

Two-species contact process with competition

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We study the two-species contact process (CP) introduced by Oliveira et al. [1] with a competitive interaction. In this model, each lattice site is either vacant or hosts individuals of species A and/or B (double occupation by a single species is forbidden). Species A and B compete for empty space and in addition there is a death rate $\mu > 1$ for individuals at sites with both species present. Otherwise, the dynamics is that of the basic CP, with creation (at vacant neighbor sites) at rate λ and death of individuals at singly occupied sites at a rate of unity. Mean-field Theory, semianalytic solutions on complete graphs, and Monte Carlo simulations in one and two dimensions show that the critical creation rate λ_c for $\mu > 1$ does not depend on μ and is equal to the critical creation rate of the basic CP. Simulations yield results for the critical behavior that are compatible with the directed percolation universality class. They reveal the existence of a quasistationary state in which both species coexist, in contradiction with the competitive exclusion principle [2].

References

[1] M. M. de Oliveira, R. V. Dos Santos, and R. Dickman, Symbiotic two-species contact process, *Phys. Rev. E* **86**, 011121 (2012).

[2] E. Renshaw, *Modelling Biological Populations in Space and Time*, Cambridge Studies in Mathematical Biology, Cambridge University Press, 1991.

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