Bao, Xiong-Xiong; Li, Wan-Tong; Wang, Zhi-Cheng
Time periodic traveling curved fronts in the periodic Lotka-Volterra competition-diffusion system. (English) Zbl 1374.35408

Summary: This paper is concerned with time periodic traveling curved fronts for periodic Lotka-Volterra competition system with diffusion in two dimensional spatial space

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\begin{align*}
\frac{\partial u_1}{\partial t} &= \Delta u_1 + u_1(x, y, t)(r_1(t) - a_1(t)u_1(x, y, t) - b_1(t)u_2(x, y, t)), \\
\frac{\partial u_2}{\partial t} &= d\Delta u_2 + u_2(x, y, t)(r_2(t) - a_2(t)u_1(x, y, t) - b_2(t)u_2(x, y, t)),
\end{align*}
\]

where \(\Delta\) denotes \(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\), \(x, y \in \mathbb{R}\) and \(d > 0\) is a constant, the functions \(r_i(t), a_i(t)\) and \(b_i(t)\) are \(T\)-periodic and Hölder continuous. Under suitable assumptions that the corresponding kinetic system admits two stable periodic solutions \((p(t), 0)\) and \((0, q(t))\), the existence, uniqueness and stability of one-dimensional traveling wave solution \((\Phi_1(x + ct, t), \Phi_2(x + ct, t))\) connecting two periodic solutions \((p(t), 0)\) and \((0, q(t))\) have been recently established by the first and third authors [J. Differ. Equations 255, No. 8, 2402-2435 (2013; Zbl 1371.35017)]. In this paper we continue to investigate two-dimensional traveling wave solutions of the above system under the same assumptions. First, we establish the asymptotic behaviors of one-dimensional traveling wave solutions of the system at infinity. Using these asymptotic behaviors, we then construct appropriate super- and subsolutions and prove the existence and non-existence of two-dimensional time periodic traveling curved fronts. Finally, we show that the time periodic traveling curved front is asymptotically stable.

MSC:
- 35Q92 PDEs in connection with biology, chemistry and other natural sciences
- 35K57 Reaction-diffusion equations
- 35C07 Traveling wave solutions
- 35B10 Periodic solutions to PDEs
- 35K40 Second-order parabolic systems
- 35B35 Stability in context of PDEs

Keywords:
- periodic Lotka-Volterra competition-diffusion system; asymptotic behaviors; time periodic traveling curved fronts; existence; stability

Full Text: DOI

References:


