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PERMANENCE IN N SPECIES COMPETITIVE REACTION DIFFUSION ADVECTION SYSTEMS

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ABSTRACT

Reaction diffusion systems and reaction diffusion advection systems have been an important topic in population dynamics. Reaction diffusion advection system is described as the following equations

$$\frac{\partial u_i}{\partial t} = \nabla[\mu_i \nabla u_i + \alpha_i u_i \nabla \tilde{f}_i(x)] + f_i(t, x, u_1, \ldots, u_N)u_i \ , \quad i = 1, \ldots, N \ ,$$

where $\tilde{f}_i(x) = \lim_{t-s\to\infty} \int_s^t f_i(\tau, x, 0, \ldots, 0)d\tau$, u_i is a density of ith species, $\Omega \subset R^N$ is bounded domain with a sufficiently smooth boundary $\partial\Omega$, $\mu_i > 0$ is a diffusion rate of the ith species , $\alpha_i \in R$ measure the rate at which the population moves up the gradient of the growth rate $\tilde{f}_i(x)$ of the i th species and $f_i(t, x, u_1, \ldots, u_N)$ is the carrying capacity. This system is competitive. Using the methods of sub- and supersolution for partial differential equations we give a conditions which guarantee that our system is permanent. These conditions are given as the inequalities between time averages of the intrinsic growth rates interaction coefficients and principal eigenvalues.