



Research article

A study of a prey-predator model with disease in predator including gestation delay, treatment and linear harvesting of predator species

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Abstract: In this work, we investigated a predator-prey model based on ecodemiology in which the predator population was infected with a transmissible illness, and the time delay equaled the predator's gestation period. Predators can be divided into two separate groups: The ones that are infected and the ones that are susceptible to infection. Assume that the infected predator's sickness is thought to be treatable. The explanations for the solutions' positive invariance and the reason there are equilibria are stated in the suggested system. We showed the boundedness of the system solutions. Additionally, the local stability of every possible equilibrium point was investigated with respect to delayed as well as non-delayed systems. Furthermore, time delay has been demonstrated to be essential for controlling the dynamics of the system, and the periodic solutions were known to exist through Hopf bifurcation in connection to gestation delay. Also, our finding showed that treatment for infected predators have an influence on the dynamics of the system. Lastly, a computational simulation is used to verify the conceptual inquiry's conclusion.

Keywords: prey-predator; linear harvesting; gestation time delay; disease; treatment; numerical simulations

Mathematics Subject Classification: 92D25, 92D40, 34D20, 37G15

1. Introduction

Predator-prey dynamic relationships are fundamental to both mathematics and biological ecology. Due to the fundamental work of A. J. Lotka [1] and V. Volterra [2], the first predator-prey model was developed and examined. Since then, a tremendous amount of effort has been completed, and it continues to increase yearly. Many academics have been developed and studied mathematical models