oogenesis. Repeated blood meals make Anopheles efficient vectors of malaria, causing 445, 000 deaths globally in 2016. Proteins are the predominant constituents of blood. Within hours after feeding, there is a significant increase in hemolymph amino acid level. Such increase leads to activation of the target of rapamycin (TOR) signaling pathway. TOR activation phosphorylates S6 kinase (S6K), ultimately stimulating protein translation and initiating egg development. The ingested malaria parasite, Plasmodium, also initiates the biosynthesis of immune molecules, including TEP1, responsible for pathogen defense. It is still unknown how mosquitos maintain the fecundity while effectively eliminate parasites. Here we find that inhibiting TOR signaling pathway by either rapamycin treatment or TOR knockdown significantly enhance Anopheles' resistance to parasite infection. Accordingly, activation of TOR pathway by knocking down its negative regulator TSC1 increased parasite infection. The influence of TOR pathway on vector competence is achieved by the regulation of mosquito immune molecules TEP1. Knockdown of TEP1 in mosquitoes, of which TOR signaling pathway is blocked completely and lose refractoriness to Plasmodium. Our results indicate that interactions between TOR and immune signaling pathways play an important role in determining infection outcome of Plasmodium. Our findings pave the way for developing novel strategies for mosquito control.

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