



## Phylogeny, classification, and species-level taxonomy of ants (Hymenoptera: Formicidae)\*

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### Abstract

The current state of ant systematics is reviewed. In recent years substantial progress has been made in identifying the major clades of ants and the relationships among them. Earlier inferences about ant phylogeny based on morphology have been refined and modified as a result of a recent influx of molecular (DNA sequence) data and new fossil discoveries. It is now apparent that much of the biological and taxonomic diversity of ants is contained within the “formicoid clade” which comprises 14 of the 20 extant subfamilies and about 90% of all species. Whether the remaining groups of extant ants (Leptanillinae and the poneroid subfamilies) represent a clade or a grade at the base of the ant tree remains unresolved. The fossil record for crown group ants extends back to 90–100 mya. Stem ants (sphecomyrmines, armaniines) were also present during this period. Molecular divergence date estimates that take into account the fossil record of both ants and other Hymenoptera suggest that crown group ants arose ~115–135 mya. Most of the extant ant subfamilies and genera are well defined morphologically and likely monophyletic, but there are some notable exceptions including the subfamily Cerapachyinae and several large and ambiguously delimited genera such as *Pachycondyla*. Several tribes in the large subfamilies Formicinae and Myrmicinae also represent artificial assemblages. Finally, while the species-level taxonomy of some ant genera is in a satisfactory state, taxonomic anarchy reigns in others, with numerous ill-defined species and many names of uncertain applicability. Progress in this area of ant systematics will require sustained individual efforts, expansion of job opportunities, enlistment of new technologies, and a deeper understanding of the nature of ant species and the differences between them.

**Key words:** ant systematics, molecular phylogenetics, alpha-taxonomy, fossils, formicoid clade