Is worker reproduction in Acromyrmex leaf-cutting ants affected by genomic imprinting?

Author(s): Jack Howe, Jack Howe , Morten Schiøtt , Qiye Li , Guojie Zhang , Jacobus J. Boomsma

Institution(s): Centre for Social Evolution, University of Copenhagen, Denmark ; Centre for Social Evolution, University of Copenhagen, Denmark ; China National GeneBank, BGI-Shenzhen, Shenzhen, China ; 1. Centre for Social Evolution, University of Copenhagen, Denmark. 2. China National GeneBank, BGI-Shenzhen, Shenzhen, 518083, China. ; Centre for Social Evolution, University of Copenhagen, Denmark ; University of Copenhagen, Denmark

Genomic imprinting describes an unusual pattern of gene-expression whereby only a single copy of a gene is used, dependent on the parent from whom the allele was inherited. The kinship theory of genomic imprinting proposes that imprinting can evolve when relatedness asymmetries induce conflict between maternally and paternally derived genes over the optimal levels of altruism and selfishness . There is now considerable support for the kinship theory in genes expressed in mammalian placentas and brains, and in the seed endosperm of flowering plants. As such, attention is now starting to focus on other systems where imprinting is predicted. The eusocial Hymenoptera have long been touted as ideal model organisms for finding evidence of imprinting, as they have both the required relatedness asymmetries and the close interactions among kin that should select for imprinting. Yet, while tentative behavioural, epigenetic and sequence-based evidence is beginning to accumulate, definitive confirmation of an imprinted gene is still lacking. Several studies have now identified a number of genes with parental bias in the honeybee, and there are indications of bias consistent with imprinting in the bumblebee. While this is encouraging, studies in the honeybee to date have typically relied on the creation of unnatural, simplified colony kin-structures, obtained via hybrid crosses or artificial insemination with a single father. Here, we utilise the natural variation present in colonies of another highly derived superorganismal insect, the leaf-cutting ant Acromyrmex echinatior whose queens are typically inseminated by 3-10 males. We use a combination of morphological observation, paternity analysis and high-throughput sequencing to elucidate the putative roles of colony kin-structure and paternal identity in the reproductive behaviour of unmated workers who develop their ovaries, and to determine whether the genes involved in selfish worker reproduction are imprinted as predicted.