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Analysis of a vector-bias model on malaria transmission. (English) Zbl 1225.92030

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Summary: We incorporate a vector-bias term into a malaria-transmission model to account for the greater attractiveness of infectious humans to mosquitoes in terms of differing probabilities that a mosquito arriving at a human at random picks that human depending on whether he is infectious or susceptible. We prove that transcritical bifurcation occurs at the basic reproductive ratio equalling 1 by projecting the flow onto the extended centre manifold. We next study the dynamics of the system when the incubation time of malaria parasites in mosquitoes is included, and find that the longer incubation time reduces the prevalence of malaria. Also, we incorporate a random movement of mosquitoes as a diffusion term and a chemically directed movement of mosquitoes to humans expressed in terms of sweat and body odour as a chemotaxis term to study the propagation of infected populations to uninfected populations. We find that a travelling wave occurs; its speed is calculated numerically and estimated for the lower bound analytically.

MSC:

92C60 Medical epidemiology

34C60 Qualitative investigation and simulation of ordinary differential equation models

35Q92 PDEs in connection with biology, chemistry and other natural sciences

37N25 Dynamical systems in biology

Cited in **1** Review
Cited in **24** Documents

Keywords:

time delays; travelling waves

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