Group composition, division of labor and fitness in the clonal raider ant

Author(s): Yuko Ulrich, Yuko Ulrich , Jonathan Saragosti , Vikram Chandra , Molly Liu , Daniel Kronauer

Institution(s): Lausanne University, Switzerland ; Rockefeller University, USA ; Rockefeller University, USA ; Rockefeller University, USA ; Rockefeller University, USA ; Lausanne University, Switzerland

Testing hypotheses on division of labor (DOL) requires the ability to manipulate colony composition. For example, the demographic and genetic structure of colonies, as well as their size, is expected to affect DOL and, in turn, colony fitness. However, measuring the effect of each of these factors is challenging because they inherently co-vary in many systems. To avoid this issue, we investigated the relationship between group composition, DOL, and fitness in the clonal raider ant *Ooceraea biroi*, a queenless, parthenogenetic species that affords maximal control over colony composition and size. We manipulated each of these factors independently by setting up experimental colonies varying in size (1 to 16 workers), genetic structure (single vs. mixed genotypes), demographic structure (single vs. mixed age cohorts), or reproductive physiology (mixing workers with low and high ovariole number). Long-term automated tracking of individual ants in over 300 colonies allowed us to quantify DOL and we also measured several fitness components. We show: 1) emergence of DOL and increases in fitness occurring already in very small colonies, 2) effects of individual age, genotype, and reproductive physiology on behaviour, 3) unexpected effects of mixing individuals of different genotypes, age, or reproductive physiology on colony-level behavior. By manipulating the main aspects of colony composition that are proposed to affect DOL and measuring their effects on colony performance, we provide a thorough picture of the causes and consequences of DOL in an emergent model system for social behavior.