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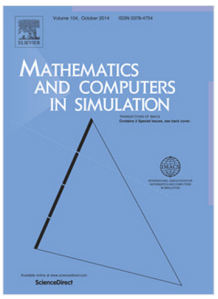

Comparative analysis between prey-dependent and ratio-dependent predator–prey systems relating to patterning phenomenon

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Comparative analysis between prey-dependent and ratio-dependent predator-prey systems relating to patterning phenomenon

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Abstract

In this paper, we explore two different kinds of reaction-diffusion predator-prey systems with quadratic intra-predator interaction and linear prey harvesting. One has a Holling type II functional response, a typical type of prey dependence, and the other has a ratio-dependent functional response, a typical type of predator dependence. Firstly, by making use of the linear stability analysis and the bifurcation analysis, we obtain the conditions for a Hopf bifurcation of the nonspatial predator-prey systems and for the diffusion-driven instability, so called Turing bifurcation, of the reaction-diffusion systems in a two-dimensional spatial domain. Secondly, we investigate the effects of the intra-predator interaction and linear prey harvesting on these reaction-diffusion predator-prey systems in terms of spatiotemporal pattern formations caused by Turing bifurcation via numerical simulation. In fact, by choosing the intra-predator interaction and linear harvesting rate of the prey species as the bifurcation parameters, we show that these systems undergo a sequence of spatial patterns including typical Turing patterns such as spots, spots-stripes mixture, holes-stripes mixture, holes and labyrinthine pattern through diffusion-driven instability. Our results disclose that the intra-predator interaction and prey harvesting have a significant effect on the spatiotemporal pattern formations of predator-prey systems regardless of the type of functional responses.

Key words and phrases: Turing bifurcation, Hopf bifurcation, Harvesting, Intra-predator interaction, Reaction-diffusion predator-prey system, Spatiotemporal pattern.

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