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Global stability of discrete models of Lotka-Volterra type. (English) Zbl 0919.92030

Nonlinear Anal., Theory Methods Appl. 35, No. 8, B, 1019-1030 (1999).

Global stability of population models governed by difference equations has been studied by a number of papers. But most of them focus their attention on one-species models with or without time delays. For many-species difference models, some papers studied the permanence and extinction of populations. Few papers concern with the global stability of positive equilibria of these models. In this paper we will consider the following Lotka-Volterra model

$$x_i(k+1) = x_i(k) \exp\left\{ r_i(k) - \sum_{j=1}^{n} a_{ij}(k) x_j(k) \right\}, \quad i = 1, \ldots, n, \tag{1}$$

where $x_i(k)$ is the density of population i at kth generation, $r_i(k)$ is the growth rate of population i at kth generation, $a_{ij}(k)$ measures the intensity of intraspecific competition or interspecific action of species. It is assumed that $\{r_i(k)\}$ and $\{a_{ij}(k)\}(i, j = 1, \ldots, n)$ are bounded.

System (1) is a counterpart of continuous Lotka-Volterra models. It is shown in the literature that a continuous Lotka-Volterra system is globally asymptotically stable if the interaction matrix is diagonally dominant. The purpose of this paper is to find further conditions to ensure that the discrete system (1) is globally asymptotically stable.

MSC:

92D25 Population dynamics (general)
39A11 Stability of difference equations (MSC2000)

Keywords:

global stability; nonautonomous

Full Text: DOI