UNUSUAL WAVE PHENOMENON IN EXCITABLE SYSTEMS WITH NONLINEAR CROSS-DIFFUSION

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Mathematical models with cross-diffusion describe many processes of pattern formation and nonlinear wave propagation in spatially distributed systems [1]. It was shown [2-4] that excitable systems with cross-diffusion exhibit new wave properties that make them substantially different from excitable waves in systems of reaction-diffusion type. Of special interest are population taxis waves. Mathematical description of those includes nonlinear cross-diffusion.

In this report we consider population systems in a "predator-prey" relationship with each other. Spatial evolution is governed by three processes: positive taxis of predators up the gradient of prey (pursuit) and negative taxis of prey down the gradient of predators (evasion), yielding nonlinear "cross-diffusion" terms, and random motion of both species (diffusion). We describe a new type of wave phenomena observed in reaction-taxis systems of equations. This is ''running tail'', a localized stable perturbation steadily moving laterally along the back of a plane wave [5]. We suggest a mechanism of such running tails for bacterial population waves. This mechanism was confirmed by numeral simulation on mathematical model describing chemotaxis of bacteria on the nutrient substrate. Different regimes of interactions of running tail were investigated.

The study was supported by RFBR grant 07-04-00363.

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