Backward Bifurcation in vector-borne model with direct transmission.

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This paper deals with the study of time since infection structured vector born model with the direct transmission. The model is analyzed to investigate the dynamical behaviour of the system. Analysis of the existence and stability of equilibria reveals the existence of backward bifurcation i.e. where the disease-free equilibrium(DFE) coexists with the endemic equilibrium(EE) when the reproduction number $\mathcal{R}_0$ is less than unity. This aspect shows that in order to control vector borne disease, it is not sufficient to have reproduction number less than unity although necessary. Thus, the infection can persist in the population even if the reproduction number is less that unity. Numerical simulation is presented to see the bifurcation behaviour in the model. By taking the reproduction number as the bifurcation parameter, we find the system undergoes backward bifurcation at $\mathcal{R}_0 = 1$. Thus, the model has backward bifurcation and may have one or two positive endemic equilibrium when $\mathcal{R}_0 < 1$ and unique positive endemic equilibrium whenever $\mathcal{R}_0 > 1$.

Keywords: Backward bifurcation, Reproduction Number, Endemic Equilibrium, [4] [3] [1] [2]

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