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Evolution of social hybridogenesis in Cataglyphis *desert ants*

Hugo Darras, Serge Aron

Social hybridogenesis has evolved repeatedly in ants (e.g., *Pogonomyrmex*, *Solenopsis*). Hybridogenetic populations consist of self-sustainable pairs of hybridizing lineages. Queens of each pair mate with males of the opposite lineage to produce workers. By contrast, reproductive individuals arise from intra-lineage mating and maintain pure-lineage genomes. Recently, a new form of social hybridogenesis was discovered in the desert ant *Cataglyphis hispanica*. All workers are inter-lineage hybrids, whereas male and female sexuals are produced by asexual reproduction through parthenogenesis. As a consequence, only maternal genes should be perpetuated across generations. This system, as it stands, is expected to be evolutionarily short-lived due to long-term costs of asexual reproduction and selection against males, which do not contribute any genes to reproductive offspring. Contrary to this expectation, we show (i) that hybridogenetic lineages in *Cataglyphis* ants have been maintained over a long evolutionary time and across a large geographic scale. Hybridogenetic lineages occur in a whole complex of species that have diverged several millions years ago and are distributed from Northwest Africa to West Asia. (ii) Furthermore, a detailed survey of colonies structure in *C. hispanica* reveals that the workers are hybrids of the same two genetic lineages across the whole distribution range of the species. (iii) Remarkably, hybridogenetic *Cataglyphis* ants escape the costs of asexual reproduction by the sporadic production of new queens by intra-lineage mating, instead of parthenogenesis. Rare intra-lineage mated queens were found in polygynous colonies. Genetic analyses indicate that they lay fertilized eggs; these eggs fail to develop into workers but can achieve queen development. Thus, intra-lineage mated queens produce new queens and males only. Though they do not contribute to the production of the worker-force, these ‘social parasites’ promote genetic diversity and ensure non-null male fitness.