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Mutation Accumulation and Fitness Collapse at Population Frontiers MAXIM LAVRENTOVICH, University of Pennsylvania, DAVID NELSON, Harvard University — Rapid, deleterious mutations occurring in, e.g., viral populations and cancerous tissue, may accumulate and lead to fitness loss. Previous studies show that sufficiently rapid accumulation in one-dimensional populations leads to a fitness collapse, governed by the directed percolation (DP) universality class. We compare this situation to the collapse in effectively two-dimensional populations, such as the frontiers of three-dimensional range expansions. A phase diagram is computed as a function of the mutation rate μ and strength s. Relative to one-dimensional populations, we find that the collapse occurs in a smaller region of phase space. The scaling combination governing the phase diagram shape is $\mu|\ln s|/s$ (μ/s^2 for one-dimensional populations). We argue that the evolutionary dynamics is described by a set of coupled DP Langevin equations near the transition, and that the coupling terms lead to deviations from expected DP scaling.

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