Abstract

Ecological interactions play a very important role in the population dynamics of any species. Understanding how single population growth dynamics is influenced by its interaction with other species and also its distribution and connectivity among different subpopulations through migration, is important to control the abundance and spatial distribution of species in any region. In this study, we have approached the problem theoretically by considering simple discrete population growth models of - a single host population, the host-parasite interacting population in a single site, and a metapopulation of the host-parasite interacting subpopulations with migration occurring to the nearest neighbors. The effects of the intrinsic reproduction rate of single species host population in the logistic model, the non-intuitive effects of parasitism on host growth dynamics in a logistic host-parasite model, and the effect of different rates of migration among subpopulations (in a metapopulation scenario) of the host-parasite model on the spatiotemporal dynamics of host population were studied under different conditions. Our systematic study for large parameter ranges and different dynamical regimes showed how both biotic and abiotic factors, such as the intrinsic growth rate of host species, infectivity rate of parasites, and the extent of migration in a metapopulation, affects the host populations' temporal dynamics and the patterns of distribution in space and time. We characterized the spatial patterns using quantitative measures of spatiotemporal synchrony. We showed that, at all dynamical regimes (stable, periodic and quasiperiodic) except for chaotic population dynamics, increasing the rates of migration between subpopulations would decrease the asynchronicity in spatial patterns.