Competition of Two Host Species for a Single-Limited Resource Mediated by Parasites

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Abstract. In this paper we consider a mathematical model of two host species competing for a single -limited resource mediated by parasites. Each host population is divided into susceptible and infective populations. We assume that species 1 has the lowest break-even concentration with respect to nutrient, when there is no parasite. Thus species 1 is a superior competitor that outcompetes species 2. When parasites present, the competitive outcome is determined by the contact rate of the superior competitor. We analyze the model by finding the conditions for the existence of various equilibria and doing their stability analysis. Two bifurcation diagrams are presented. The first one is in $\beta_1 \beta_2$ plane (See Figure 3) and the second one is in $R^{(0)}$-line (See Figure 4).

1   Introduction

Ecologists are interested in understanding how and to what extent interspecific interactions influence community structure, species coexistence and biodiversity. Host-parasite interactions occurr frequently in nature and has been shown that parasites could affect the growth and survival rate of a host thus influence its competitive ability. In the past two decades, people investigate the potential importance of parasites and pathogens in determining the outcome in trophic interactions and community process. In the paper ([1]) the authors reviewed the recent research on how parasites influence competitive and predatory interactions of the host species they infected. However, no theoretical model has been developed that consider the competitive outcome between two hosts who shared the same parasite. In this paper we shall investigate a mathematical