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Impact of predator on the host-vector disease model with stage structure for the vector.

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Summary: In this paper, we propose a host-vector-predator model with stage structure for the vector to explore the impact of biological control agents on host-vector dynamics and disease control. Here the total vector population is divided into two physiological subclasses which are immature and mature subclasses. Holling type II functional response is used to portray the interactions between vectors and predators. Stability analysis of the equilibria demonstrates that the basic reproduction number gives the threshold condition determining the persistence and extinction of the disease. Furthermore, the phenomenon of Hopf bifurcation occurs when predators are introduced. The stability of limit cycle arising from a Hopf bifurcation is rigorously investigated. Finally, numerical simulations are given to show the validity of analytical results, and the comparative results of disease dynamics with and without predators.

MSC:

92D25 Population dynamics (general)
37N25 Dynamical systems in biology

Keywords:

vector-host diseases; disease control; stage structure; Hopf bifurcation; persistence

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