

“Quantifying social dilemma in ant societies”

Shigeto Dobata (University of Tokyo)

Social insects such as ants, bees, wasps and termites are regarded as one of the most prosperous organisms on the earth. Their ecological and evolutionary success is often attributed to the cooperation among nestmates, defined by any social traits that are beneficial to others but costly to the actor (in fitness term). Although apparently highly adaptive at the level of the colony, cooperation is easily undermined by the evolution of individual selfishness, as is well known in prisoner's dilemma and snowdrift games in evolutionary game theory. To illustrate the existence of such social dilemma in real social insect colonies, I provide two lines of studies, both obtained from the Japanese ant *Pristomyrmex punctatus*. The life history of *P. punctatus* is characterized by annual life cycle, parthenogenesis, and queenless reproduction, which enable us to measure reproductive success of individuals. I will first introduce our finding of the rare “cheater” lineage that causes public goods dilemma in their colonies. The cheater lineage can be regarded as an example of “evolutionary suicide” that eventually leads to the evolutionary maintenance of cooperation in this species. Then I will outline our ongoing project of genome-wide association study of workers' reproductive success in normal wild colonies to illustrate that the social dilemma can be locus-specific by taking a form of opposing directions between direct and indirect genetic effects.