

Effects of Spatial Variations and Dispersal Strategies on Principal Eigenvalues of Dispersal Operators and Spreading Speeds of Monostable Equations

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Abstract. The current paper is concerned with the following two separate, but related dynamical problems, the effects of spatial variations on the principal eigenvalues of dispersal operators with random or discrete or nonlocal dispersal and periodic boundary condition, and the effects of spatial variations and dispersal strategies on the spreading speeds of monostable equations in periodic environments. It first shows that spatial variation cannot reduce the principal eigenvalue (if exists) of a dispersal operator with random or discrete or nonlocal dispersal and periodic boundary condition, and indeed it is increased except for degenerate cases. It then shows that spatial variation enhances the spatial spreading in a non-degenerate spatially periodic monostable equation with random or discrete or nonlocal dispersal. It also shows that, for two monostable equations with the same population dynamics, but different dispersal strategies, one of which is random and the other is nonlocal, the spatial spreading speed of the equation with random dispersal is greater (resp. smaller) than the spreading speed of the equation with nonlocal dispersal if the dispersal distance is small (resp. large). The results obtained in the paper reveal the importance of spatial variation and dispersal strategies in population dynamics.

Key words. Monostable equation; random dispersal; discrete dispersal; nonlocal dispersal; principal eigenvalue; spreading speed; variational principle.

Mathematics subject classification. 34L15, 35K55, 35K57, 37L60, 45C05, 45G10, 45M20, 47G10, 92D25

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