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ON THE AVERAGE PERSISTENCE AND EXTINCTION IN NONAUTONOMOUS PREDATOR-PREY KOLMOGOROV SYSTEMS *

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Abstract. The paper studies the general nonautonomous predator-prey Kolmogorov systems. The general criteria of integrable form on the average persistence and extinction are obtained. As applications of these results, the sufficient conditions of integrable form on the average persistence and extinction are established for nonautonomous Lotka-Volterra type systems, Holling (m,n)-type functional response systems, Beddington-DeAngelis functional response systems and Chemostat-type systems.

Keywords. Average persistence, Extinction, Nonautonomous, Predator-prey, Kolmogorov system, Lotka-Volterra system, Holling functional response system, Beddington-DeAngelis functional response system, Chemostat-type system.

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1 Introduction

In this paper, we consider the following two-species nonautonomous predator-prey Kolmogorov system

$$\begin{aligned} \frac{dx_1}{dt} &= x_1 f_1(t, x_1, x_2) \\ \frac{dx_2}{dt} &= x_2 f_2(t, x_1, x_2) \end{aligned} \tag{1}$$

where we assume that functions $f_i(t, x_1, x_2)(i = 1, 2)$ are continuous for all $t \in R_{+0} = [0, \infty)$, $x_1 > 0$ and $x_2 \geq 0$. But, when $x_1 = 0, f_i(t, x_1, x_2)(i = 1, 2)$ may have not any definition for any $t \in R_{+0}$ and $x_2 \geq 0$.

System (1) includes many well-known two-species nonautonomous predator-prey systems as its specific cases, for example:

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