

# New Insects (Insecta: Mecoptera, Grylloblattida) from the Middle Permian Chepanikha Locality, Udmurtia

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**Abstract**—New scorpionflies, *Asiachorista europaea* sp. nov. and *Petromantis udmurtica* sp. nov. (Mecoptera: Permochoristidae), and new grylloblattids, *Tshepanichoptera lacera* gen. et sp. nov. (Grylloblattida: Aliculidae) and *Miralioma urzhumica* sp. nov. (Liomopteridae), are described from the Urzhumian of Udmurtia (Chepanikha locality). *Liomopterites novissimus* Aristov, 2004 (Liomopteridae) is redescribed.

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**Key words:** Mecoptera, Grylloblattida, new taxa, Middle Permian, Udmurtia.

## INTRODUCTION

In the present paper describes new insect taxa collected in different years in the Chepanikha locality (Udmurtia, Zavyalovskii District, Rossokha River valley, 1.8 km north of the village of Chepanikha; Middle Permian, Urzhumian).

The collection stored in the Paleontological Institute of the Russian Academy of Sciences (PIN) presently contains about 290 insect fossils from this locality. The first insects from there were collected by E.I. Ulanov (Gorky Geological-Exploring Expedition) and E.M. Polyakov (Gor'kovskaya Geological Exploring Party, Mozhginskii GGSU) in 1970 and by N.I. Novojilov (PIN) in 1975; a part of this collection was studied earlier (Ponomarenko, 1972; Novokshonov, 1997; Sinitshenkova, 2004). Most fossils (about 90%) were collected in 2005 and 2006 by A.S. Bashkuev, D.S. Kopylov, D.E. Shcherbakov (PIN), and A.V. Gomankov (Botanical Institute, Russian Academy of Sciences).

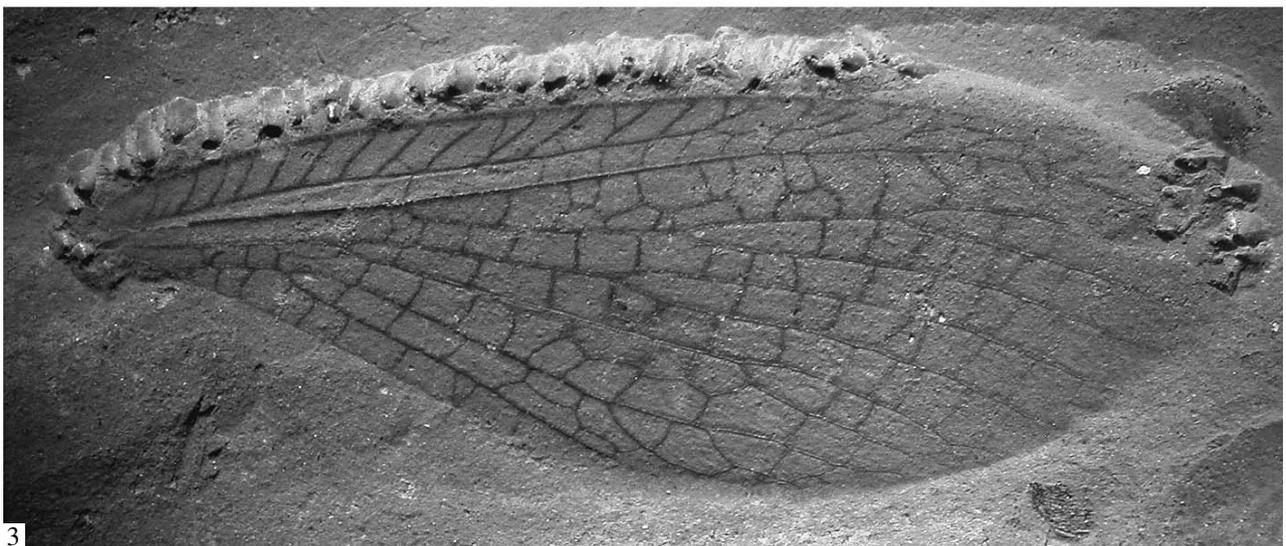
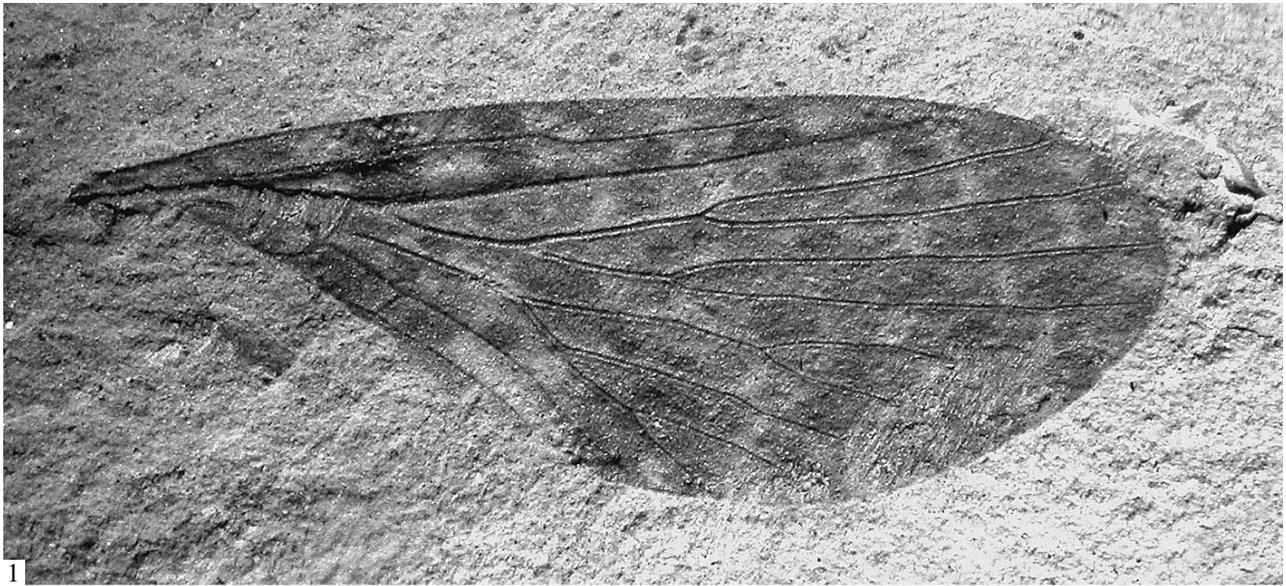
Fourteen insect orders are present: dominating Grylloblattida (22%); common Plecoptera (14%), Mecoptera (10%), and Homoptera (8%); not rare (2–8%) cockroaches, beetles, neuropterans, grasshoppers, miomopterans, caddisflies, and glosselytrods; rare Hypopterygida, Ephemeroptera, and Odonata. About 20% of the insect fossils are not identifiable to order level.

The insect fauna of Chepanikha differs from the other known Urzhumian and Tatarian faunas of the Russian Platform. It is dominated by grylloblattids rather than cockroaches; small-sized forms prevail among the latter, while the larger ones are represented by a genus other than *Aissoblatta*, which is most characteristic of the Middle–Upper Permian of the Russian Platform; this genus presumably belongs to the same family (identifications by D.E. Shcherbakov). The Auchenorrhyncha association is dominated by Prosbol-

idae; Scytinopteridae, Pereboriidae, Suriokocixiidae, Ingruidae, and, perhaps, Serpentinae and Dymorphoptilidae are also represented, while the Triassic groups appearing in the Severodvinian are absent (identifications by D.E. Shcherbakov). Beetles are represented by the families Rhombocoleidae and Permocupedidae (identifications by A.G. Ponomarenko). Some taxa found were previously unknown from the post-Kazanian of the Russian Platform, i.e., the grylloblattid family Aliculidae and the miomopteran genus *Permosialis*. There are no other relict groups. Triassic elements are rare, only the subfamily Meselcaninae (Orthoptera, Permelcanidae: Gorokhov, 2007) formerly unknown from the Permian. Caddisflies are represented by the genera typical for the Permian: *Kamopanorpa* (Microptysmatidae), *Cladochorista* (Cladochoristidae), *Permomerope*, and *Pseudomeropella* (Protomeropidae) (identifications by I.D. Sukatsheva). Among stoneflies, *Palaeonemoura proximalis* Sinitshenkova, 2004 (Palaeonemouridae) was described.

The overall composition of the assemblage, especially of beetles and Auchenorrhyncha, supports the dating of this locality to the Urzhumian.

A total of 65 grylloblattid specimens were collected; Liomopteridae (81%) and Megakhosaridae (13.5%) dominate, and Aliculidae are rare. Liomopterids are represented by the dominant species *Liomopterites novissimus* Aristov, 2004 and rare *Rigidilioma radialis* Aristov, 2004, *Parapermula tatarica* Aristov, 2004 (Aristov, 2004b), and *Miralioma urzhumica* sp. nov. Aliculids and megakhosarids are represented by *Tshepanichoptera lacera* sp. nov. and *Megakhosarina* sp., respectively. The grylloblattid assemblage of Chepanikha is in general typical for the Kazanian and Urzhumian. The only difference is the presence of aliculids, the latest representatives of which were formerly known from the Lower Kazanian.



A total of 30 specimens of Mecoptera were collected, about 10% of the insects. They belong to the families Kaltanidae (which will be described in a separate paper) and Permochoristidae (25 specimens). Among permochoristids, *Xenochorista borealis* Novokshonov, 1997 was described first; further species, *Asiachorista europaea* sp. nov. and *Petromantis udmurtica* sp. nov. are described below. *Petromantis rossica* Handl., 1904 (typical for the Kazanian of eastern and northeastern European Russia) and *Mesochorista* sp. are also present.

The mecopteran assemblage is quite unique: the Kaltanidae and permochoristid genera *Asiachorista* and *Xenochorista* are unknown from the other European faunas, but recorded in the Permian of Angaria (Kuznetsk Basin), possibly including Eastern Subangaria (eastern Kazakhstan and southern Mongolia), and of Gondwana (Brazil, India, and Australia). *P. udmurtica* sp. nov. is more similar to the Kuznetsk species than to the European ones. At the same time, the typical European species *P. rossica* is present.

This and possibly some other features of the Chepanikha Entomofauna may be related to the geographic position of this locality near the southern boundary of Angaria, at the higher paleolatitude than other Permian localities on the Russian Platform.

## SYSTEMATIC PALEONTOLOGY

### Order Mecoptera

#### Family Permochoristidae Tillyard, 1917

#### Subfamily Permochoristinae Tillyard, 1917

#### Genus *Asiachorista* O. Martynova, 1958

*Asiachorista europaea* Bashkuev, sp. nov.

Plate 7, fig. 1

**E t y m o l o g y.** From the Latin *europaea* (European).

**H o l o t y p e.** PIN, no. 3286/49, forewing without anal area; Chepanikha locality; Middle Permian, Urzhumian.

**D e s c r i p t i o n** (Fig. 1a). The anterior margin of the forewing is slightly convex, the apex is at RS, and the apical margin is oblique, smoothly rounded at the tornus. The costal area is moderately narrow, two-thirds as wide as the subcostal area before the distal branch of SC. SC is relatively straight, with a slight bend at the origin of the basal branch, terminating near the pterostigma. The free termination of SC is at least 2.5 times longer than its distal branch. The short basal branch of SC originates distal to the origin of RS + MA; SC<sub>2</sub> originates at the level of RS + MA bifurcation. Dis-

tal to the origin of RS + MA, R is straight. The RS and MA forks are subequal, all their terminations are somewhat deflected forwards. RS + MA and MP bifurcate at the same level. The thyridium is well pronounced. The base of MA is desclerotized at a short distance. MP bears five branches (MP<sub>2</sub> is simple). MP<sub>1+2</sub> bifurcates distal to the bifurcation of RS and MA, and is 4.5 times as long as MP<sub>3+4</sub>. The MP<sub>4</sub> stem is half as long as its fork. The free base of M<sub>5</sub> is shorter than the base of CuA. The wing is slightly darkened, with dark oval spots between the longitudinal veins, and pale patches confined mainly to crossveins. The pterostigma is feebly marked. Longitudinal veins are beset with tubercles (bases of setae), there are also tubercles in the costal area.

**M e a s u r e m e n t s** (mm): forewing length, 7.8; forewing width, 3.

**C o m p a r i s o n.** The new species is similar to *A. kaltanica* O. Mart., 1958 and *A. pulchella* O. Mart., 1958, but is distinct from the former in the shorter distal branch of SC and from the latter in the tubercles on longitudinal veins. It is distinct from all congeners in the wing shape and the RS and MA terminations slightly deflected anteriorly.

**R e m a r k s.** The new species is the only representative of the genus known from European Russia; about 20 species occur in the Kuznetsk Basin, South America, India, and possibly Eastern Kazakhstan and Mongolia (Novokshonov, 1997; Srivastava, 1997). Among all congeners, the species described is most similar to the genus *Callitheira* O. Mart., 1958 from the Upper Permian of the Kuznetsk Basin, differing in the less pronounced tornus and the much wider costal area.

**M a t e r i a l.** Holotype.

#### Genus *Petromantis* Handlirsch, 1904

*Petromantis udmurtica* Bashkuev, sp. nov.

Plate 7, fig. 2

**E t y m o l o g y.** From Udmurtia.

**H o l o t y p e.** PIN, no. 3286/50, complete forewing (part and counterpart); Chepanikha locality; Middle Permian, Urzhumian.

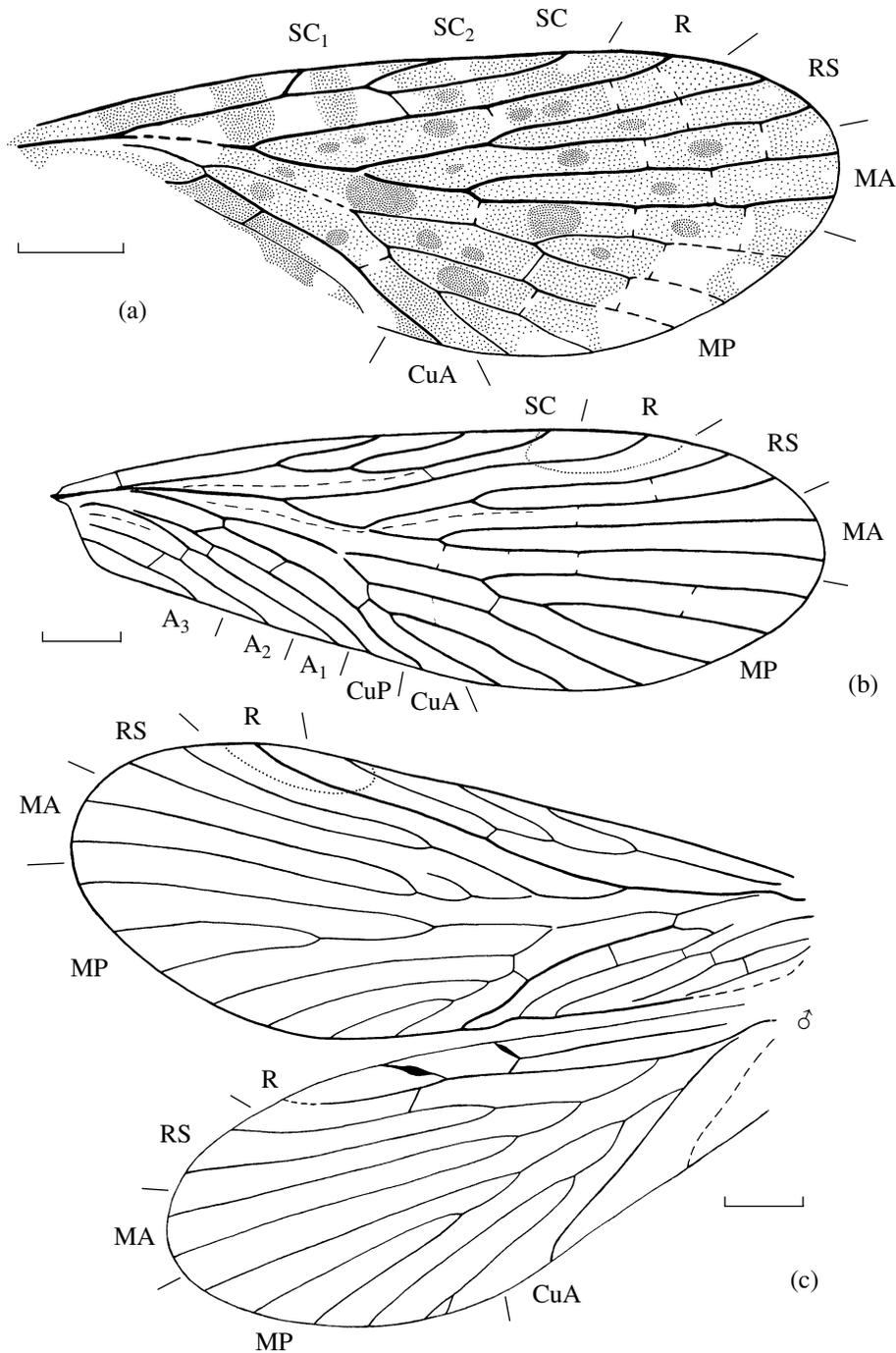
**D e s c r i p t i o n** (Figs. 1b, 1c). The forewing has anterior margin slightly convex and posterior one nearly straight. The costa is gradually thickening in the distal part of the wing, reaching the maximum width near the pterostigma. The costal area is wider than subcostal one distal to the origin of SC branches. The SC<sub>1</sub> and SC<sub>2</sub> are equal in length. The basal branch of SC originates slightly proximal to the origin of RS + MA; SC<sub>2</sub> originates proximal to the level of RS + MA bifur-

### Explanation of Plate 7

**Fig. 1.** *Asiachorista europaea* sp. nov., holotype PIN, no. 3286/49, forewing, ×18; Chepanikha locality; Middle Permian.

**Fig. 2.** *Petromantis udmurtica* sp. nov., holotype PIN, no. 3286/50, forewing, ×15; Chepanikha locality; Middle Permian.

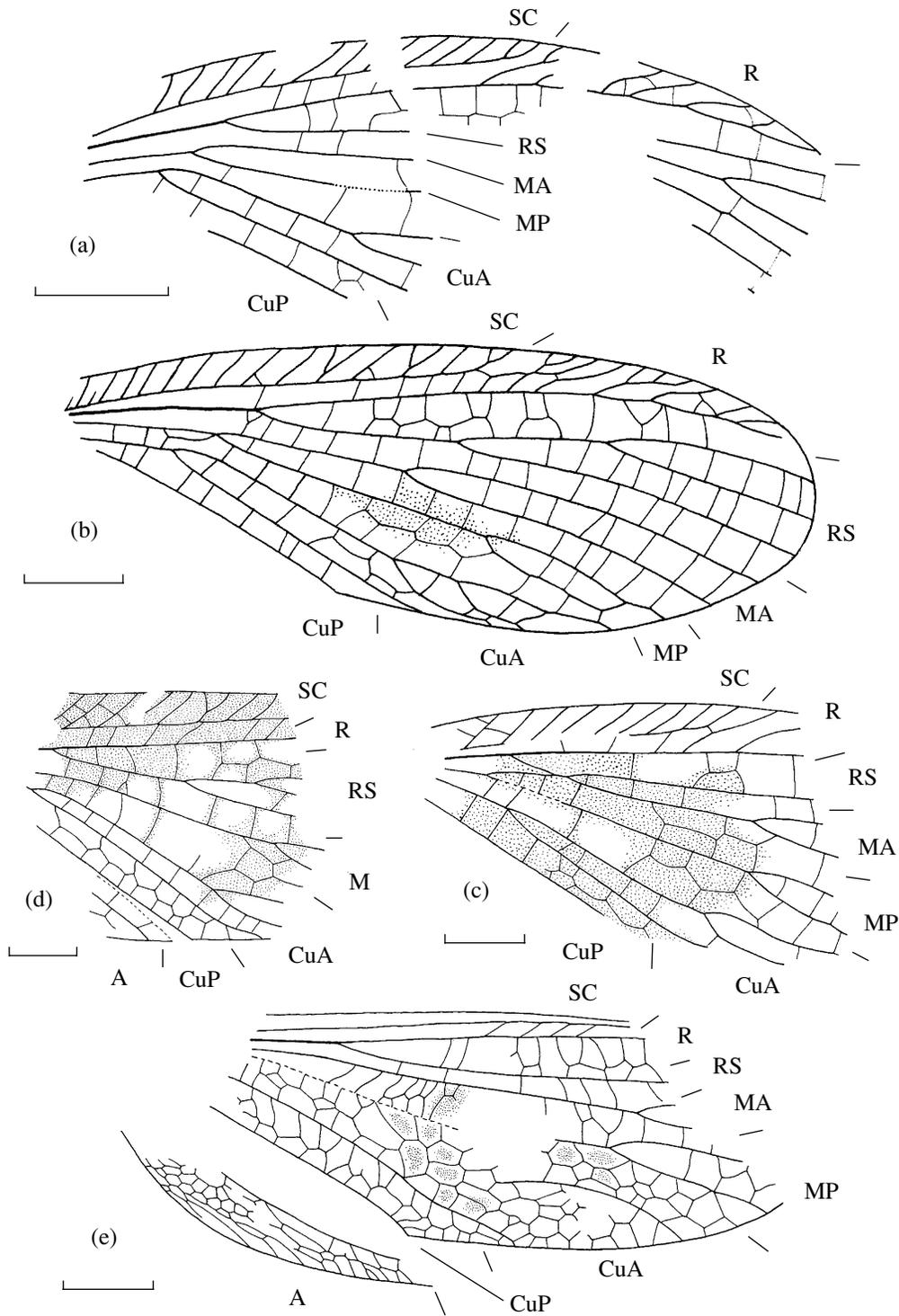
**Fig. 3.** *Liomopterites novissimus* Aristov, 2004, paratype PIN, no. 3286/17, forewing, ×8; Chepanikha locality; Middle Permian.



**Fig. 1.** Wings of scorpionflies of the family Permochoristidae: (a) *Asiachorista europaea* sp. nov., holotype PIN, no. 3286/49, forewing; (b, c) *Petromantis udmurtica* sp. nov.: (b) holotype PIN, no. 3286/50, forewing; and (c) paratype PIN, no. 3286/51, fore and hind wings superimposed. Scale bar, 1 mm.

cation. The RS + MA stem is slightly shorter than the RS stem and slightly longer than the MA stem. RS bifurcates distal to the midlength of the wing, MA bifurcates about the midlength. The  $MP_{1+2}$  stem is 3.5 times as long as the  $MP_{3+4}$  stem. The  $MP_2$  stem is one-third as long as its fork; the  $MP_4$  stem is equal to

$MP_{3+4}$  stem and one-fourth as long as its fork. The free base of  $M_5$  is shorter than the base of CuA. There is a thyridium and a pointlike desclerotized section at the base of MA. Longitudinal veins are beset with tubercles (bases of setae). The pterostigma is lanceolate and darkened. Between veins the wing has a few relatively



**Fig. 2.** Forewings of the grylloblattid families Liomopteridae and Aliculidae: (a–c) *Liomopterites novissimus* Aristov, 2004: (a) holotype PIN, no. 3286/8; (b) paratype PIN, no. 3286/17; (c) paratype PIN, no. 3286/15; (d) *Miralioma urzhumica* sp. nov., holotype PIN, no. 3286/16; and (e) *Tshepanichoptera lacera* sp. nov., holotype PIN, no. 3286/14. Scale bars: (a) 5 mm and (b–e) 2 mm.

small elongated dark spots about the midwing and numerous ones in the distal wing third.

The hind wing has Carpenter's organs (Novokshonov, 1994) on SC branches.

**Measurements** (mm): forewing length, 9.8; forewing width, 3.4.

**Comparison.** The new species is most similar to *P. kaltanica* O. Mart., 1958, differing in the more proximal SC branches and in the larger size.

**Remarks.** In the forewing of paratype no. 3286/51, MA bears a short blind anterior branch before its fork, MP bears seven branches (posterior branch of MP<sub>4</sub> with an additional fork). MP of the hind wing also bears an extremely short additional fork. These deviations are within the variability registered in species of *Petromantis*.

**Material.** In addition to the holotype, paratype PIN, no. 3286/51, overlapping fore- and hind wing (part and counterpart) from the type locality.

Order Grylloblattida

Suborder Grylloblattina

**Family Liomopteridae Sellards, 1909**

**Genus *Liomopterites* Sharov, 1961**

*Liomopterites novissimus* Aristov, 2004

Plate 7, fig. 3

*Liomopterites novissimus*: Aristov, 2004b, p. 157, pl. 8, fig. 1; text-fig. 3f.

**Holotype.** PIN, no. 3286/8, forewing; Chepanikha locality; Middle Permian, Urzhumian.

**Redescription** (Figs. 2a–2c). The anterior margin of the forewing is convex. The costal area is 1.5 times wider than the subcostal area. SC terminates at the boundary of the distal third of the wing. The SC branches are simple or Y-shaped, the dichotomous branches of R are connected by crossveins. The radial area is broad, RS is three-branched, originates in the basal wing third, free or fused with MA. The MA branches are bifurcating, the MP branches may be fused. CuA<sub>1</sub> forks late, with two or three branches, the area between CuA and CuP is narrow. Crossveins are simple and form double rows of cells. The color pattern consists of large dark spots.

**Measurements** (mm): forewing length, 16.5–20.

**Material.** In addition to the holotype, paratypes PIN, nos. 3286/15, 17, 18, 19, 20, 21, 28, 29, 30 from the type locality.

**Genus *Miralioma* Aristov, 2004**

*Miralioma urzhumica* Aristov, sp. nov.

**Etymology.** From the Urzhumian Stage.

**Holotype.** PIN, no. 3286/16, forewing fragment; Chepanikha locality; Middle Permian, Urzhumian.

**Description** (Fig. 2d). The costal area is 1.5 times as wide as the subcostal area, crossed by simple or Y-shaped anterior branches of SC. RS has three or more branches, the median vein bifurcates after the first RS fork. CuA<sub>1</sub> bifurcates near the posterior margin. Crossveins are simple and form double or triple rows of cells. The color pattern consists of large dark spots.

**Measurements** (mm): reconstructed forewing length, about 12.

**Comparison.** The new species is distinct from the type species, *M. monstrosa* Aristov, 2004 (Aristov, 2004b) in the CuA<sub>1</sub> bifurcating more distally.

**Remarks.** Among all genera of the family, the very distal bifurcation of the median vein is only characteristic of the genus *Miralioma*, to which we assign the species described above.

**Material.** Holotype.

Suborder Protoperlina

**Family Aliculidae Storozhenko, 1997**

**Genus *Tshepanichoptera* Aristov, gen. nov.**

**Etymology.** From the Chepanikha locality and the Greek *pteron* (wing).

**Type species.** *T. lacera* Aristov, sp. nov.

**Diagnosis.** Medium-sized insects. Anterior margin of forewing nearly straight; SC terminating in distal wing quarter; at midlength of wing, costal area subequal in width to subcostal area. RS originating in basal wing third, RS and M forking distally. CuA forked near posterior margin; single distal branch reaching apical wing quarter and lacking comb of posterior branches; area between CuA branches filled by network of crossveins. A<sub>2</sub> reduced.

**Comparison.** The genus *Tshepanichoptera* is most similar to *Neraphidia* Novokshonov et Novokshonova, 1997 from the Kungurian of the Middle Ural Mountains (Aristov, 2004a), being distinct in having the costal area as wide as the subcostal area at the midwing, in the reduced comb of the posterior branches on the distal main branch of CuA, and in the reduced A<sub>2</sub>.

*Tshepanichoptera lacera* Aristov, sp. nov.

**Etymology.** From the Latin *lacera* (torn).

**Holotype.** PIN, no. 3286/14, forewing without apex and with anal area separated (part and counterpart); Chepanikha locality; Middle Permian, Urzhumian.

**Description** (Fig. 2e). RS is simple; MA and MP have two and three branches, respectively. The anal area is small, A<sub>1</sub> is simple. Crossveins are simple and form several rows of cells. The color pattern consists of small spots near the center of the wing.

**Measurements** (mm): forewing length, about 18.

**Remarks.** The anal area was buried separately, but judging from the measurements, it belongs to the same specimen.

**Material.** Holotype.

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## REFERENCES

1. D. S. Aristov, "The Fauna of Grylloblattid Insects (Grylloblattida) of the Lower Permian Locality of Tshékarda," *Paleontol. J.* **38** (Suppl. 2), 80–145 (2004a).
2. D. S. Aristov, "Grylloblattids of the Family Liomopteridae (Insecta: Grylloblattida) of the Upper Half of the Upper Permian," *Paleontol. J.* **38** (Suppl. 2), 150–157 (2004b).
3. A. V. Gorokhov, "The First Representative of the Suborder Mesotitanina from the Paleozoic and Notes on the System and Evolution of the Order Titanoptera (Insecta: Polyneoptera)," *Paleontol. Zh.*, No. 6, 31–35 (2007) [*Paleontol. J.* **41** (6), 621–625 (2007)].
4. V. G. Novokshonov, "The Permochoristidae, the Nearest Common Ancestors of the Extant Scorpionflies (Insecta: Panorpida = Mecoptera)," *Zool. Zh.* **73** (7–8), 58–70 (1994).
5. V. G. Novokshonov, *Early Evolution of Scorpionflies (Insecta: Panorpida)* (Nauka, Moscow, 1997) [in Russian].
6. A. G. Ponomarenko, "On the Nomenclature of Wing Venation in Beetles (Coleoptera)," *Entomol. Obozr.* **60** (4), 768–775 (1972).
7. N. D. Sinitshenkova, "New Stoneflies of the Family Palaeonemouridae from the Upper Permian of Udmurtiya and the Orenburg Region (Insecta: Perlida = Plecoptera)," *Paleontol. J.* **38** (Suppl. 2), 164–172 (2004).
8. A. K. Srivastava, "Insect and Insect Activities in Permian Gondwana of India," *Permophiles*, No. 30, 17 (1997).