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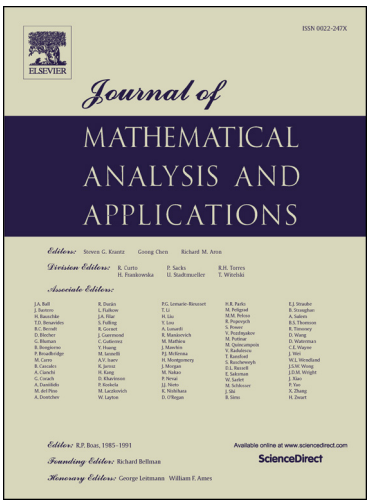

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Effect of predator cannibalism and prey growth on the dynamic behavior for a predator-stage structured population model with diffusion *

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Abstract In this paper, a predator-prey model with predator-stage structured and diffusion is concerned. We deal with the system by endowing it with the homogeneous Neumann boundary conditions. We first give the a priori estimates of positive solutions for the reduced reaction diffusion system. Secondly, we discuss the effects of predator cannibalism and prey growth on the stability of nonnegative constant steady states of the model in detail. Thirdly, we investigate the nonexistence and existence of nonconstant positive solutions. Finally, we discuss the Hopf bifurcation created by diffusion.
Keywords Predator-prey model; stage structure; steady states; stability; fixed point index; Hopf bifurcation.
2000 Mathematics subject classifications 92D25; 93C20; 35K57

1 Introduction

In population dynamics, in order to model populations which go through distinct stages, such as laboratory insect populations, it is necessary to take the age structure of the populations into account. The age and development stage always effect the existence and extinction of different species which inhabit in a same living environment. Population growth models with age or stage structure often predict complex population dynamics. Due to these evidences, models with stage structured populations are important in different kinds of ecosystems, see, for example [3, 7, 9, 10, 15, 19, 20, 21, 22, 23, 27, 33, 34]. Generally speaking, population growth models that include stage structure predict more complex population dynamics than those without taking these factors into account.

For stage structured predator-prey systems, the phenomenon of adults cannibalize juveniles within the same species is a common natural phenomenon in some species [4, 5,

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