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Fossil Coleoptera of the USSR: their evolution and distribution

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SUMMARY

Early appearance of the order Coleoptera is in the lower Permian period. Paleozoic Coleoptera, so far discovered in Permian deposits, are not numerous and not diversified, and should be referred to Archostemata. Most difficult is the study of mesozoic Coleoptera. The ancient mesozoic Coleoptera - triassic - are closer to palaeozoic, than to late mesozoic. The overwhelming majority of those refer to Archostemata - Cupedidae and Schizophoridae. Adephaga are represented by Triaplidae.

In the early jurassic period Archostemata are represented by aquatic forms of Ademosynidae and Schizophoridae. Adephaga at this period are represented by main mesozoic Carabidae and Trachypacheidae. Polyphaga is the mother of Elateridae - Photagrypninae and Praelateridae.

Middle jurassic period - aquatic Adephaga, Parahygrobiidae, Liasytidae, Coptoclauidae, Gyrinidae.

Late jurassic period is dominated by Polyphaga. Among them are Staphyliniformia, Elateriformia, Cucujiformia and primitive Scarabaeidae, Chrysomelidae. Fauna of the beetles belonging to the lower cretaceous period resembles that of the late jurassic period.

Adephaga are represented by Coptoclauidae and Gyrinidae. Polyphaga are diversified and are of mesozoic character, and Scarabaeidae among them are well represented.

By the late cretaceous period Cainozoic forms of Coleoptera dominate. Boundary between mesozoic and cainozoic periods is one of the largest reformations in the beetles evolution.

KEY WORDS: Fossil Coleoptera, Soviet Union, Evolution, Distribution.

The origin of the order Coleoptera, according to MARTYNOV (1926), is to be referred to the lower Permian period.

Paleozoic Coleoptera, whose remains have been found in permian deposits only, are not numerous and not diversified. Up to the present among permian Coleoptera,

no specimens have been found, which could be assuredly referred to the higher Coleoptera suborders – all of them belong most probably to Archostemata.

As to the Cainozoic beetles, they differ little from the modern ones. This allows use of various indirect diagnostic features in determining their systematic status.

Most difficulties in the studies of fossil Coleoptera are posed by mesozoic Coleoptera, which are as numerous and diversified as the presently existing ones. Though the majority belong in or near modern families, the use of indirect diagnostic features becomes unreliable in placing them.

The oldest of mesozoic – triassic and early jurassic beetle faunas differ sharply from the later ones. In their composition, they are closer to paleozoic than to later mesozoic faunas. Their overwhelming majority belong to the ancient and primitive suborder – Archostemata, among which representatives of the family Cupedidae are most diversified. In different locations they make up to 50% of the total number of beetles. From the Djajyauch location there have been described 29 species. Schizophoridae are in the second place (16 species referring to 10 genera). Being fewer than Cupedidae in their species composition, they are close to them in number of genera. As to the diversity of their habitus they are little inferior to the presently existing Cupedidae, excluding Paussidae*). The rest of the families – Tricoleidae, Ademosynidae and Canitidae are notably less diverse.

The Adephaga suborder is represented at Djajyauch by Triaplidae, which is possibly one of the ancestors of the suborder.

Representatives of Polyphaga during this period are few and their systematic position is not clear.

Concerning the ecological relations of triassic Coleoptera, the phytophages are mainly represented by Cupedidae, which differ little from the jurassic ones. Among them there is a number of modern genera. Most species probably fed on wood destroyed by fungi.

The most extensive known faunas of early jurassic Coleoptera have been found in Central Asia as well.

Archostemata are still dominant here, especially Cupedidae, but relative to the other Coleoptera they make up to only 10%. The most ancient subfamily of Triadocupedidae is not discovered in these locations. In the early jurassic period there appear such genera of Cupedidae as *Omma* NEWMAN and *Tetraphalerus* PONOMARENKO which survived till the present time.

Archostemata, however, in this period is mainly represented by the aquatic forms (Ademosynidae and Schizophoridae). Among the aquatic Schizophoridae it is necessary to mention the appearance of characteristic morphological forms with long legs and head tucked under.

Beetles of the suborder Adephaga in the early jurassic period are represented by the all main mesozoic groups, not all of which are known practically. Land beetles are represented by Carabidae and Trachypachidae. Polyphaga in this period are represented by representatives of Elateridae (mesozoic Protagrypninae and Praelateridae) only.

The next evolutionary period – the middle jurassic one – is represented by mesozoic aquatic Adephaga: Parahygrobiidae, Lyadytidae, Coptoclavidae, Gyrinidae. In loca-

tions of this period there are collected the aquatic larvae (the most ancient of the larvae) of *Paragydrobia* PONOMARENKO, *Angaragabus* PONOMARENKO and *Stygeonectes* PONOMARENKO, which belong to Dytiscidae Adephaga.

Beetles of the late jurassic period are known from locations in Southern Kazakhstan – in Karatau (there was collected more than 18,000 Insecta remains).

Composition of beetles in Karatau differs sharply from the composition of beetles of the lower jurassic period. Representatives of Archostemata make only 10%, of which Cupedidae make three quarters.

Number of Adephaga is approximately equal to the number of Archostemata.

The overwhelming majority of beetles in Karatau belongs to Polyphaga, this is the most ancient fauna with Polyphaga being predominant. Apparently all the series of superfamilies are represented in this location. There are found representatives of Staphyliniformia, Elateriformia, Cucujiformia.

Scarabaeiformia in Karatau are rather rare, and are more close to the primitive Scarabaeidae of the low cretaceous period.

Most numerous in Karatau are the remains of Elateriformia beetles. There is discovered a group of remains which may be referred to the Armatopoidae superfamily, but differs from its typical representatives in having transverse metasternal suture. This peculiarity unites them with Buprestidae. The most numerous group is Elateridae.

Clerodea, Cucujoidea and Chrysomeloidea are clearly present in Karatau, the latter being presented by Ptoscelinae, referring to Chrysomelidae. There are numerous remains of Rhynchophora (Eobelidae) as well.

Coleoptera found in Karatau are diversified ecologically as well. The aquatic insects almost never lived there. They inhabit woody plants and are represented by xylophages. Real phylophages are absent. Among the jurassic dendrobionts Cupedidae were most widely spread, feeding on wood destroyed by fungi; Eobelidae, however, appear as well.

Finds of the fossils of the beginning of the lower cretaceous period are scattered. The largest location basis is discovered in Siberia, Transbaikal in Vitimskoye plateau. In general, fossil beetles of the early cretaceous period have been found in Siberia, Mongolia, China and Kazakhstan, also in Western Europe, North Africa, South America and Australia.

Fauna of beetles of the lower cretaceous period is similar to that of the late jurassic period.

Abundance of Archostemata somewhat decreased. *Notocupes* PONOMARENKO prevail among Cupedidae.

Adephaga are represented by aquatic Coptoclavidae and of those belonging to the first family there are found species of *Coptoclava* PING and *Necronetes* PONOMARENKO.

Polyphaga are diversified and numerous and their habitus is a mesozoic one. Among Staphyliniformia there are found primitive Hydrophilidae and Staphylinidae; among Eucinetiforma – Eucinetidae, which are closer to the presently existing *Eucinetus* GERMAR.

For the first time Scarabaeiformia, which are in one of the first places in Eastern Asia locations, are widely represented in the early cretaceous period. There was practically nothing known about Scarabaeidae up to the first studies of the early cretaceous period. In the lower cretaceous deposits of Transbaikal there are found numerous fossils whose placing in the Scarabaeidae is without doubt, as the majority of the remains

* Family of beetles habitus not clear

represent whole specimens. Their number increased more than 10 times, compared to the late jurassic period.

However, despite their wide diversity and rather good conservation, it is difficult to clear up their systematics. In their habitus they are close to cockchafers, but examination, when possible, of their structural features (real wings structure, stigma structure) shows that they are on the primitive level and belong rather to the lower Geotrupidae and Dynastidae.

As to their mode of life they are most probably xylobiontic phytophages, inhabiting wood more or less destroyed by fungi. These very primitive Scarabaeidae produced two major branches - Laparosticti and Pleurosticti.

Subsequent evolution of Scarabaeidae, appearance of new taxa at different levels followed, depending on the general evolution of vegetable and animal kingdom.

Thus, evolution of Laprosticti is associated mainly with the appearance of herbivora, and Pleurosticti - with the development of angiospermous plants. These very processes resulted in growth of these branches as early as in the upper cretaceous period and then in the kainozoic period.

In the other groups certain changes have place as well: number of Elateridae becomes lower, but the number of Buprestidae increases. Cucujoidea are represented by Nitidulidae and Scaptiidae, which differ little from the presently existing ones.

Rhynchophora of the early cretaceous period are diversified there are found the first representatives of Attelabidae and Curculionidae.

Coleoptera of the upper cretaceous period should be understood much better than the faunas of the previous periods.

Scientists in different regions know not only locations of imprints of Coleoptera of the late cretaceous period, but numerous locations of fossil resins containing the remains or insects as well.

Cainozoic forms of Coleoptera dominate in the late cretaceous period. Boundary between mesozoic and cainozoic periods is one of the greatest changes in the evolution of beetles. Composition of Cupedidae does not diminish, however.

Among Adephaga Dytiscidae, Gyrinidae and Carabidae of the presently existing type come to the first place. The same is found among Polyphaga, and particularly Scarabaeidae.

In conclusion it should be noted that in the evolution of Coleoptera in the course of the mesozoic period we may state two moments of great faunistic reformations: the first one - between the lower and upper jurassic periods, when Archostemata lost their domination and the second one - at the end of the low cretaceous period, when the cainozoic faunas succeeded the mesozoic one - the precursor of the presently existing fauna of Coleoptera.

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