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Article

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Immature stages of the rose chafers (Coleoptera: Scarabaeidae: Cetoniinae): a historical overview

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Abstract

Immature stages of holometabolous insects represent a useful source of information for phylogenetic studies. However, knowledge about immature stages of insects is generally poor. This paper presents a historical overview on the study of immature Cetoniinae and provides an up-to-date list of 194 so far described taxa at the species level. Most immature stages are described for the Cetoniini. Larvae of Microvalgini, Taenioderini, and Phaediminini are unknown, while the larvae of Platygeniini need to be redescribed.

Key words: Cetoniinae, Cetoniini, Trichiini, Valgini, immature stages, white grubs

Introduction

The modern phylogenetic approach in entomology demands more and more material to create datasets for conducting various analyses. In addition to molecular studies, there is a significant renaissance of morphology-based phylogenetic work (*e.g.*, Ahrens 2006, Straka & Bogusch 2007, Lee *et al.* 2007, Grebennikov & Newton 2009). In many studies, larval characters demonstrated to be helpful in recovering phylogenetic relationships either alone or in combination with other datasets (Archangelsky 2004, Beutel & Leschen 2005, Grebennikov & Newton 2009, Kiselyova & McHugh 2006). The same situation also occurs in the phytophagous clade of scarab beetles (sensu Smith *et al*. 2006). Besides a number of recently published descriptions of various scarab larvae (*e.g.*, Orozco & Pardo-Locarno 2004, Randriamanantsoa *et al*. 2010), there have also been a few attempts to use larval characters in phylogenetic research (Sawada 1991, Grebennikov & Scholtz 2004, Micó *et al.* 2008, Šípek *et al.* 2009; see also below).

Orozco & Pardo-Locarno (2004) estimated that larvae of 61 species of Cetoniinae (sensu Krikken 1984) have been described, however their number seemed to be far from complete. This led us to update the data in an unpublished thesis (Šípek 2003) and to make them available for the scientific community. The aim of this paper is to provide a more complete overview of the described immature stages of Cetoniinae beetles, summarize available literary records, show where data are missing, and to indicate a possible direction of further research. Despite all efforts, the presented list might not be complete; the authors will appreciate any updates and suggestions in order to compleete the list of described immature Cetoniinae.

Material and methods

References to relevant studies were collected using the *Zoological Record* and *Biological Abstracts* databases as well as other commonly used electronic search engines and individual searches in libraries. All relevant data on immature stages of Cetoniinae available to us are summarized in Table 2.

The suprageneric classification of Cetoniinae remains an issue of dispute among various authors and need to be commented upon at this point. The origins of the contemporary suprageneric classifications date back to 1984

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