# Wingless workers underlie the evolutionary success of ants

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Ant colonies are organized similarly to those of wasps and bees: infertility of workers, division of labor based on age, and complex communication. Yet ants exhibit much higher total biomass, more species, and their lifestyles and diet are more diverse. What factors additional to sociality caused this evolutionary diversification? First, wingless workers revolutionized colonial economy because they are cheaper *per capita*. Second, miniaturization is widespread among insects (especially parasitic wasps), and is based on simplifications of organs and tissues. This ability was fully exploited in over 50 ant genera that have dwarf workers (head width < 1mm), resulting in further reductions in costs. In parallel, expensive giant queens occur in many lineages as adaptation for claustral foundation and higher fecundity. This independence of costs between workers and queens allows for numerous and varied patterns of allocation of a colony's finite energy budget. Accordingly, worker numbers increased whenever this was adaptive. Dwarf workers and giant queens also promoted the evolution of novel castes such as soldiers. Nonetheless, many formicoid genera exhibit limited queen-worker dimorphism, and their colonies are not populous. The winglessness of ant helpers permitted to benefit fully from morphologically specialized castes, unlike in social wasps and bees.

Peeters C. & Ito F. Wingless workers underlie the evolutionary success of ants. Submitted