



Systematics of the *Protohermes costalis* species-group (Megaloptera: Corydalidae)

XINGYUE LIU¹, FUMIO HAYASHI² & DING YANG^{1,*}

¹Department of Entomology, China Agricultural University, Beijing 100094, China.

E-mail: liu_xingyue@yahoo.com.cn or dyangcau@yahoo.com.cn

²Department of Biology, Tokyo Metropolitan University, Minamiosawa 1-1, Hachioji, Tokyo 192-0397, Japan.

*Corresponding author

Table of contents

Abstract	2
Introduction	2
Material and methods	2
Results	7
Discussion	7
Systematics.....	11
Genus <i>Protohermes</i> Weele 1907	11
The <i>Protohermes costalis</i> species-group	11
Key to species of the <i>P. costalis</i> species-group	12
<i>Protohermes acutatus</i> sp. nov.	13
<i>Protohermes arunachalensis</i> Ghosh	16
<i>Protohermes basiflavus</i> Yang	18
<i>Protohermes basimaculatus</i> sp. nov.	19
<i>Protohermes costalis</i> (Walker)	21
<i>Protohermes disjunctus</i> sp. nov.	23
<i>Protohermes fujianensis</i> Yang & Yang	25
<i>Protohermes gutianensis</i> Yang & Yang	26
<i>Protohermes hunanensis</i> Yang & Yang	28
<i>Protohermes lii</i> sp. nov.	30
<i>Protohermes niger</i> Yang & Yang	31
<i>Protohermes orientalis</i> sp. nov.	33
<i>Protohermes similis</i> Yang & Yang	35
<i>Protohermes sinensis</i> Yang & Yang	36
<i>Protohermes stigmosus</i> sp. nov.	38
<i>Protohermes triangulatus</i> sp. nov.	39
<i>Protohermes yangi</i> sp. nov.	41
<i>Protohermes yunnanensis</i> Yang & Yang	43
Acknowledgements	44
References	45

Abstract

The dobsonfly genus *Protohermes* is the largest genus in Megaloptera, with the richest species diversity and the widest geographic distributions. In the present study, the *Protohermes costalis* species-group is recognised, including 18 species. Eight species are described herein as new: *Protohermes acutatus*, *Protohermes basimaculatus*, *Protohermes disjunctus*, *Protohermes lii*, *Protohermes orientalis*, *Protohermes stigmosus*, *Protohermes triangulatus* and *Protohermes yangi* spp. nov. The interspecific phylogeny within the *P. costalis* species-group is reconstructed by a cladistic analysis. Discussions on the phylogeny and the biogeography of the *P. costalis* species-group are also made.

Key words: Corydalidae, *Protohermes*, new species, phylogeny, biogeography, Asia

Introduction

The megalopeteran genus *Protohermes* Weele is the largest genus of Corydalidae, with nearly 50 described species, which are distributed from far eastern to southeastern Asia. The adult is medium to large sized, usually with yellowish body coloration and several yellowish or whitish markings on wings. The male genitalia show various modifications and provide useful evidence for specific identification. The male tenth tergum varies considerably from elongated band-like structures to short subcylindrical processes. The male ninth sternum is modified to form a subgenital plate, with a posterior incision varying from deep to shallow and from V-shaped to trapezoidal. The female genitalia sometimes show a few interspecific differences in morphology.

As with many corydalid species, *Protohermes* larvae are predaceous, living in clean streams of mountainous and wooded areas. The adults emerge from late spring to early autumn, are usually found near stream banks, and are readily collected at lights. The detailed natural history of *Protohermes* is well known only in *Protohermes costalis* (Walker), *Protohermes immaculatus* Kuwayama, and *Protohermes grandis* (Thunberg), from the studies by Hayashi (1989a, 1989c, 1990).

The genus *Protohermes* was established by Weele (1907) and revised by many authors (Weele, 1910; Lestage, 1927; Kimmins, 1948; Glorioso, 1981; Yang, 1985). The genus is monophyletic, with *Neurhermes* as its sister. Together they are a sister lineage to the remaining genera within Corydalinae under Penny's assumption (1993) or sister lineage to the rest of Corydalinae genera, excepting *Chloroniella*, with the most primitive phylogenetic status under Contreras-Ramos' (1998) assumption. However, the interspecific phylogeny of the *Protohermes* species remains poorly studied so far. Recently, Liu & Yang (2005) have split the genus into several species groups.

Protohermes costalis (Walker) is a common species in Oriental China. It is characterized by widely separated ocelli and a subcylindrical male tenth tergum bearing a ventral tuft. During this study, more species were found to be closely related to *P. costalis*. Thus, in the present paper, the *Protohermes costalis* species-group is recognized. All 18 group members, including eight species new to science, are keyed, described, and illustrated. A preliminary phylogenetic analysis of the *P. costalis* species group is undertaken based on morphological data. Geographic distributions are updated, and phylogenetic relationships and biogeography for the species group are also discussed.

Material and methods

Taxa studied

Specimens were obtained from the following collections: the Entomological Museum of China Agricultural University (CAU), Beijing; Hebei University (HBU), Baoding; Institute of Zoology, Chinese Academy of Sciences (IZCAS), Beijing; Kunming Institute of Zoology, Chinese Academy of Sciences (KIZCAS), Kun-