**Elliidae, a new fossil family of the infraorder Axymyiomorpha (Diptera)**

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Abstract. A new fossil family, *Elliidae*, of the infraorder *Axymyiomorpha* is described from Upper Jurassic and Lower Cretaceous of Central Asia. It comprises two new genera: *Ellia* gen. n. and *Polyanka* gen. n.; the first with two species, *E. colorissima* sp. n. and *E. khara*, sp. n., the second with *P. minuta* sp. n. Age and phylogenetical relations of *Elliidae* fam. n. is discussed; the family shows wing venation characters linking the *Axymyiomorpha* and the oldest, Triassic *Anisopodomorpha*.

Key words: *Axymyiomorpha*, fossil, new family, *Elliidae*, *Perissommatidae*, *Thaumaleidae*, *Axymyiidae*, *Pachyneuridae*, Jurassic, Cretaceous.

INTRODUCTION

The *Axymyiomorpha* were distinguished by Mc ALPINE et al. (1981) and WOOD and BORKENT (1989) as a separate infraorder comprising a single family, *Axymyiidae*, known only from the Recent species. The distinction was made on the basis of larval and pupal characters, with only one that of adults, the surface of scutum. However, also the wing venation of *Axymyiidae* (Fig. 1b) shows the characters unique for the group: radial field with a long *R*3+4, a very short *R*3 vein and four radial veins terminating in wing margin, while in the medial field only three medial veins reach the wing margin and *d* cell is open. This type of venation resembles that observed in the families *Pachyneuridae*, *Perissommatidae* and *Thauma-
leidae (Fig. 1 c,d,e, respectively) and flies of all four groups in question are closely related, according to KOVALEV (1989, 1990). The latter author (KOVALEV, 1990) also includes to this suborder the family Limnorhyphidae with one species, Limnorhyphus haifanggouensis described by HONG (1983) in the infraorder Bibionomorpha. We refrain herein from including this taxon into the Axymiomiomorpha, before the specimen in question is accessible for the revision.

Among the fossil materials from the central Asiatic localities (Upper Jurassic and Lower Cretaceous) numerous specimens were found and are included herein into the infraorder Axymiomiomorpha on the basis of their venation of radial field as defined above, while the medial field is plesiomorphic, resembling the Anisopodomorpha, with d cell closed and all four medial veins terminating in the wing margin (Fig. 2a; compare Anisopodomorpha, 1a). This unique combination of primitive and derived characters, linking both infraorders, forced us to create a new family, Eliiidae.
SYSTEMATIC PART

**Elliiidae fam. n.**

**Diagnosis.** Mesonotum only slightly concave. Venation: four long radial veins terminate in wing margin, \( R_3 \) very short, with very long \( R_{3+4} \); all four medial veins present; \( d \) cell closed, large. Three small spermathecae present.

**Type genus:** *Ellia* gen. n. with two species from the Upper Jurassic and Lower Cretaceous of Asia.

**Key to the genera**

1. Vein \( R_{3+4} \) originating from \( R_{3+4+5} \), distally to cross-vein \( r-m \) (Fig. 2a) . . . . . *Ellia* gen. n.

\( \sim \) \( R_{3+4} \) originating directly from \( Rs \), proximally to cross-vein \( r-m \) (Fig. 4b) . . . . *Polyanka* gen. n.

**Ellia gen. n.**

**Diagnosis.** \( R_{3+4} \) originates distally to cross-vein \( r-m \). Type species: *Ellia colorissima* sp. n. from the Lower Cretaceous locality Baysa (Asia, Transbaikalia). Two species of this genus were distinguished, described below.

**Description.** Flies sized 8-12 mm, wing 4.5-7 mm long, distinctly patterned or overally pigmented, with conspicuous stigma. Head with palpi and antennae unknown (not preserved). Venation: \( Sc \) slightly exceeding midlength of wing; cross-vein \( sc-r \) close to \( Rb \) fork; \( R_{3+4+5} \) present, very short; cross-vein \( r-m \) positioned centrally at the upper edge of \( d \) cell; \( M_1 \) exceeding double length of \( d \) cell upper edge; cross-vein \( m-m \) connecting \( M_2 \) and \( M_3 \) or fork of \( M_{1+2} \) and \( M_3 \); cross-vein \( m-cu \) subsinuous, parallel to costal wing margin; terminating section of \( A_1 \) more or less curved to wing margin. Female cerci shorter than width of 8th abdominal segment.

**Ellia colorissima** sp. n.

**Diagnosis.** Wing with dark pattern; \( R_5 \) 1.5 times as long as \( Rs \); cross-vein \( sc-r \) before fork of \( Rb \); cross-vein \( m-m \) between \( M_2 \) and \( M_3 \).

**Description** (Plate I). Female with thorax and abdomen in good condition, head not preserved. Body length 10 mm (without head), wing length 7 mm.

![Image](image-url)

Fig. 2. *Ellia colorissima* sp. n., holotype; a, wing; b, fore leg.
Wing (Fig. 2a): dark pattern over a greater part of wing; Sc ending between cross-vein r-m and fork of R3+4+5; cross-vein sc-r at its two lengths before fork of Rb; length ratio Rs:R3+4+5:R5 is like 7:1:12; d cell closed; M₁ slightly longer than twice the length of d cell upper edge; cross-vein m-m between M₂ and M₃, (i.e., positioned beyond M₁+2 fork); cross-vein m-cu long, subsinuous, parallel to costal wing margin; terminating section of A₁ curved to wing margin.

Legs short and stout, only one fore leg is well preserved (Fig. 2b), with a very thick femur, three times as long as thick; tibia thick, short, ca. 1/3 shorter than femur, with large, single spur and two or three lobes at inner side (probably the sensible organs); first tarsomere more than twice as long as the second one.

Female genital organs: poorly visible, cerci short, round, covered with dense, delicate trichiae; three small spermathecae present (diameter 0.12 mm).

Material examined: holotype No. 3064/9730, female, from Bayan (Central Asia), Lower Cretaceous (ca. 130 Ma). Housed in the Paleontological Institute, Russian Academy of Sciences, Moscow.

**Ellia khara** sp. n.

**Diagnosis.** Wing without pattern, but overally pigmented; R₅ more than twice as long as Rs; cross-vein sc-r positioned distally to fork of Rb; cross-vein m-m between M₁+2 and M₃ (at the M₁+2 fork).

**Description** (Plate II). Female with only abdomen and one wing preserved, 5.5 mm and 4.5 mm long, respectively. Head, thorax and legs lacking.

Wing (Fig. 3a): uniformly pigmented, well preserved, only a small, most distal portion lacking. Sc ending opposite fork of R₃+4+5; cross-vein sc-r at its two lengths beyond the fork of Rb; R₃ very short, its length equals 1/3 of R₄; length of R₅ twice exceeding Rs; length ratio Rs:R₃+4+5:R₅ is 6:1:14; M₁ more than twice as long as the upper edge of d cell; cross-vein m-m at the fork of M₁+2; cross-vein m-cu long, conspicuously subsinuous, parallel to costal wing margin; A₁ almost straight, curved to wing margin at a lower angle when comparing with the previous species. Anal lobe folded; distal margin of wing invisible.

![Fig. 3. Ellia khara sp. n., holotype: a, wing, b, female terminalia.](image-url)
Genitalia: ovipositor (Fig. 3b) with cerci distinctly twofold, densely covered with delicate trichiae; three small spermathecae poorly visible but recognizable, diameter equals 0.1 mm.

Material examined: holotype No. 3965/2977, female, from Khutel-khara (Mongolia), turn of Jurassic to Cretaceous. Housed in Paleontological Institute, Russian Academy of Sciences, Moscow.

Polyanka gen. n.

Diagnosis. R_{3+4} before cross-vein r-m (originates directly from Rs).

Description of the genus is covered by that of the type species.

Type species: Polyanka minuta sp. n. from Karatau (Kazakhstan, Asia), Upper Jurassic. Only one species of this genus is distinguished.

Polyanka minuta sp. n.

Diagnosis of the species is identical with the generic one.

Description (based on all specimens included; holotype, Plate III). Body length 4.5-6.7 mm, wing length 3.0-4.7 mm.

Head rounded, rostrum somewhat shorter than the rest of the head; antennae (Fig. 4c) slightly longer than head, 15-16 segmented, flagellomeres short and thick, tapering towards the end; palpi (Fig. 4a) 5-segmented, not longer than the head, last palpomere shorter than the preceding one.

Wing clear (Fig. 4b,d,e): Sc ending opposite fork of Rs; cross-vein sc-r at its 2-3 lengths before fork of Rb; R_{3} 2-3 times shorter that R_{4}; R_{5} three times as long as R_{5}; length ratio R_{5}:R_{3+4+5}:R_{5} is 5:5:1:17 in the holotype (while in all specimens examined variability

![Fig. 4. Polyanka minuta sp. n., holotype: a, palpus, b, wing; paratype No. 2904/1406: c, antenna, d, wing; specimen No. 2904/1499: e, wing.]
ranges 4-6.5:1:13-17, respectively); cross-vein \( m-m \) positioned between \( M_2 \) and \( M_3 \); \( M_1 \) 3.5-4 times as long as \( M_{1+2} \) (which makes upper edge of \( d \) cell); cross-vein \( m-cu \) long, slightly subsinuous to almost straight; \( A1 \) curved to wing margin at the end.

Legs with tibial spurs, one in fore legs, two in middle and hind ones.

Genitalia: poorly identifiable in all specimens; cerci sharpened at the end, covered with delicate trichiae; three small spermathecae of a diameter 0.075-0.1 mm.

Material examined: holotype – female No. 2904/1339 (+,-); paratypes: 2384/988; 2784/87 (+,-); 2784/414 female, 2904/1406 female, all from Karatau (central Asia; turn of Jurassic to the Cretaceous). Other materials: 1701 = 1789/121; 2066/1313; 2384/87 (+,-); 2384/988; 2554/1121; 2554/1207; 2784/388; 2784/407; 2784/414; 2904/1286; 2904/1339; 2904/1499; 2997/1041; 2997/3467; 2997/3775; 2997/3487; 2997/4769; 2997/4785, same locality.

Remarks. Specimens Nos. 2904/1499 and 2997/1041 slightly differ from the remaining ones in the \( d \) cell shape (compare Fig. 4b,d,e). Although the materials listed comprise males and females, their separation is not possible.

DISCUSSION

Proposed phylogeny of the group

The phylogenetic tree of the Axymiomiormpha is shown in Fig. 5. It comprises also the relations of this infraorder with the Anisopodomorpha, through the oldest representative of the latter, \( Yalaargentata \) KRZEM. from the family Procrampomyiidae (KRZEMIŃSKI 1992). The main difference in wing venation between the two infraorders considers the details of the radial field: while in the Axymiomiormpha \( R_4 \) is fused with \( R_3 \) (Fig. 1b,c,d,e) over a section called \( R_{3+4} \) (apomorphy 1 in Fig.5), in the Anisopodomorpha the vein \( R_4 \) is fused with \( R_5 \), thus forming the vein \( R_{4+5} \) (Fig. 1a). This latter vein is very short in the fossil family Procrampomyiidae, and especially in its Upper Triassic representative, \( Yalaargentata \) from USA (Fig. 5a). Hence it can be conceived that the similar species could make an ancestor line for the Axymiomiormpha. Within the latter group, the \( Elliiidae \) fam. n. resembles the fossil Anisopodomorpha of the families: Procrampomyiidae and Protorhypoidea in having a complete of four radial and four medial veins terminating in wing margin, and \( d \) cell closed; these characters are plesiomorphic when compared with the further reduction in both respective infraorders. Thus the \( Elliiidae \) show the characters of a stem group within the Axymiomiormpha.

It seems plausible that the remaining families of this infraorder represent three main evolutionary lines. Within each of them the medial field had undergone reduction of veins, but independently, resulting in somewhat different final pattern.

The first lineage, family Perissommatidae is characterized by a strongly reduced \( Sc \) and \( R_1 \) veins, the former ending freely, not reaching the costa (apomorphy 2). In the medial field, the vein \( M_{1+2} \) is extremely long. The second lineage, family Thaumaleidae, is distinctly separated by the following three autapomorphies: \( R_3 \) taking the position of a cross-vein (apomorphy 3), \( R_4 \) bent in the middle (apomorphy 4) and reduction of two
Fig. 5. Phylogenetic tree of *Axymyiomorpha*. Apomorphies: 1, *R*₂₃₄ present; 2, *Sc* strongly reduced, not reaching costa; 3, *R*₃ positioned as cross-vein; 4, *R*₄ bent medially; 5, only two medial veins present; 6, *Rs* wavy; 7, *M₁₂* very short. Superfamilies’ system is applied after KOVALEV (1990).
Fig. 6. Age of families included in Acanthomorpha.

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<th>TRIAS</th>
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<th>CRETACEOUS</th>
<th>TERTIARY</th>
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- Procramptonomyiidae
- Perissommatidae
- Eelliidae
- Pachyneuridae
- Axymyliidae
- Thaumaleidae
Fig. 7. Distribution of the Recent and Mesozoic Axymyiomorpha. Recent: 1 – Thaumaleidae, 2 – Axymyiidae, 3 – Pachyneuridae, 4 – Perissommatidae. Fossil: Elliiidae: circle, Ellia colorissima sp. n. (Baissa, Transbaikalia, Lower Cretaceous); square, E. kharu sp. n. (Khutel-khara, Mongolia, Jurassic/Cretaceous); triangle, Polynka minuta sp. n. (Kratau, Kazakhstan, Upper Jurassic); Perissommatidae: cross in circle, Palaeoperissomma collessi KOVALEV (Kubekovo, East Siberia, Middle Jurassic); reversed open triangle, P. demetrii KOVALEV (Turga, Transbaikalia, Lower Cretaceous); Thaumaleidae: X, Mesothaumalea fossilis (KOVALEV – Daya, Transbaikalia, Jurassic/Cretaceous).
medial veins and a cross-vein m-m (d cell open) (apomorphy 5). The position of R₃ may indicate that this vein is not homologous with R₃ vein in the other families; maybe it is an additional cross-vein. If this is true, then possibly the bending in R₄ is a trace left after the origin of completely reduced R₃. This family is so distinct that was included into the *Culicomorpha* by HENNIG (1973) and WOOD and BORKENT (1989); KOVALEV however, basing on wing venation studies classified it to the *Axymyiomorpha* (KOVALEV 1989, 1990) and we share his opinion herein. The third lineage encloses two families, *Pachyneuridae* and *Axymyiidae* which share 2 synapomorphies, Rs wavy and M₁+₂ very short (apomorphies 6 and 7, resp.).

The age of all families mentioned, based on their oldest representants, is shown in Fig. 6. With the exception for the *Elliidae*, all are represented also by the Recent species. Surprisingly, the *Elliidae* which exhibit the most ancient characters in wing venation, were found not before the Upper Jurassic, as for now. Basing on the arguments given in this discussion we presume that its age is much older and anticipate the discoveries of the *Elliidae* in much older deposits, at least from the Lower Jurassic.

The distribution of the Recent and Mesozoic *Axymyiomorpha* is shown in Fig. 7. Noteworthy is the South American and Australian distribution of *Perissommatidae* suggesting their origin in Gondwana; however, their presence in fossil state in Asia denies it, as was already stated by ESKOV and GOLOVATCH (1986).

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REFERENCES


Plate I. *Ellia colorissima* sp. n. (holotype).

Plate II. *Ellia khara* sp. n. (holotype).

Plate III. *Polyanka minuta* sp. n. (holotype).
medical veins and a cross vein under the ant. The position of A3 may indicate that this venation is early in the evolution of the family, maybe it is an additional cross-vein under the ant. However, it is a trace left after the origin of complete venation found in modern Heteroptera (KOVALEV 1980). Thus, we included Pycnonotinae and Ancistrotera into the Cadomocera for analysis. The families, Pachyonidae and Ayyroidea, both have only a single basal m4 which is very short (apomorphies 6 and 7).

The age of all families is shown in Fig. 6. With the exception of the Recent species, the family Palaczyk, of the family Palaczyk, is shown in Fig. 7. The family has a unique character that distinguishes it from the other families in its characterisation of the family Palaczyk. The family Palaczyk is currently the subject of a study in Asia.

With support from Dr. A. Y. and Ms. P. X. of the Palaczyk family, we have obtained a new character that is a unique feature of the family Palaczyk. Our current focus is on preparing the map of distribution of the family Palaczyk.