

MODELING AND ANALYSIS OF A VECTOR-HOST EPIDEMIC MODEL WITH SATURATED INCIDENCE RATE UNDER TREATMENT

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ABSTRACT

Global stability of an epidemic model for vector-borne disease was studied by Yang et al. [7]. A reinvestigation of the model with a saturated incidence rate and a treatment function proportionate to infectious population I is presented to understand the effect of the capacity for treatment. An equivalent system is obtained, which has two equilibriums: a disease-free equilibrium and an endemic equilibrium. The stability of these two equilibriums can be controlled by the basic reproduction number $\mathcal{R}_0$. The global stability of the disease-free equilibrium state is established by Lyapunov method and a geometric approach is used for the global stability of the endemic equilibrium state. The model has a globally asymptotically stable disease-free solution whenever the basic reproduction number $\mathcal{R}_0$ is less than or equal unity and has a unique positive globally asymptotically stable endemic equilibrium whenever $\mathcal{R}_0$ exceeds unity. Numerical examples are given for the model with different values of the parameters. Graphical presentations are also provided. The details are supplemented by numerical results given in annexure.

KEYWORDS: Epidemic Model, Vector-Borne Disease, Saturated Incidence, Equilibrium Point, Stability, Reproduction Number, Treatment Function