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Predator interference in predator-prey system with disease in prey population

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ABSTRACT

Predation on a species subjected to an infectious disease can affect both the infection level and the population dynamics. In [2] we present a predator-prey system with disease in prey population where we investigate how interference among predators affects the dynamics and structure of the predator-prey community. We use bifurcation theory to analyse the three-dimensional system of ODE's for the dynamics of susceptible and infected prey and the predator population. Predator-prey (both susceptible and infected) interactions are modelled using the Beddington-DeAngelis functional response. We find an unusually large variety of complex dynamics including steady state, periodic, quasi-periodic and chaotic dynamics. We will discuss in detail how a quasi-periodic solution on a torus is destructed by collision with a saddle limit cycle. This resembles a situation also studied in [1]. Three different ways in which chaos originates under parameter variation will be discussed: via a torus bifurcation, a tangent bifurcation and a transcritical bifurcation. We will show that, depending on the strength of interference among predators, predator can enhance or control disease outbreak and population persistence. Moreover, the presence of multistable regimes makes the system very sensitive to perturbations and entail a number of regime shifts.

References

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