Zootaxa 3881 (4): 362–372
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

http://dx.doi.org/10.11646/zootaxa.3881.4.4
http://zoobank.org/urn:lsid:zoobank.org:pub:33C50A47-49D3-4CA1-8887-EB2EE9DC611D

Description of the second and third instars of *Aspidytes wrasei* Balke, Ribera & Beutel, 2003, with comments on the identification of larvae of *Aspidytes* Ribera, Beutel, Balke & Vogler, 2002 (Coleoptera: Aspidytidae), and phylogenetic considerations

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Abstract

The second- and third instar larvae of the cliff water beetle *Aspidytes wrasei* Balke, Ribera & Beutel, 2003 are studied for the first time with special emphasis on morphometry and chaetotaxy. A review of the characters useful in the identification of larvae of *Aspidytes* Ribera, Beutel, Balke & Vogler, 2002 is presented. Confirming previous findings, larvae of this genus are unique within Hydradephaga in the dorsally oriented spiracles on the abdominal segment VIII of instars II and III. The inclusion of Aspidytidae within the superfamily Dytiscoidea is reinforced by the following putative synapomorphies: presence of pore PAp, proximal insertion of pore ANg, apical or subapical insertion of seta MX8, presence of pore LAd, and distal insertion of seta CO6. Larvae of *A. wrasei* differ from those of *A. niobe* Ribera, Beutel, Balke & Vogler, 2002 in several significant characters that may indicate that both species have a long history of independent evolution.

Key words: Coleoptera, Aspidytidae, *Aspidytes*, larva, morphometry, chaetotaxy

Introduction

Ribera *et al.* (2002) erected the water beetle family Aspidytidae based on a single genus, *Aspidytes* Ribera, Beutel, Balke & Vogler, 2002 and a single species, *A. niobe* Ribera, Beutel, Balke & Vogler, 2002 from the Western Cape Province in South Africa. Based on a phylogenetic analysis combining adult morphological and molecular data, the authors placed the new family within the adephagan superfamily Dytiscoidea, as the sister group of Paelobiidae + Dytiscidae. Balke *et al.* (2003) described a second species, *A. wrasei* Balke, Ribera & Beutel, 2003, from Shaanxi Province in central China and provided a detailed account of the adult morphology of the genus and species. Alarie & Bilton (2005) described in detail the three larval instars of *A. niobe* with emphasis on chaetotaxy, and provided a description of the habitat of adults and larvae, which are strictly madicolous, living in permanent water seepages 1–2 mm in depth, flowing over exposed vertical or nearly vertical rock faces. Jia *et al.* (2012) described and illustrated the habitat of *A. wrasei* (see also Balke 2010). Based on a phylogenetic analysis of larval characters, Alarie & Bilton (2005) supported the placement of Aspidytidae within Dytiscoidea, although the relationships with other dytiscoid families were unresolved. Finally, Balke *et al.* (2005) provided a phylogenetic analysis combining adult and larval morphological and molecular characters which supports the inclusion of Aspidytidae in Dytiscoidea as the sister group of Amphizoidae, a relationship later supported by Balke *et al.* (2008) and Alarie *et*

 Accepted by H. Fery: 14 Oct. 2014; published: 6 Nov. 2014

TABLE 1. Characters useful to distinguish larvae of the species of *Aspidytes*. The reader is referred to Alarie & Bilton (2005) and Balke *et al.* (2005) for figures regarding *A. niobe*.

Character	*A. niobe*	*A. wrasei*
Frontoclypeolabrum	Extended anteriorly into a short and narrow subconical nasale, more than 0.8 times as long as head length	Extended anteriorly into a short and broad subrectangular nasale (Fig. 1), less than 0.7 times as long as head length
Coronal suture	About 0.2 times as long as head length	About 0.3 times as long as head length (Fig. 1)
Antenna	More than 2.5 times longer than maxillary palpus	Less than 1.7 times longer than maxillary palpus
Apical lateroventral process of antennomere 3	Not prominent	Prominent, short, bulge-like (Fig. 4)
Maxillary palpomere 1	Subequal or longer than maxillary palpomere 2	Less than 0.75 times as long as maxillary palpomere 2
Maxillary palpomere 3	More than 1.5 times longer than maxillary palpomere 2	About as long as maxillary palpomere 2
Metathoracic leg	More than 2 mm long, more than 2.7 times longer than head width	Less than 2 mm long, about twice as long as head width
Abdominal segments III–VII	Completely sclerotized, ring-like	Membranous ventrally
Abdominal segment VIII	Subquadrate, not extended posteriorly into a short siphon	Subtrapezoidal, extended posteriorly into a short siphon (Fig. 13)
Urogomphus	Less than 2.8 times longer than last abdominal segment	More than 3.3 times longer than last abdominal segment
Anterior margin of nasale	With at most six lamellae clypeales	With 12–16 lamellae clypeales (Fig. 1)
Femur	Lacking secondary setae on posteroventral surface	With one secondary seta on posteroventral surface (Fig. 12)
Tibia	With one additional anterodistal pore	Lacking additional pores

Acknowledgements

We are grateful to R.G. Beutel (Institut für Spezielle Zoologie und Evolutionsbiologie, FSN Jena, Germany) for the SEM pictures of *A. wrasei*, and to two anonymous referees for their valuable comments on the manuscript. M.C. Michat was supported by project PIP 112–201101–01087 from CONICET. Financial support was also provided by the Natural Sciences and Engineering Research Council of Canada in the form of a discovery research grant to Y. Alarie. The work of J. Hájek was partly supported by the Ministry of Culture of the Czech Republic (DKRVO 2014/13, National Museum, 0002327201).

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