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ABSTRACT | Krishna Pada Das

Title

Chaotic dynamics and its possible control in eco-epidemiological system

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Abstract

In ecology the disease in the prey population plays an important role in controlling the dynamical behaviour of the system. We modify Hastings and Powell's (HP) (1991)model by introducing disease in the prey population. The conditions for which the modified HP model system represents extinction, permanence or impermanence of population are worked out. The modified model is analyzed to obtain different conditions for which the system exhibits stability around the biologically feasible equilibria. Through numerical simulations we display that the modified system enters into stable solutions depending upon the force of infection in prey population as well as body size of intermediate predator. Our results demonstrate that disease in prey population and body size of intermediate predator are the key parameters for controlling the chaotic dynamics observed in original HP model.Eco-epidemiological models are now receiving great attention to the researchers. We re-visit the model of Holling-Tanner which is recently modified by Haqueand Venturino (2006) with the introduction of disease in preypopulation. Density dependent disease-induced predator mortality function is an important consideration of such systems. We extend the model of Haque and Venturino (2006) with density dependent disease-induced predator mortality function. Preliminary results like existence, uniqueness, positive invariance and boundedness of solutions of the model are worked out. The existence and local stability of the equilibrium points and the conditions for the permanence and impermanence of the system have studied. The system shows different dynamical behavior including chaos for different values of the rate of infection. The model considered by Haque and Venturino (2006) also exhibits chaotic nature but they did not shed any light in this direction. Our analysis reveals that by controlling disease-induced mortality of predator due to ingested infected prey may prevent the occurrence of chaos.