Temporally Intermittent Interaction Allows the Mutual Invasion of Competing Two Species Dispersing in Space

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We consider the two-species Lotka-Volterra system with temporal intermittence of interspecific competitive relationship. We assume that the competition coefficient is constant in a fixed time interval of length τ_1, while it is zero in another time interval of length τ_2. The temporal variation of competition coefficient is rigorously periodic with period $\tau_1 + \tau_2$, in which the competition coefficient becomes a given positive constant and zero by turns. We try to analyze the system analytically and numerically, and study the permanence of whole system, the coexistence of competing two species, and the specific dominance in terms of the persistence under competitive relationship.

Not only for competitive relationship but also for any other type of interspecific relationships, such temporal intermittence of interspecific relationship would occur in nature: for example, due to seasonal separation of niches (habitat, homerange, food, etc.) of two species. From mathematical viewpoint, this type of interspecific relationship can be modelled by introducing a temporally intermittent vanishment of terms which represent the interspecific relationship.

We could find some interesting and unexpected natures of such competition system, distinguished from the Lotka-Volterra system with temporally constant interspecific competitive relationship.

Further, we consider the diffusing two-species Lotka-Volterra system with temporal intermittence of interspecific competitive relationship. In this advanced case, we discuss the existence and speed of travelling waves,

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and the possible coexistence due to the temporal intermittence of competition between two species. We find some relation between the stability of stationary state in population dynamics without diffusion and that of travelling wave with diffusion.