Recent developments of the basic reproduction number theory in population dynamics

Hisashi Inaba
Graduate School of Mathematical Sciences
The University of Tokyo

The basic reproduction number R0 is a most important key idea in population dynamics and control, which gives a threshold value for population growth based on the life cycle parameters of individuals.

In my talk, I introduce a new definitions of the basic reproduction number R0 for structured populations in time-heterogeneous environments based on the generation evolution operator acting on the extended state space (the set of time-dependent generation distributions), which has a clear, realistic biological meaning and can be applied to structured population dynamics in any heterogeneous environment. The well-known next generation operator in a constant or in a periodic environment is naturally induced from the GEO by aggregating generation distributions with respect to time parameter, so we can show that our definition is a complete generalization of existing definitions.

As applications of the new definition, we can give a general formulation of the type-reproduction number in heterogeneous environments and, moreover discuss endemic threshold results in infectious disease epidemiology.

References

[1] H. Inaba (2012), On a new perspective of the basic reproduction number in heterogeneous environments, J. Math. Biol. 65(2), 309-348.

[2] H. Inaba (2013), On the definition and the computation of the type-reproduction number T for structured populations in heterogeneous environments, J. Math. Biol. 66: 1065-1097.