Survival of a lazy evasive prey: modest effort, high success

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We study the survival of a prey which is hunted by N predators. The predators perform independent random walks on a regular lattice with V sites. When a predator jumps to the site occupied by the prey, the prey is caught. We analyze the efficacy of a lazy evasion strategy according to which the prey tries to avoid encounters with the predators by making a hop only when any of the predators appears within its sighting range. Otherwise the prey stays at its position. In this situation a prey exhibit diffusive-type motion. If the sighting range of such a lazy prey is equal to one lattice spacing, several predators are needed in order to catch the prey. Hence, when the density of the predators is low, the lazy evasion strategy leads to the spectacular increase of the survival probability. The model has been studied on different lattices: honeycomb, square and triangular in 2D, and simple cubic and diamond in 3D. The minimal number of predators needed to catch a prey, depends on the lattice type. The minimal number of predators is 2 for the triangular lattice, 3 for the square and honeycomb lattices and 4 for simple cubic and diamond lattices. The survival probability of an lazy evasive prey exponentially decreases with the time. For small predators density the rate of the survival probability is proportional to the predators density to the power Q, where Q is the minimal number of predators we need to catch a prey on the particular lattice. We also study the model with predators having large sighting range. Whenever the prey appears within predators sighting range, predators start a direct chase. In this case a pair of the predator and the evasive prey exhibit superdiffusive motion. The lazy evasion strategy leads to the spectacular increase of the survival probability when the density of the predators is low. The system with large sighting range of the predators exhibit an effective superdiffusive motion, whereas a far-sighting prey performs a diffusive-type motion.

[l] G. Oshanin, O. Vasilyev,, PNAS **106**, 13696 (2009).