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## Larval morphology of selected *Quedius* Stephens, 1829 (Coleoptera: Staphylinidae: Staphylinini) with comments on their subgeneric affiliation

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### Abstract

The study concerns the larval morphology of eight *Quedius* species from four subgenera: *Distichalius*, *Microsaurus*, *Quedius*, and *Raphirus*. Mature larvae of three species: *Q. (Microsaurus) brevis*, *Q. (M.) cruentus*, and *Q. (M.) microps* are newly described. The hitherto poorly known larvae of five species: *Q. (Raphirus) boops*, *Q. (Distichalius) cinctus*, *Q. (s. str.) fuliginosus*, *Q. (s. str.) molochinus* and *Q. (M.) mesomelinus*, are redescribed. Illustrations of structural features are provided. The combination of characters that allow for distinguishing the known mature larvae of *Quedius* from closely related genera within the subtribe Quediina is specified. Diagnostic larval morphological characters for each of the subgenera are proposed. The analysis of morphological features within the genus *Quedius*, with the application of the Multi-Variate Statistic Package (MVSP), showed high distinctiveness of the subgenus *Quedius* and low coherence among species within the subgenus *Microsaurus*. The intraspecific variation in the number of bifurcate setae and their spacing on fore tibiae of *Q. cinctus* is presented.

**Key words:** description, larva, tibial comb, diagnostic characters, Quediina

### Introduction

According to the current conventional system of the rove beetles tribe Staphylinini, the genus *Quedius* represents one of the largest groups, including approximately 800 described species divided into more than 10 subgenera (Herman 2001). However, recent phylogenetic analyses have demonstrated that the genus *Quedius* is polyphyletic and restricted to a smaller group of species from north temperate zone of the Holarctic region. The limits of this genus and, to some extent, problems of its subgeneric division have lately been discussed at a global scale (e.g. Solodovnikov 2006, 2012; Brunke & Solodovnikov 2013; Smetana 2013). In contrast to the extensive on adults, the available data on larval characters of *Quedius* are still too fragmentary to be explored as an informative source of data in resolving questions of generic limits and intrageneric division. Therefore, they have never been included in any robust systematic or phylogenetic discussion. Well defined larval characters of some species, however, constitute a useful and helpful tool that has already allowed a revision of the systematic position of some puzzling *Quediina* species (e.g. *Quedius antipodum* Sharp, 1886, *Astrapaeus ulmi* (Rossi, 1790); Pietrykowska-Tudruj *et al.* 2011; Pietrykowska-Tudruj *et al.* 2014).

For the genus *Quedius*, larval morphology has been described for 31 species primarily distributed in the Palearctic region. Due to the relatively high number of species with known larval morphology, it would seem that this species-rich genus, similar to the others within Staphylinini (e.g. in *Philonthus*, larvae of approximately 50 out of more than 1200 known species have been described) is thoroughly studied. However, a number of the existing descriptions are outdated, incomplete or fragmentary with poor, if any, illustrations. The majority of larval data are included in the following three collective works: Paulian (1941), Pototskaya (1967), and Kasule (1970). A few works by Voris (1939), Smetana (1957, 1962), Frank (1969), Bordoni (1978), and Staniec (2003), each targeting one or two species only.

Due to the above circumstances, the objective of this paper is to study the morphology of mature larvae (L<sub>3</sub>) of

detailed illustrations, SEM photos or measurements, it is difficult to accurately determine their real similarity to those present in *Q. brevis* and *Q. brevicornis*.

Subclade b includes the remaining members of *Microsaurus* as well as *Distichalius* and *Raphirus*. Representatives of the two latter ones, namely *Q. cinctus* and *Q. boops* form a clade sister to three species of *Microsaurus*. Characters unique to the subgenus *Microsaurus* seem to include the shape of the posterior part of nasale as in Figs 3C, D. At the same time we assume that the shape of nasale present in *Q. mesomelinus* and *Q. cruentus* as in Fig. 3D is a character state different from that encountered in the remaining members of this subgenus (Fig. 3C). However, because the distinction between those states as in Fig. 3D and Fig. 3C is not entirely clear, they are treated collectively in morphological analyses. On one tree (Fig. 13A), *Q. microps* collected in rotting wood forms a sister group to the detriticolous species: *Q. cruentus* and *Q. mesomelinus*. This species is distinguished from the other *Quedius* studied particularly by: stout segments of antenna, maxillary and labial palp, and very short and dilated segments of urogomphi. In contrast, in the second tree (Fig. 13B) *Q. mesomelinus* is the species placed on a separate branch. This difference is a result of enriching the data matrix for computing the tree B with two additional characters that were not included for computing the tree A. These additional characters are: shape of apex on mandible, and teeth on nasale (see list of characters: number 4 and 11). In the larvae of *Q. mesomelinus* found under rotten debris, these structures are rounded (Figs 3H, 5C), in contrast to other *Quedius* species in which they are pointed (e.g. Figs 3G, 5B). It can be presumed that the unique shape of the structures in *Q. mesomelinus* is shape developed as a result of intensive grazing of an individual that originally had that structures normal, i.e. pointed as in other *Quedius* species. However, because (1) no other known *Quedius* larvae obtained in the field or reared in laboratory have rounded apex of mandible and teeth on nasale, and (2) these two features somehow correspond with each other, it can also be assumed that they are real character conditions reflecting an adaptation to feeding on some specific type of food not known to us so far. Since the observations were made based on a single larva only, the verification of the above two hypotheses requires further studies comprising a larger group of specimens.

The results of the analysis of similarity among mature larvae of *Quedius* species can be summarised as follows: (i) representatives of the subgenus *Quedius* (*Q. fuliginosus* and *Q. molochinus*) clearly differ in the number of morphological characters from those of the subgenera *Distichalius*, *Microsaurus*, and *Raphirus*, and match the current intrageneric division traditionally based on adult characters; (ii) there is no clear coherence within the subgenus *Microsaurus*, no evident character was determined that would be both unique to and common for all members of *Microsaurus*; (iii) no clear distinction of *Distichalius* and *Raphirus* from the subgenus *Microsaurus* was determined.

In spite of a certain progress in the knowledge on the larval morphology of the genus *Quedius*, the available data are still too fragmentary to draw definitive and extensive conclusions regarding the intrasubgeneric relationship of *Quedius*. But it seems likely that the current subgenera of *Quedius* as defined now maybe artificial. Moreover, further comprehensive larval studies are necessary, and particularly studies on the species-rich subgenera *Raphirus* and *Microsaurus*, or poorly known *Quedionuchus* or *Velleius*.

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