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Testing the validity of Northern European species in the *Chrysis ignita* species group (Hymenoptera: Chrysididae) with DNA Barcoding

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Abstract

Containing more than a hundred species, the *Chrysis ignita* species group is the largest and one of the most taxonomically challenging groups in its genus. It has not been possible to resolve the taxonomy of the group using traditional methods due to the lack of robust diagnostic morphological characters. Here we present the results of a molecular analysis designed to delimit species in the *Chrysis ignita* group for the first time; using mitochondrial sequence data for 364 in-group specimens consisting of all 18 species known to occur in Northern Europe. Two mitochondrial loci were analysed: a COI gene fragment, and a continuous DNA sequence consisting of 16S rRNA, tRNA^{Val}, 12S rRNA and ND4. Two approaches were employed for delimiting species: (1) genetic distance analysis based on the standard COI barcode sequences and; (2) phylogenetic analysis of the COI fragment together with rRNA genes. Both analyses yielded trees with similar topology, but support values for nodes were higher using the second approach. Fifteen species were distinguished in all analyses: *Chrysis angustula* Schenck, 1856, *C. brevitarsis* Thomson, 1870, *C. clarinicolis* Linsenmaier, 1951, *C. corusca* Valkeila, 1971, *C. fulgida* Linnaeus, 1761, *C. ignita* (Linnaeus, 1758), *C. impressa* Schenck, 1856, *C. iris* Christ, 1791, *C. leptomandibularis* Niehuis, 2000, *C. longula* Abeille de Perrin, 1879, *C. ruddii* Shuckard, 1837, *C. schencki* Linsenmaier, 1968, *C. subcoriacea* Linsenmaier, 1959, *C. terminata* Dahlbom, 1854 and *C. vanlithi* Linsenmaier, 1959. The specific status of *C. mediata* Linsenmaier, 1951 and *C. solida* Haupt, 1957 was not resolved. Included unidentified specimens grouped in three clusters, two of which are distinctly delimited and apparently represent cryptic species. The specific status of the unidentified samples in the third cluster remained unclear. Moreover, our data suggest the existence of additional cryptic species currently lumped under the names *C. pseudobrevitarsis* Linsenmaier, 1951 and *C. schencki* Linsenmaier, 1968. In conclusion, our results derived from analysis of mitochondrial loci strongly support the specific status of the majority of currently recognised species in the *Chrysis ignita* species group, and suggest the existence of additional cryptic species in Northern Europe. Thus, considering the difficulties that often arise during species determination based on morphological characters, the mtDNA loci used here appear highly suitable for assisting species delimitation in this group as well as identification of specimens.

Key words: barcoding, cryptic species, Bali-Phy, cuckoo wasps, molecular phylogeny

Introduction

Commonly known as cuckoo wasps, the Hymenoptera family Chrysididae is a medium sized cosmopolitan group including more than 3000 described species. All members of the family are parasitoids or cleptoparasites, whose hosts belong to various families of Hymenoptera, Phasmatodea or Lepidoptera. The largest genus in the family, *Chrysis* Linnaeus, 1761, is diverse and cosmopolitan, and contains several taxonomically unresolved species

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