

The Polysphincta-group of Japan : Phylogeny, systematics and evolution of mode of parasitism (Pimplinae, Ichneumonidae, Hymenoptera)

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Abstract

The *Polysphincta*-group of Japan was revised, 51 species were recognized and arranged in 21 genera. Four genera and 11 species were described as new to science; six genera and 9 species were newly recorded from Japan, one species was resurrected from synonymy; redescriptions were given for taxa other than new ones; one new generic and one new specific synonymies, and four new combinations were proposed; twenty two new host-parasitoid associations were established. A key to Japanese genera and species of the group is provided. Biological information of this group was reviewed to exhibit diversity in mode of parasitism, and notes on the host, immature stages and behaviours of the parasitoid and host spiders are given for each species where available. The phylogenetic relationships between genera of the group were surveyed using molecular markers, partial sequences of COI, 28S rRNA and EF-1 α , and maximum likelihood and Bayesian approaches to obtain a robust phylogenetic hypothesis to understand the evolution of the group. The *Polysphincta* group was recovered as monophyletic, although relationships between genera were different from previous hypotheses based on morphological data. Within the *Polysphincta* group, three major clades were recognized and phylogenetic relationships among them were well resolved as (*Schizopyga* subgroup + (*Acrodactyla* subgroup + *Polysphincta* subgroup)). The *Schizopyga* subgroup consisted of the genera *Piogaster*, *Schizopyga*, *Zabrachypus* and *Brachyzapus*. As the genus *Schizopyga* was found to be polyphyletic, the genus *Dreisbachia*, which had been synonymized under *Schizopyga*, was resurrected and *Iania* gen.n. is proposed for *Dreisbachia pictifrons*, to maintain monophyletic genera. Species of the *Schizopyga* subgroup utilize spiders constructing egg-laying chambers or funnel webs as hosts. The genus *Piogaster* was not recovered as the sister to all other members of the genus group, unlike previous hypotheses, but was nested in this clade as (*Zabrachypus* + ((*Brachyzapus* + *Schizopyga*) + (*Dreisbachia* + (*Iania* + *Piogaster*))))). Members of the *Acrodactyla* and *Polysphincta* subgroups attack spiders that weave aerial webs. The host range of the former is centred on tetragnathid and linyphiid spiders, the host range of the latter seems to centre mainly on orb-weaving araneids and partly on theridiids weaving three-dimensional (3D) irregular webs. Based on the obtained phylogeny of the group, the evolution of larval and cocoon morphology, and the mode of parasitism are discussed. A checklist of all Japanese taxa and host-parasitoid index were also provided.