

# MESOZOIC EPHEMEROPTERA AND THE SYSTEM OF THE ORDER

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The division of the order of Mayflies into superfamilies is supplemented by a study of extinct forms which allows to show the phylogeny of the order. Of late, in the USSR, namely in Central Asia, in Western and Eastern Siberia, different new Mesozoic mayflies have been discovered. The Mesozoic is of special interest for the phylogeny of mayflies since up to now the fauna of that era was known very poorly, and only by a few West European finds. On other continents Mesozoic mayflies had not been discovered before, and therefore their discovery in the Asian parts of the Soviet Union is particularly valuable. A study of palaeontological records and of the relationships between living families allowed to build up a phylogenetic tree.

The tree starts with the ancient Permian groups of homonomous-winged mayflies, which, as shown by representatives of *Misthodotidae*, discovered in the Urals, still possessed well-developed mouth parts in the adult forms. In all probability, the mayflies, still before the Permian, had divided into two branches which had descended from the Permian *Protereismatidea* — homonomous-winged *Mesephemeridae* and heteronomous-winged *Siphonuridea*. The *Mesephemeridae* are characterised by rich venation and the gemination of the longitudinal veins; this brings them close to the living *Palingeniidae* and allows to regard this branch of mayflies as the ancestors of the entire superfamily *Ephemeridea*. The appearance of wing heteronomy in this superfamily was only a secondary phenomenon which never reached the extreme stages of reduction of the hind wings.

Another branch of the Mayflies, characterised by early development of wing heteronomy and a common type of larvae, is formed by the superfamily *Siphonuridea*, which became the ancestors of other superfamilies.

In the lower Jurassic in Western and Eastern Siberia, representatives of a peculiar family — *Epeoromimidae* were found, characterised by large gill plates, resembling the gills of some of the *Heptageniidae*. It is probable that the development of large gills had begun early and served as the basis for further adaptations to dwelling on stony bottoms. It is reasonable to suggest a link between the Cenozoic *Heptageniidae* with these early Mesozoic Mayflies; and this brings the *Heptageniidae* close to the *Siphonuridae*.

The first representatives of the superfamily *Siphonuridea* had a primitive venation with regularly arranged veins in the basal part of the wing and only further on the veins and the size of the hind wing become reduced in many families. Quite unexpected was the discovery of genuine *Siphonuridae* back in the mid-Jurassic in the trans-Baikal region. The late Jurassic *Heragenitidae* with a peculiar build of the imago, but with a larva similar to that of *Siphonuridae*, form the special Mesozoic superfamily *Hexagenitidea*, well known by the genus *Ephemeropsis* Eichwald, widely spread in Asia.

New fossil materials made it possible to establish the early Jurassic family of *Mesonetidae* and discuss its relationships with living families.

The special family of *Aenigmephemeridae* discovered in the Jurassic fauna of the Kara-Tau, has certain similar characters with *Siphonuridae*, while it differs by its peculiar multi-vein medial field of the forewing (5 branches of the medial-posterior vein) which brings it close to the living unique family of *Baetiscidae*, the extinct *Hexagenitidae* and, partly, with the living *Ephemerellidae*.

The main result of our phylogenetic analysis is the establishment of two superfamilies — the homonomous-winged *Mesephemeridea* and the Mesozoic *Hexagenitidea*. Besides, the discovery of some new Mesozoic families allowed to line out the main processes which determined the points of divergence of the basic branches of the order *Ephemeroptera*.

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