Genome of clonal raider ant provides promising model to study social evolution and behavior

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Social insects, which usually have specialized behavioral groups (also called castes), are important models for social evolution and behavior researches. How division of labor in insect societies is regulated is an outstanding question and not fully understood yet. However, in many social insect species, experimental control over important factors that regulate division of labor, such as genotype and age, is limited. In a study published online on February 6th in *Current Biology*, researchers from Rockefeller University and BGI-Shenzhen have sequenced the genome of the queenless clonal raider ant *Cerapachys biroi*, a new model system to study the molecular mechanisms of social behaviors.

Ants of the genus *Cerapachys* are myrmecophagous and raid the nests of other ants. It belongs to the dorylomorph clade of ants, which also includes the infamous army ants. Since the early 1900s, introduced populations of *C. biroi* have become established on tropical and subtropical islands around the world, probably as a consequence of human traffic and trade. Like in many other army ants, colonies of *C. biroi* undergo two phases in their life cycles: one is for reproduction and the other for foraging and brood care. And more interestingly, colonies of *C. biroi* uniquely consist entirely of totipotent workers, all of which reproduce asexually.

The authors noted one of the most interesting findings of this study is that nestmates in a colony are almost clonally related and reproduce via an asexual way called automixis with central fusion, which was also found in the Cape honeybees. Asexual reproduction usually leads to loss of genomic heterozygosity, which is harmful in the long run. However, that genomic heterozygosity in *C. biroi* is lost extremely slowly. "It is not yet clear whether maintaining heterozygosity in *C. biroi* is through reduced recombination during meiosis, via selection against homozygous individuals, or both." said Dr. Peter Oxley, co-first author of this study, in Laboratory of Insect Social Evolution, Rockefeller University.

Nestmates of *C. biroi* can synchronously alternate between reproduction and brood care. The authors also found expression patterns of the genes associated with division of labor in other social insects are conserved in *C. biroi* and dynamically regulated during the colony cycle. "This suggests that the gene networks underlying reproduction and brood care in *C. biroi* are likely to be the same conserved networks underlying caste-specific behavior in other eusocial insects." said Dr. Daniel Kronauer, co-senior author of this study and head of Laboratory of Insect Social Evolution in Rockefeller University.

Because *C. biroi* colonies have totipotent workers and no queens, it is easy to conduct colony propagation and control the composition of arbitrarily sized experimental colonies. In addition, the colony cycle of *C. biroi* allows for precise selection of age-matched workers and experimental control over colony demography. "Ants represent one of the most successful exclusively eusocial insects, with at least 15,000 species have been recorded, they have evolved innumerous diversity. This is the fourth ant genome published in our group. The clonal raider ant is unique in many aspects compared to other ants. There are still many interesting questions related to the development and evolution of the queenless and reproductive cycle in this system that we don't know yet. The availability of this genome could pave the road for these future studies." said Dr. Guojie Zhang, co-senior author of this study, from China National Genebank, BGI-Shenzhen and Centre for Social Evolution in University of Copenhagen.

Provided by BGI Shenzhen