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## New fossil taxa and notes on the Mesozoic evolution of Liadytidae and Dytiscidae (Coleoptera)

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### Abstract

The diagnoses of Liadytidae Ponomarenko, 1977, Liadytiscinae Prokin & Ren, 2010, *Liadytiscus* Prokin & Ren, 2010 and *Mesoderus* Prokin & Ren, 2010 (Dytiscidae) are modified, and the following new taxa are described from Mesozoic fossils: *Liadytes aspidytoides* **sp. n.** (Liadytidae); Mesoderini trib. n., *Liadyxianus kirejtshuki* **gen. n. et sp. n.**, *Mesoderus punctatus* **sp. n.**, *Mesoderus ovatus* **sp. n.**, *Mesodytes rhantoides* **gen. n. et sp. n.**, *Palaeodytes baissiensis* **sp. n.** and *Cretodytes incertus* **sp. n.** (Dytiscidae). A summarized checklist of all Mesozoic Liadytidae and Dytiscidae known from adults is given, and an identification key to the genera of Mesozoic Dytiscidae known from adults is provided for the first time. *Palaeodytes incompletus* Ponomarenko, Coram & Jarzembowski, 2005 (the suffix of the specific epithet is emended from the original *incompleta*) is found to belong not to this genus, but to another one, which remains to be described. The fossil larva *Angaragabus jurassicus* Ponomarenko, 1963 from the Lower Jurassic of Irkutsk Oblast, Russia, probably belonging to Liadytidae, is re-examined. If this larva actually belongs to Liadytidae, then its morphological characters provide additional confirmation of the conclusion, based on the characters of adult liadytids, that the family is quite separate from the recent family Aspidytidae, and the similarity between the adults of both families results from parallel processes in the evolution of the superfamily Dytiscoidea. We show that the principal trends of morphological changes of Liadytidae and Dytiscidae during the Upper Jurassic and Lower Cretaceous included a consistent increase in the area of the metacoxal plates at the expense of decreasing area of the lateral lobes of the metaventrite ("wings"), flattening and loss of the lateral border of the elevated median area of the metaventrite, and shortening and dilation of the metafemur and metatibia. These changes were probably associated with an increased load of swimming taken by the hindlegs, which required, among other things, the development of swimming muscles attached to the metacoxal plates. The development of the hindlegs allowed diving deeper, thus being an adaptation to the nektonic instead of benthic lifestyle. This is confirmed by the adaptive coloration of the Liadytidae and Dytiscidae found in Shar Teg (*Liadytes aspidytoides* **sp. n.**), Yixian (*Mesoderus magnus* Prokin & Ren, 2010) and Baisa (*Palaeodytes baissiensis* **sp. n.**), in which the dorsum was darker than underside, providing camouflage in the depths of the water.

**Key words:** Liadytidae, Dytiscidae, Mesozoic, new taxa, evolution, swimming.

### Introduction

Relatively little is known about the earlier stages in the evolution of the superfamily Dytiscoidea (Coleoptera: Adepaga), which includes several recent and several extant families of water beetles.<sup>1</sup> There is no consensus among specialists about the chronological order in which the major clades of Adepaga diverged. Possible