A Model of Caste Differentiation in Termite Colony Based on Juvenile Hormone Inhibition

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Eusocial insects form colony and adapt environmental fluctuations. Colony is maintained with caste differentiation, which is a self-organized task allocation. We researched termite caste differentiation. Termites have several specialized castes. The pseudergate, one of those, has some differentiation possibilities. It is suggested that Juvenile Hormone (JH) is concerned in termite caste differentiation. Our research emphasized focus on the relationship between the pseudergate caste differentiation and time evolution of JH titer. We built an termite internal state model through development for understanding of caste differentiation mechanism. Additionally, we built the model of the caste differentiation in termite colony. Mathematical analysis of the model with dynamical system conduced comprehensive property of the model. In addition, the model of termite internal state were evaluated with computer simulation.

Eusocial insect colonies have been studied as an example of swarm intelligence. Clarification of caste differentiation mechanisms engenders not only understanding of eusocial insect colonies, but also understanding of the design of multi-agent systems. This study clarifies the termite caste differentiation mechanism. Termites are known to have multiple castes and display many caste differentiation phenomena. Nevertheless, the internal state of individuals with respect to caste differentiation remains unclear. Mathematical modeling that reproduces caste differentiation was used to solve the problem. An earlier termite caste differentiation model was investigated, but that study did not include a developmental process. Measured chemical amounts of termites ' standalone chemicals are technically too difficult to evaluate using a model. Therefore, an internal state model using the colony and a colony mathematical simulation model is introduced for mathematical analysis of caste global behavior by inspecting the internal state model to evaluate.