ROCKY MOUNTAIN
JOURNAL OF MATHEMATICS
Volume 38, Number 5, 2008

STABILITY AND BIFURCATION IN A BEDDINGTON-DEANGELIS TYPE PREDATOR-PREY MODEL WITH PREY DISPERSAL

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ABSTRACT. A time delayed predator-prey model with prey dispersal and Beddington-DeAngelis type functional response is investigated. By analyzing the corresponding characteristic equations, the local stability of a positive equilibrium and each of the boundary equilibria is discussed. The existence of Hopf bifurcations at the positive equilibrium is established. By using an iteration technique, sufficient conditions are derived for the global attractiveness of the positive equilibrium of the proposed model. By comparison arguments, sufficient conditions are obtained for the global stability of each of the boundary equilibria of the model. Numerical simulations are carried out to illustrate some main results.

1. Introduction. The traditional mathematical model describing predator-prey interactions consists of the following system of differential equations

$$\begin{aligned} \dot{x}(t) &= a(x) - F(x,y), \\ \dot{y}(t) &= eF(x,y) - c(y), \end{aligned} \tag{1.1}$$

where $x(t)$ and $y(t)$ represent densities of the prey and the predator at time t, respectively. The functions $a(x)$ and $c(y)$ are the intrinsic growth rate of the prey and the mortality rate of the predator, respectively. The function $F(x,y)$ is called the "response function" representing the prey consumption per unit of time. The most popular response functions used in the modeling of predator-prey systems

2000 AMS *Mathematics subject classification.* Primary 34K20, 34K60, 92D25.
Keywords and phrases. Predator-prey model, dispersal, time delay, stability.
This work was supported by the National Natural Science Foundation of China (Nos. 10671209, 10471066), China Postdoctoral Science Foundation (No. 20060391010), and the Scientific Research Foundation for the Returned Overseas Chinese Scholars, State Education Ministry.
Received by the editors on August 30, 2007, and in revised form on January 2, 2008.

DOI:10.1216/RMJ-2008-38-5-1761