

# New Scorpionflies (Insecta: Mecoptera: Permochoristidae) from the Ufimian of Cisuralia

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**Abstract**—Two new species of *Protopanorpa* Carpenter (Mecoptera: Permochoristidae), *P. longicubitalis* sp. nov. and *P. similis* sp. nov. from the Ufimian Solikamsk Horizon of the Perm Region (Tyulkino locality) are described. Scorpionflies of Tyulkino are compared with scorpionflies of the Kungurian Chekarda locality (Perm Region) and the Early Kazanian Soyana locality (Arkhangelsk Region).

**Key words:** Mecoptera, *Protopanorpa*, new species, Permian, Ufimian.

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## INTRODUCTION

The oldest undoubted mecopterans are known from beds near the Carboniferous–Permian boundary in North America (Rasnitsyn et al., 2004). In the Permian, scorpionflies reached their acme and continued to be one of the most abundant groups in entomofaunas till the Cretaceous; then, their abundance declined and came nearer to the recent level. Permian scorpionflies are known from almost all continents, with the richest and most numerous localities in Eurasia, especially in European Russia (stratotypic region of the Permian). This area has yielded the most complete sequence of Permian scorpionfly assemblages from the Upper Kungurian up to the basal Triassic.

However, within this stratigraphic interval, mecopterans are quite unevenly studied. Kungurian and Kazanian scorpionflies are well known owing to two rich localities, Chekarda and Soyana, which have been studied the 1930s. Scorpionflies from the Urzhumian (Aristov and Bashkuev, 2008; Bashkuev, 2008) and Severodvinian (unpublished data) are less known, whereas only rare, mostly undescribed Mecoptera specimens are discovered in the Ufimian, Vyatkian, and basal Triassic.

Ufimian scorpionflies are known by a few specimens from the Vorkuta Group of the Pechora Basin (Rasnitsyn et al., 2005: *Petromantis* Handlirsch, 1904 and *Protopanorpa* Tillyard, 1926; the latter genus in the list of taxa is erroneously mentioned as *Agetopanorpa* sp.) and from the Solikamsk Horizon of the Perm Region (*Tjulkinella* Novokshonov, 1995 and *Protopanorpa*).

The Tyulkino section (Perm Region, Solikamsk District, right bank of the Kama River near the village of Tyulkino) is the stratotype of the Upper Solikamsk Subformation of Solikamsk Horizon, which was

examined in detail by V.V. Silant'ev (1998). Fossil material coming mainly from carbonate-argillaceous deposits of the upper part of the section (member C, layer 14) was collected by a field party of Borissiak Paleontological Institute of the Russian Academy of Sciences (PIN) in 2006 and 2008. Conchostracans, ostracods, bivalves, fish scales, and plants (mainly bryophytes) were found along with insects.

The Tyulkino Insect Assemblage looks like a rather impoverished variant of the Kungurian Entomofauna of Chekarda (Shcherbakov, 2008). Blattinopseida dominate numerically, grylloblattids and caddisflies are common, while scorpionflies are rare. Among a total of about 300 insects collected, there are only 14 scorpionfly specimens (about 5% of all identifiable insects); besides endemic *Tjulkinella silantjevi* Novokshonov, 1995 (1 specimen), all others belong to the Early–Middle Permian genus *Protopanorpa*: *P. longicubitalis* sp. nov. (5 specimens), *P. similis* sp. nov. (3 specimens), *P. ?minuta* (Novokshonov, 1993) (2 specimens), and two hindwings and a forewing of the same genus not identified to the species. Both genera belong to the family Permochoristidae.

In the Chekarda locality, the most abundant genus is *Agetopanorpa* Carpenter, 1930 (about 55% of Mecoptera specimens: Novokshonov, 1994, corrected), while *Protopanorpa* amounts 12%. Both genera belong to the subfamily Agetopanorpinæ, constituting more than 80% of Mecoptera in Chekarda; other 20% fall in the subfamilies Permochoristinae (represented by the genus *Petromantis*) and endemic Sylvopanorpinæ.

In the Early Kazanian assemblage of Soyana, Agetopanorpinæ constitute by preliminary estimate some 30% of Mecoptera, and Permochoristinae (*Petromantis*) almost 70%. Among Agetopanorpinæ,

*Agetopanorpa* Carpenter, 1930, dominates and *Protopanorpa* is represented by a single specimen (Martynov, 1933).

Thus, the Solikamskian Fauna of Mecoptera is more similar to the Kungurian fauna than to the Early Kazanian one in the dominance of Agetopanorpinæ (93%) and the presence of a species very close to *P. minuta* from Chekarda. Another characteristic feature is the absence of the genus *Agetopanorpa*, which is typical of the Kungurian and Kazanian of the Russian Platform and replaced by *Protopanorpa* in Tyulkino. Low diversity of the Solikamskian Entomofauna and a small proportion of Mecoptera (5% in Tyulkino versus 15% in Chekarda and 17% in Soyana: Shcherbakov, 2008) were probably caused by regional aridification in the Solikamskian Time (Naugolnykh, 2001).

The material is housed in PIN, collection no. 3474.

## SYSTEMATIC PALEONTOLOGY

### Family Pernochoeristidae Tillyard, 1917

#### Subfamily Agetopanorpinæ Carpenter, 1930

#### Genus *Protopanorpa* Tillyard, 1926

*Protopanorpa*: Tillyard, 1926, p. 151; Carpenter, 1930, p. 91; Martynov, 1933, p. 44; Novokshonov, 1997, p. 52.

*Protopanorpoidea*: Martynova, 1962, p. 287; Novokshonov, 1993, p. 78.

**Type species.** *Protopanorpa permiana* Tillyard, 1926; Elmo, Kansas, USA; Lower Permian, Wellington Formation.

**Diagnosis.** SC with two oblique branches, reaching basal margin of pterostigma. R with one or two branches in pterostigmal area. RS with three terminations (RS<sub>2</sub> forked), MA with two terminations. MP normally six-branched, but often with additional forks. Bases of CuA and M<sub>5</sub> relatively long, distinct. In hindwing, SC long, almost reaching pterostigma. Forewing 4.8–8.7 mm long.

**Species composition.** In addition to the type species, *P. media* (Novokshonov, 1994) and *P. minuta* (Novokshonov, 1994) from the Kungurian of Cisuralia (Chekarda), *P. elongata* Martynov, 1933 from the Kazanian of the Arkhangelsk Region (Soyana), *P. longicubitalis* sp. nov. and *P. similis* sp. nov. from the Ufimian of Cisuralia (Tyulkino). In addition, two undescribed specimens from the Ufimian of the Pechora Basin and the Kungurian of Primorye (Rusky Island) stored in PIN.

**Comparison.** *Protopanorpa* differs from other genera in the branching pattern of RS+MA.

#### *Protopanorpa longicubitalis* Bashkuev, sp. nov.

Plate 6, fig. 1

**Etymology.** From the Latin *longus* (long) and the cubital vein.

**Holotype.** PIN, no. 3474/7, well-preserved complete forewing; Tyulkino locality; Lower Permian, Ufimian, Solikamsk Horizon.

**Description** (Figs. 1a–1d). The forewing is almost symmetric, elongate (2.7–3.1 : 1), with a slightly pointed apex. The anterior margin is slightly convex, with a slight concavity before the pterostigma. The costal area is moderately wide, as wide as the subcostal area, becoming somewhat wider in the distal part. SC with two equally oblique branches, with a sharp bend just before joining the anterior margin. The crossvein sc-r is short, straight. R has one or two branches in the pterostigmal area, bending sharply backwards at the base of the pterostigma and curving smoothly at the beginning of RS+MA. The RS+MA stem is relatively long, 2–2.5 times as long as the RS stem. The CuA base is much longer than free base of M<sub>5</sub>. CuA terminates beyond the wing midlength, about the level of SC apex. The crossvein mp-cua is absent or weakly sclerotized.

**Measurements** (mm). Forewing length, 5.9–8.7; maximum width, 2.0–3.2.

**Variability.** In the holotype, MP<sub>1</sub> has an additional fork. The paratypes PIN, nos. 3474/8, 3474/91 are about 0.66 as large as the holotype.

**Comparison.** The new species differs from congeners in the pointed wing apex and the long CuA, terminating at the level of the SC apex. Additionally, it differs from *P. media* in the shorter sc-r crossvein and R with a distal bend, from *P. permiana* in the longer RS+MA stem and the shorter M<sub>5</sub> base.

**Remarks.** Specimen PIN, no. 3474/95 (forewing without basal third) may also belong to this species because of long CuA, but differs in the very narrow wing (>3.5 : 1) and short branches of SC (Fig. 1e).

**Material.** In addition to the holotype, paratypes PIN, nos. 3474/8, 3474/9, and 3474/91 (Figs. 1b–1d).

#### *Protopanorpa similis* Bashkuev, sp. nov.

Plate 6, fig. 2

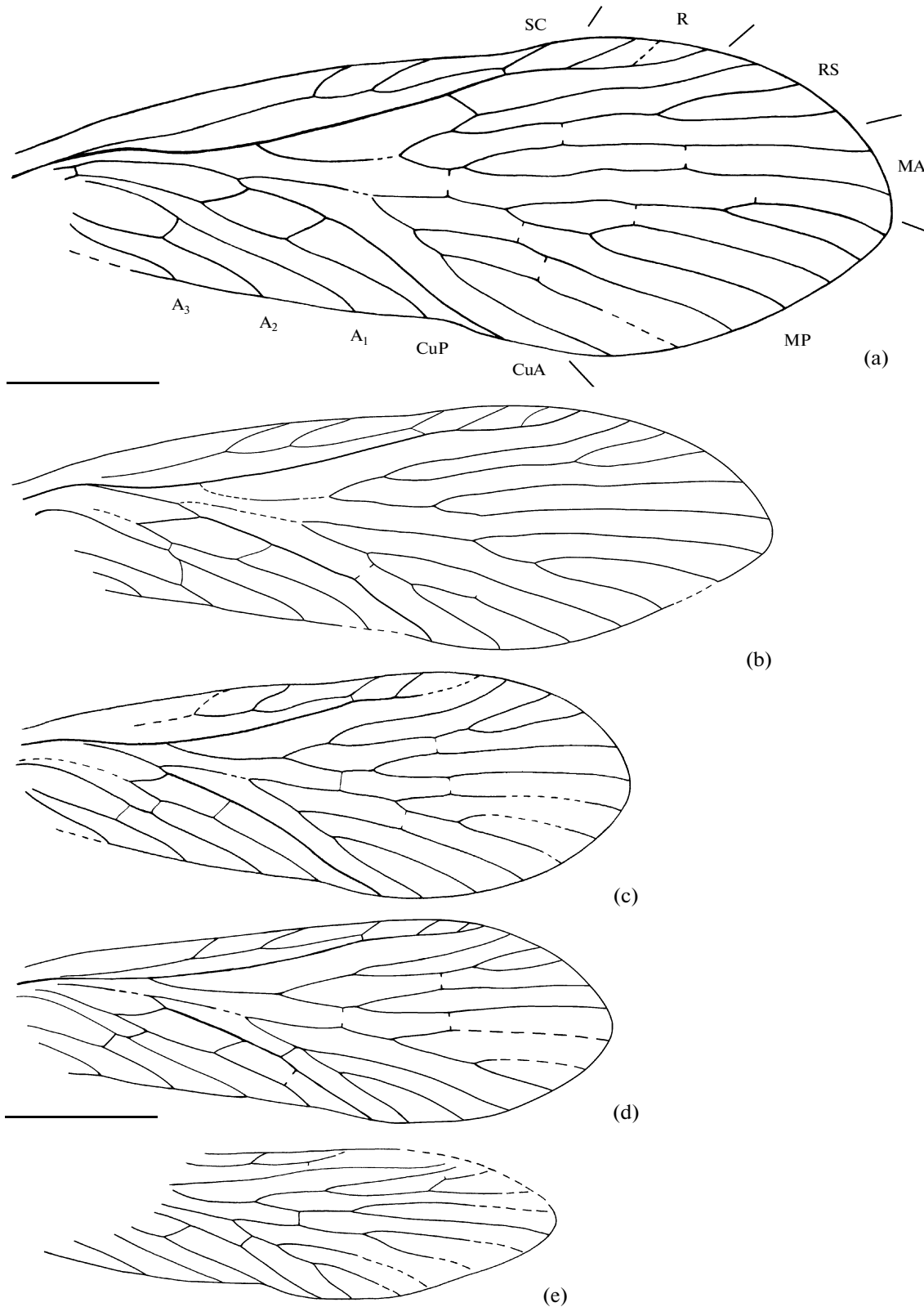
**Etymology.** From the Latin *similis* (similar).

**Holotype.** PIN, no. 3474/96, well-preserved complete forewing; Tyulkino locality; Lower Permian, Ufimian, Solikamsk Horizon.

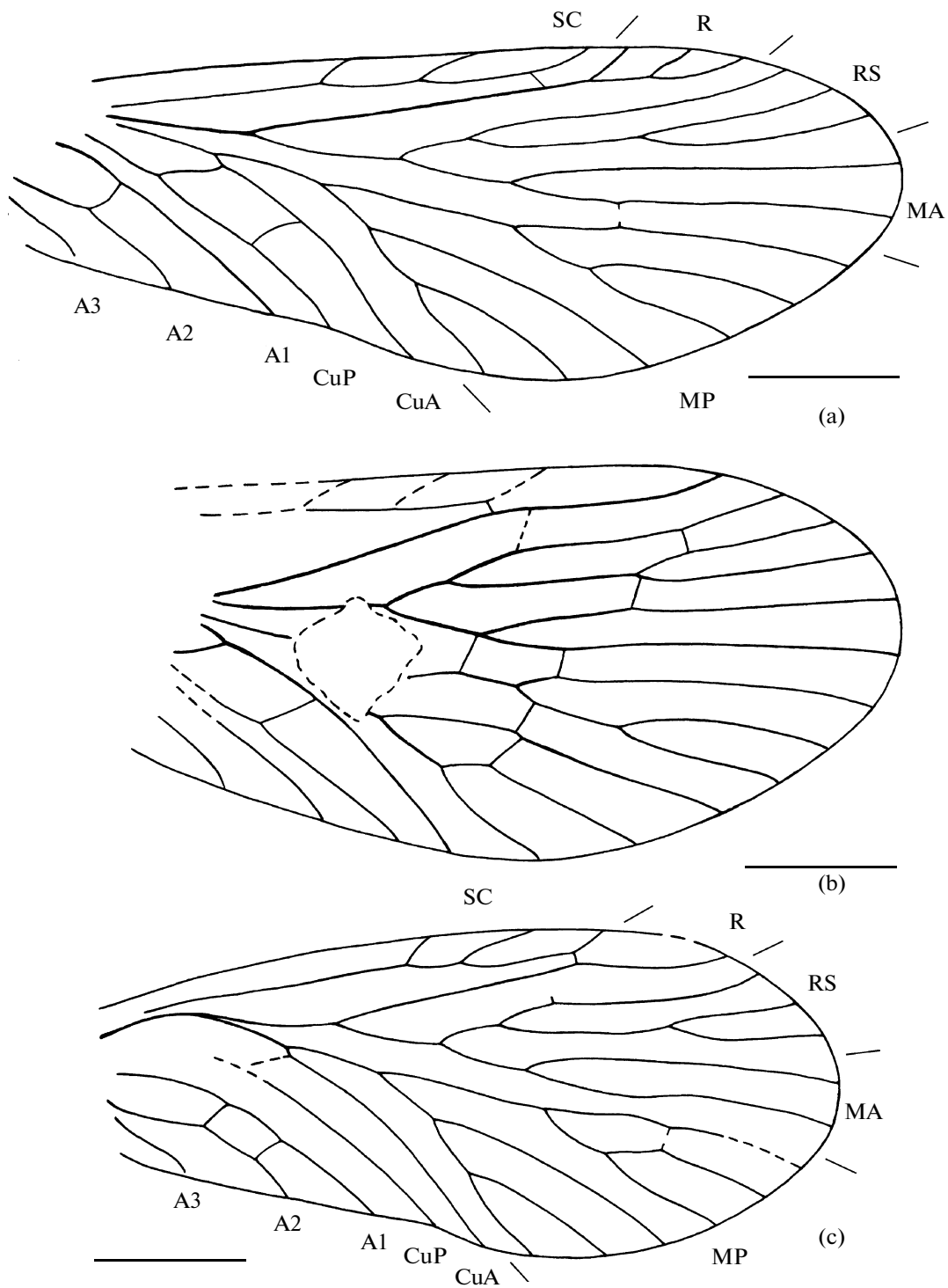
**Description** (Figs. 2a, 2b). The anterior margin of the forewing is straight, the apical margin is oblique, smoothly rounded at the tornus. The costal area is relatively narrow. The crossvein sc-r is short. R has one or two distal branches, smoothly curved in the distal part and distinctly concave at the beginning of RS+MA. The RS+MA stem is 2–2.5 times as long as the RS stem. The CuA base is longer than free base of M<sub>5</sub>. CuA terminates near the wing midlength, about the level of the distal branch of SC.

**Measurements** (mm). Forewing length, 5.3–5.8; width, 2.1–2.5.

**Comparison.** The new species is most similar to *P. media* and *P. permiana*, differing in the wing shape; it additionally differs from *P. media* in the shorter sc-r crossvein.



**Fig. 1.** Forewings of *Protopanorpa* spp.: (a–d) *P. longicubitalis* sp. nov.: (a) holotype PIN, no. 3474/7, mirrored; (b) paratype PIN, no. 3474/9, mirrored; (c) paratype PIN, no. 3474/8; (d) paratype PIN, no. 3474/91; (e) *Protopanorpa* sp., PIN, no. 3474/95, mirrored. Scale bar, 1 mm.



**Fig. 2.** Forewings of *Protopanorpa* spp.: (a, b) *P. similis* sp. nov.: (a) holotype PIN, no. 3474/96; (b) paratype PIN, no. 3474/94; (c) *P. ?minuta* (Novokshonov), PIN, no. 3474/92. Scale bar, 1 mm.

Explanation of Plate 6

**Fig. 1.** *Protopanorpa longicubitalis* sp. nov., holotype PIN, no. 3474/7, forewing,  $\times 18$ .

**Fig. 2.** *Protopanorpa similis* sp. nov., holotype PIN, no. 3474/96, forewing,  $\times 25$ .

**Fig. 3.** *Protopanorpa ?minuta* (Novokshonov, 1933), PIN, no. 3474/92, forewing,  $\times 25$ .

Plate 6



**Material.** In addition to the holotype, paratypes PIN, nos. 3474/94 (distorted forewing without basal part, part and counterpart) (Fig. 2b) and 3474/93 (poorly preserved forewing, part and counterpart). The subcostal area of PIN, no. 3474/94 seeming exceptionally wide is in fact owing to disrupted wing membrane.

Specimens PIN, nos. 3474/92 (Fig. 2c; Pl. 6, Fig. 3) and 3474/190 are similar in most of their characters to *Protopanorpa minuta* described upon a single specimen from the Chekarda locality (Novokshonov, 1993, text-fig. 2a), but differ in the slightly deeper RS<sub>2</sub> fork, more pronounced distal bend of R, and concavity in the posterior wing margin. These differences are presumed to be within the range of intraspecific variability.

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