Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **18 (2012)** 231-249
 http://www.watam.org

STATE-DEPENDENT IMPULSIVE FEEDBACK CONTROL OF A DELAYED PREY-PREDATOR SYSTEM

Anuraj Singh and Sunita Gakkhar

Department of Mathematics
Indian Institute of Technology Roorkee, India

Corresponding author email:anuarjiitr@gmail.com

Abstract. An impulsive delay differential prey-predator system is proposed for pest control. A state-dependent combined strategy for biological and chemical control is used. The boundedness of solution is analyzed by applying the comparison argument. The Poincare map is used to establish the sufficient conditions for existence and stability of predator-free positive period-one solution. The qualitative analysis shows that the positive period-one solution bifurcates from the semi-trivial solution through a fold bifurcation. The complex dynamics including chaos is obtained and numerical simulations substantiate the analytical results.

Keywords. State-dependent Impulse, Periodic solution, Time delay, Chaos, Poincare map

AMS (MOS) subject classification: 34A37, 34C25

1 Introduction

There are different approaches to get rid of agricultural pests. An important method for pest control is chemical control. Chemical control relies mainly on the use of synthetic pesticides to suppress pests. Pesticides are useful because they quickly kill a significant portion of a pest population and they sometimes provide the only feasible method for preventing economic losses. However, pesticides pollutes the environment and adversely affect many often species. Pesticide pollution is also recognized as a major health hazard to human beings and to natural enemies. Biological control is the reduction in pest populations by other living organisms, often called natural enemies or beneficial species. Virtually all pests have some natural enemies. The key to successful biological control is to identify the pest and its natural enemy, releasing the beneficial insect early when pest levels are low. It is natural to combine biological and chemical controls. Integrated pest management strategy is a long term, low cost, integrated management strategy that uses a combination of biological, cultural and chemical tactics that reduce pest population to tolerable levels.