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Modeling ant activity cycles with delay differential equations

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Ants are eusocial insects, characterized by a caste structured society, in which some individuals are responsible for work (and are often sterile) and others for reproduction. Workers present activity bursts, i.e., a fraction of workers become active roughly at the same time, as observed in the *Leptothorax acervorum* species. (1) While active, a worker might enter an inactive state where it does not execute any action for some period. After this rest period, it may engage in a task, whether by contact with an active ant or by itself (autocatalysis), as described by Goss and Deneubourg in 1988. (2) We derived a mean-field delay differential equation (DDE) system, with the delay representing the rest period, in which the agents are allocated in groups regarding their activity state. (3) Through fixed point analysis, we found the region in parameter space where solutions are unstable, and the critical rest period values for which the fixed point solutions are stable.

Palavras-chave: Ethology; Ant activity; Delay differential equations;

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