Dynamics of a class of nonlinear pest-natural enemy discrete model

Yazhi Wu[1], Guangyao Tang[1], and Changcheng Xiang[1]

[1]Hubei Minzu University

March 13, 2022

Abstract

The inappropriate use of insecticides may lead to disastrous pest outbreaks. Aiming at avoiding the outbreak of pests by optimizing the control strategies, we propose a novel mathematical model base on the idea of pulse in this study, namely a discrete-time model of pest-natural enemies, which considers the implementation of spraying insecticides within the time interval between two generations of pests. We first investigates the existence and stability of fixed points, and then using the central manifold theory, we proved that the system can exist period-doubling bifurcation. The main theoretical results are verified by numerical simulations. The experiments show that if the insecticidal time is within a certain range, the lower insecticidal rate stimulates the growth of pests and natural enemies, while the larger insecticidal rate can inhibit the growth of pests and natural enemies. In addition, the effects of pest growth rate, timing of pesticide spraying, and pesticide intensity on the system are comprehensively discussed. The main research provides good reference significance to choose an appropriate time to prevent the pest outbreaks.

Hosted file

`Manuscript.pdf` available at https://authorea.com/users/464993/articles/559697-dynamics-of-a-class-of-nonlinear-pest-natural-enemy-discrete-model