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Dynamics of an eco-epidemic model with Allee effect in prey and disease in predator

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Abstract

In this work, the dynamics of a food chain model with disease in the predator and the Allee effect in the prey have been investigated. The model also incorporates a Holling type-III functional response, accounting for both disease transmission and predation. The existence of equilibria and their stability in the model have also been investigated. The primary objective of this research is to examine the effects of the Allee parameter. Hopf bifurcations are explored about the interior and disease-free equilibrium point, where the Allee is taken as a bifurcation point. In numerical simulation, phase portraits have been used to look into the existence of equilibrium points and their stability. The bifurcation diagrams that have been drawn clearly demonstrate the presence of significant local bifurcations, including Hopf, transcritical, and saddle-node bifurcations. Through the phase portrait, limit cycle, and time series, the stability and oscillatory behaviour of the equilibrium point of the model are investigated. The numerical simulation has been done using MATLAB and Matcont.

Keywords: eco-epidemic model; equilibrium point; stability analysis; Hopf bifurcation; transcritical bifurcation

MSC 2010: 34D20; 92B05; 92D25; 34C23; 37Gxx

[36]   Vinoth, S., Sivasamy, R., Sathiyanathan, K., Rajchakit, G., Hammachukiattikul, P., Vadivel, R., & Gunasekaran, N. (2021). Dynamical analysis of a delayed food chain model with additive Allee effect. Advances in Difference Equations, 2021(1), 1–20.
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