Rock-scissors-paper game in chaotic flows

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There is increasing interest in non-transitive competition as a mechanism that maintains biodiversity. The simplest model of non-transitive competition is the so called *rock-scissors-paper* game (where R beats S, S beats P, and P beats R). Experimental and simulation studies found that local interactions and small dispersal promotes the coexistence of competitors. While the earlier studies focused on the role of random diffusion, we have analyzed the dynamics of rock-scissors-paper game in a chaotic hydrodynamical flow. We have shown numerically that coexistence mainly depends on the relative speed of cell replication to speed of mixing in the flow. While for weak mixing the coexistence is typical, we have shown that in case of imperfect, but strong mixing provided by an aquatic environment, the outcome varies depending on the initial conditions. It was even possible to find coexistence when mixing was dominant over biological activity. Based on our study it is probable that microorganisms living in nonturbulent aquatic media are more diverse in the chemical warfare strategies than organisms in a highly turbulent habitat.

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