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SPATIO-TEMPORAL HOLLING TYPE-IV AND LESLIE TYPE MODEL: EXISTENCE AND NON-EXISTENCE OF SPATIAL PATTERN

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Prey-predator models, with specialist predator, prey-dependent functional response and linear death rate for predators, are unable to generate any Turing like stationary heterogeneous pattern. On the other hand, the models with generalist predator are capable to explain the non-homogeneous distribution of the populations within their habitat. In this work we present the spatio-temporal pattern formation by a reaction-diffusion predator-prey system, with a Holling type IV functional response and the predator's growth follows the Leslie-Gower type growth law. We study the spatio-temporal system under homogeneous Neumann boundary conditions. For the spatio-temporal model, the uniform persistence and the global stability of the steady states through construction of Lyapunov functional have been analyzed. The existence of spatial pattern due to Turing bifurcation and spatio-temporal pattern occurring from Hopf-bifurcation are established. We have also provided analytical conditions for the existence and non-existence of the non-constant steady states and all those results are verified through rigorous numerical simulations.