Genomic imprinting drives the evolution of termite eusociality

Author(s): Kenji Matsuura, Kenji Matsuura , Nobuaki , Kazuya Kobayashi , Toshihisa Yashiro , Edward L. Vargo

Institution(s): Laboratory of Insect Ecology, Kyoto University, Japan ; Laboratory of Insect Ecology, Kyoto University, Japan ; Kyoto University, Japan ; School of Life and Environmental Science, University of Sydney ; Department of Entomology, Texas A&M University ; Laboratory of Insect Ecology, Kyoto University, Japan

Eusocial insects exhibit the most striking example of phenotypic plasticity. There has been a long controversy over the factors determining caste development of individuals in social insects. It has been known that parental phenotypes influence the caste fate of offspring in termites. For example, female offspring of sexually matured queens and worker-derived males develop exclusively into queens, as do parthenogenetically produced daughters. Such heritable effects on caste propensity has been recognized as an evidence of genetic caste determination. Recently, we demonstrated that parental phenotypes influence the social status of the offspring not through genetic inheritance but through genomic imprinting. We conducted extensive field survey and genetic analysis of the termite *Reticulitermes speratus* and concluded that the caste system of this species cannot be explained by genetic caste determination models. Alternatively, we documented a genomic imprinting caste determination system in termites, in which queen- and king-specific epigenetic marks antagonistically influence the sexual development of offspring and thus determine their caste fate. Our genomic imprinting model accounts for all known empirical data on caste differentiation in termites and explains the evolutionary processes underlying diverse reproductive systems. According to the genomic imprinting model, the worker caste is seen as a ‘neuter’ caste whose sexual development is suppressed due to counterbalanced maternal and paternal imprinting. Interestingly, a wide variety of species including lower and higher termites share the genomic imprinting caste determination system. In this talk, we further propose a novel hypothesis that genomic imprinting played an essential role during the transition from subsocial to eusocial.