

ANALYSIS OF AN ECO-EPIDEMIOLOGICAL MODEL WITH TIME DELAY

HUI ZHU, ZUOLIANG XIONG AND XIN WANG

ABSTRACT. An eco-epidemiological model with disease in the predator is studied in this paper. Maturity and digestion delay are considered. It is assumed that the infected predator can't prey. The existence of disease-free and endemic equilibria are obtained. The conditions of locally asymptotic stability of equilibria are obtained by discussing eigenvalue equations of the equilibria. Furthermore, global asymptotic stability of disease-free equilibria and the conditions under which the model hold a Hopf bifurcation are discussed, and a numerical simulation is given.

1. Introduction. Recent research of the epidemiology model based on the species dynamics model has already obtained many results. But most of them are sing-species models with an epidemic. We all know that in nature, a species does not exist alone. There are interactions between different species, which has an important influence on species permanence and the spreading of diseases. So it is necessary to discuss epidemiological models related to several species. But little attention had been paid to this area of research. Furthermore, more and more practical considerations have been added to the models as research has progressed, such as time delay and impulse, which has produced models with more practical significance.

Paper [7] discussed a predator-prey model with disease in the prey. The conditions of global stability of equilibriums, Hopf bifurcation and permanence of the system are analyzed. Existence of the Hopf bifurcation was investigated. Paper [4] studied an eco-epidemiological model with delays. It was assumed that only prey can spread the disease and the predator mainly eats the infected prey. The invariance of nonnegativity, nature of boundary equilibria and global stability are

Keywords and phrases. Eco-epidemiological model, stability, Hopf bifurcation, time delay.

This work was supported by the Jiangxi province Natural Science Foundation of China (0611084).

Received by the editors on June 12, 2007, and in revised form on January 24, 2008.

DOI:10.1216/RMJ-2008-38-5-1877 Copyright ©2008 Rocky Mountain Mathematics Consortium