Phylogeny of the Chalcidoidea

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Economically and ecologically, Chalcidoidea are one of the most important groups of insects. More than 500,000 estimated species are grouped into 19 families, 81 subfamilies and over 2000 genera. Relationships among these mostly parasitic wasps have remained untested, and so far are based solely upon intuitive ideas or studies of only a few closely related groups. The Hymenoptera Tree-of-Life project was focused on three important aspects of Chalcidoidea: their monophyly, their sister group relationships within Hymenoptera, and relationships within the superfamily. These questions are being addressed using morphological and molecular characters, although only the later results will be discussed. The molecular phylogeny of Hymenoptera as based on four gene regions (28S, 18S, COI and EF-1alpha) supports both monophyly of Chalcidoidea and a sister group relationship with either Diapriidae or Mymarommatidae. A more directed study using 31 outgroup Proctotrupomorpha and 504 Chalcidoidea representing all families and 69 subfamilies for portions of 28S (D2-D5) and 18S (E17-35) has been completed. Alignment is optimized by eye across all taxa and also using secondary structure analysis with ambiguous regions optimized in MAFT. Data are analyzed using RAxML and CIPRES. Monophyly of Chalcidoidea is supported, as is a sister group relationship between Diapriidae and Chalcidoidea, and Mymaridae and the remaining Chalcidoidea. Several important and diverse family groups are monophyletic, including Agaonidae, Encyrtidae, Eulophidae and Trichogrammatidae, as are most subfamilies. Several family groups are polyphyletic, including Aphelinidae and Chalcididae. The implications of the phylogeny for understanding morphological and behavioral evolution in the group will be discussed.