



Enigmatic Late Permian cockroaches from Isady, Russia (Blattida: Mutoviidae fam. n.)

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Abstract

Mutovia intercalaria gen. et sp. n. is described from the Upper Permian sediments of Isady in north-western Russia and placed within a new Palaeozoic cockroach family, Mutoviidae fam. n.. The forewing, with very basal, distinct separation of R1 and RS resembling the cockroach hind wing and also the forewing of mantises and eoblattids, and with a sharply convex clavus, is unique. The general vein scheme is closely analogous to Cretaceous mantises (*Baissomantis* Gratshev et Zherikhin, 1994), but the two taxa are not directly related. The new species comprises about 3% of all fossil insects and 10% of fossil cockroaches at the site, and thus is one of the dominant species at the site. Reorganization of the main veins within the taxon suggests the group was rapidly evolving, perhaps because of environmental stress. The high coefficient of variability for total number of veins meeting margin (14.5%) is characteristic for newly emerging (early Palaeozoic and early Mesozoic) lineages and is much higher than for the same characteristic in advanced Palaeozoic taxa. In spite of an apparently aerodynamic shape of the wing, it likely was not a good flier, as indicated by the extreme variation of veins in the anterior margin and narrow and plastic hind wing remigium. A sex ratio approaching 2:1 suggests that males were more active in flight. The new family represents a direct evidence for appearance of new taxa before the Permian boundary and disability of these taxa to cross that crisis.

Key words: Upper Permian, cockroaches, mantodeans, new family

Introduction

Only seven families of extinct cockroaches (*sensu* Vršanský *et al.* 2002) have been recorded from the entire Palaeozoic: Archimylacrididae, Mylacrididae, Necymylacrididae, Poroblattinidae, Spiloblattinidae, Subioblattidae (Mylacrididoidea) and Phyloblattidae (Phyloblattoidea) (see Schneider 1983 for general appearance). This paper is a description of a new extinct family, genus and species from the Upper Permian sediments.

Cockroach families are extremely conservative in general *bauplan*, with frequently changing morphological characters, but not general appearance. For instance, the longevity of the Phyloblattidae, the most durable among 22 known Palaeozoic, Mesozoic and living families, is 220 million years (Vršanský 2008b). Extinct *Caloblattina* Handlirsch, 1906 existed for at least 100 million years, and *Aissoblatta* Handlirsch, 1904 seems to have persisted for over 150 million years (Vršanský 2008b). The extant genus *Blattella* Caudell, 1903 may be older based on a larva from the Albian Mesozoic (98Ma) (Vršanský 2008a), but all known winged individuals belonging to extant genera are of Tertiary (Eocene) origin and the longevity of Palaeozoic genera is also significantly diminished (Schneider 1983). It seems that cockroach species survive short periods of time, with no living species recorded in the Miocene ambers of Mexico and Dominican Republic or in Eocene sediments of the Green River (Vršanský *et al.* 2011a, b).

The Early through the beginning of the Middle Permian localities are well studied, with one of the best studied Palaeozoic localities, Obora in the Czech Republic, comprising 400 to 500 cockroaches in collections (Schneider 1980). They are in contrast with virtually unstudied Late Permian and Early Triassic localities (Shcherbakov 2008), with ca. 800 undescribed cockroaches. Blattarians are being increasingly used for biostratigraphy (Jarzembowski & Schneider 2007, Schneider & Werneburg 2006, Schneider *et al.* 2005) and could deliver valuable information to the dating of processes. The present finds contribute to our knowledge on faunas shortly before the Permian boundary mass extinction event and to the understanding of the Early Triassic recovery phase.