Effect of evolution on host-parasitoid population dynamics

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There are a lot of discrete time model of population dynamics. These models often have a very complex solutions, namely quasi-periodic and chaotic solutions. It is interesting to know what kinds of dynamics will appear in natural population. In this study, we examine the population dynamics favored by natural selection.

Gatto [1] obtained a single-species population dynamics favored by natural selection. Kon and Takeuchi [2] obtained a population dynamics of a host-parasitoid system favored by natural selection, but in [2], it is assumed that only the host can evolve. In this study, we assume that both of the host and the parasitoid can evolve. We assume the evolutionary dynamics used in [3], where the evolutionary dynamics of predator-prey systems with a continuous time was investigated, for considering the effect of evolution of the host and the parasitoid simultaneously.

The model of population dynamics investigated in this study is the following host-parasitoid model:

$$\begin{cases} H(t+1) &= rH(t)\exp[-\mu H(t)]\exp[-aP(t)] \\ P(t+1) &= bH(t)(1-\exp[-aP(t)]), \end{cases}$$

where $H(t)$ and $P(t)$ are the population density of the host and the parasitoid at generation t, respectively, and r, μ, a and b are the reproductive rate of the host, the competitive ability of the host, the searching ability of the parasitoid and the number of the parasitoid which develops per host, respectively. This model is Nicholson-Bailey model with a density dependence in the host population.

References

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