A new species of Protopsylliidae (Hemiptera, Sternorrhyncha) from the Middle Jurassic of China

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Abstract

A new fossil species, Poljanka hirsuta sp.n., of the family Protopsylliidae is described from the Middle Jurassic Jiulongshan Formation of Daohugou Village, Inner Mongolia, China. A key to the species of the genus Poljanka Klimaszewski, 1995 is provided. The diagnosis of the genus is revised.

Key words: Hemiptera, Sternorrhyncha, Protopsylliidae, Middle Jurassic

Introduction

Protopsylliidae is an extinct family of insects in the Hemiptera suborder Sternorrhyncha. This family is known from the Late Permian (ca. 260 Ma) to the Late Cretaceous (90 Ma) (Grimaldi 2003). Recently we discovered two well-preserved fossil specimens that represent a species of this family. They were collected in China from the Middle Jurassic Jiulongshan Formation at Daohugou Villages, Ningcheng County, Inner Mongolia. This is the second report of the family Protopsylliidae in China, and based on these specimens, we describe a new species assigned to Poljanka Klimaszewski, 1995. The age of the Daohugou fossil-bearing beds is recognized as the Middle Jurassic (ca. 165 Ma) (Wang et al. 2009; Ren et al. 2010; Zhang et al. 2010; Shi et al. 2011; Yang et al. 2011).

Material and methods

This study is based on two fossil specimens (one includes part and counterpart), housed in the fossil insect collection of the Key Lab of Insect Evolution and Environmental Changes, College of Life Sciences, Capital Normal University, Beijing, China. The specimens were examined without alcohol and under alcohol using a Leica MZ 12.5 dissecting microscope. Photos were taken by a Nikon Digital Camera DXM1200C. Line drawings were prepared with Adobe Photoshop CS2 graphic software.

The wing venation nomenclature used in this paper is based on the interpretation of Bekker-Migdisova (1985): R, radius; R1, first branch of anterior radial vein; R2, second branch of anterior radial vein; Rs, posterior radial vein; M, media; M1+2, anterior and second branch of media; M3+4, third and fourth branch of media; CuA, cubitus anterior vein; CuA1, anterior branch of cubitus anterior; CuA2, second branch of cubitus anterior; CuP, cubitus posterior vein; A1, anterior branch of anal vein; A2, second branch of anal vein.

Protopsylliidae Carpenter, 1931

Until now, 31 genera and 57 species have been described in this family. There are 28 species known from the Permian (Tillyard 1926; Davis 1942; Evans 1943; Bekker-Migdisova 1959, 1960, 1985; Riek 1976; Klimaszewski
1995), two species from the Triassic (Tillyard 1917; Evans 1956), 20 species from the Jurassic (Martynov 1937; Handlirsch 1939; Evans 1956; Bekker-Migdisova 1959, 1968, 1985; Lin 1976; Klimaszewski 1995; Ansorge 1996), and seven species from the Cretaceous (Klimaszewski 1995; Grimaldi 2003). These species are recorded from China, Mongolia, Burma, Kyrgyzstan, Kazakhstan, Tajikistan, Australia, South Africa, America (New Jersey), England, Germany, and Russia (Carpenter 1992; Shcherbakov & Popov 2002; Grimaldi & Engel 2005).

**Poljanka** Klimaszewski, 1995

Type species: *Cicadellopsis shurabensis* Bekker-Migdisova, 1985

Four described species, together with two un-named species, have been assigned to this genus (Klimaszewski, 1995), and to these is here added a further new species (Table 1).

**Generic diagnosis:** Head width longer than length; eyes large and ovoid; antennae filiform, ten-segmented, scapus shortest and thickest, pedicelli enlarged, slightly longer than scapus, all flagellomeres slender except for apical segment swollen; rostrum straight, long, three-segmented. Femora stout, distinctly shorter than tibiae; tibiae slender, and hind tibiae longer than fore and mid tibiae; tarsi two-segmented, first segment longer than second. Forewings broadened in subapical part; vein R1 long, R reduced; Rs reaching to costal margin; stem of R slightly shorter than vein M+CuA; M with two long branches; cell m1+2 variously elongated, always longer than cell cua1; CuA forked into long CuA1 and short CuA2; anal field long, almost half length of forewing.

<table>
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<tr>
<th>TABLE 1. Geographical and stratigraphic distribution of the known species in <em>Poljanka.</em></th>
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<td>Species</td>
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<td><em>Poljanka hirsuta</em></td>
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<td><em>Poljanka kukalovae</em></td>
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<td><em>Poljanka sharovi</em></td>
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<td><em>Poljanka shurabensis</em></td>
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<td><em>Poljanka ventriculosa</em></td>
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<td><em>Poljanka sp.1</em></td>
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<td><em>Poljanka sp.2</em></td>
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**Key to species of the Poljanka**

1. M3+4 bent at the apex abruptly (Fig. 1A) ................................................................. P. *shurabensis*
   M3+4 without a sharp bend at the apex ................................................................. 2
2. Hind tibiae 1.27 times as long as hind femora (Fig. 1D) ........................................... P. *kukalovae*
   Hind tibiae 1.57–2.10 times as long as hind femora .................................................. 3
3. Both body surface and wings without setae (Fig. 1B) ............................................... P. *ventriculosa*
   Either body surface or wings bearing setae ........................................................... 4
4. Branches of M straight; abdomen apex with setae (Fig. 1C) ...................................... P. *sp.1*
   Branches of M not straight; abdomen apex without setae ......................................... 5
5. First tarsomere of fore legs about twice as long as second segment (Fig. 1F) ................ P. *sp.2*
   First tarsomere of fore legs slightly longer than second segment ................................ 6
6. CuA1 2.46 times as long as CuA2; apical flagellomere longer than flagellomere seven; veins without setae (Fig. 1E). *P. sharovi*  
   CuA1 3.60 times as long as CuA2; apical flagellomere slightly shorter than flagellomere seven; veins with long or short setae (Fig. 1G) ................................................................. *P. hirsuta* sp.n.
**Poljanka hirsuta** sp.n.
(Figs. 1–4)

**Diagnosis:** Scapus 1.50 times thicker than pedicelli, pedicelli two times thicker than flagellomeres, apical flagellomere swollen; femora about two times thicker than corresponding tibiae, hind tibiae 1.46–1.57 times longer than fore and mid tibiae, first tarsomere of fore legs 1.33 times longer than second, first tarsomere of mid legs 1.50 times longer than second, first tarsomere of hind legs 2.31 times longer than second; \( R_1 \), reduced, vein M+CuA about 1.57 times longer than vein R, branches of \( M \) about 2.22–2.39 times longer than \( M \).

**Description:** Body 2.89 times as long as wide.

Head: Head 1.27 times as wide as long. Antennae 9.47 times length of head, its bases inserted in round antennal sockets, scapus enlarged, 1.50 times as thick as pedicelli, pedicelli cylindrical, twice as thick as flagellomeres, flagellomeres with dense long hairs, apical flagellomere swollen. Clypeus approximately triangular, junction between clypeus and rostrum broken. Rostrum stout, first segment longest, second 1.25 times as long as third (Fig. 1J).

**FIGURE 1.** A-F (after Bekker-Migdisova 1985): Forewing line drawings of *Poljanka* spp. A. *P. shurabensis*; B. *P. ventriculosa*; C. *P. sp.J;* D. *P. kukalovae*; E. *P. sharovi;* F. *P. sp.2. Scale bar = 2 mm. G-K: *Poljanka hirsuta* sp. n. Line drawings, CNU-PSY-NN2011008. G. Right forewing; H. Left fore leg and antennae; I. Left middle leg; J. Rostrum; K. Right hind leg. Scale bar = 1 mm.

Thorax: Pronotum 2.88 times as wide as long, flat to moderately deflexed; mesothorax barrel-shaped.

Legs: With approximate square trochanters; femora stout, nearly subequal in length, about two times as thick as corresponding tibiae; tibiae and tarsi with dense setae. Fore tibiae about 1.34 times as long as corresponding femora, first tarsomere of fore tarsis long, 1.33 times as long as second; mid legs similar to fore legs, tibiae slightly longer than fore tibiae, tarsi 0.50 times length of tibiae; hind legs distinctly longer than fore and mid legs, tibiae 2.10 times as long as femora, hind tibiae with three visible metatibial apical spurs (Fig. 1K), first tarsomere distinctly longer than fore and mid first tarsomeres, tarsi 0.45 times as long as tibiae, with two claws at apex of tarsi.

Wings: Forewings length 4.94 mm, distinctly extending beyond abdominal tip, width 2.26 mm, with marginal fringe of short setae. Most veins with setae of 0.06–0.23 mm length. \( R_1 \) weekly sinuous. Rs branching off \( R \) very proximally and bent to costal margin of wing at apex abruptly. CuA connected to \( M \) creating the common part \( M+CuA \) and \( M+CuA \) connected to \( R \) forming the common stem \( R+M+CuA \). \( M+CuA \) stem about 1.57 times length of vein \( R \). \( M \) straight, with two branches. \( M_{1+2} \) bent to fore wing margin, \( M_{1+3+4} \) bent to wing hind margin. \( M_{1+2} \) slightly longer than \( M_{1+4} \), both \( M_{1+2} \) and \( M_{1+4} \) 2.22–2.39 times longer than \( M \). Cell \( m_{1+2} \) 3.25 times longer than cell \( cu_{1+2} \). CuA very long, about 1.89 times longer than \( M \) stem. CuA forked into CuA\(_1\) and CuA\(_2\). CuA\(_1\) long and curved, about 0.53 times length of CuA stem. CuA\(_2\) short, almost straight, 0.28 times length of CuA\(_1\). CuP nearly parallel to CuA. \( A_1 \) and \( A_2 \) merged into a point.

Abdomen: Abdomen roughly oval.
FIGURE 2. *P. hirsuta* sp. n. Photographs. A. Holotype, CNU-PSY-NN2011008p; B. Holotype, CNU-PSY-NN2011008c. Scale bar = 2 mm.

FIGURE 3. *P. hirsuta* sp. n. Line drawings of holotype, CNU-PSY-NN2011008. A. Ventral view of body with wings; B. Dorsal view of body with wings. Scale bar = 2 mm.
FIGURE 4. *P. hirsuta* sp. n. Photographs, CNU-PSY-NN2011008. A. Right forewing; B. Left fore leg and antennae; C. Ros- trum; D. Right hind leg; E. Left middle leg. Scale bar = 1 mm.
Measurements (in mm): Holotype, ♂, CNU-PSY-NN2011008pc: Body length 5.00, maximal width of body 1.73; head length 0.45, width 0.57; antennal segments length I–X: 0.19, 0.21, 0.66, 0.60, 0.42, 0.51, 0.60, 0.18, 0.48, 0.42; length rostrum I–III: 0.66, 0.45, 0.36; length pronotum 0.33, width 0.95; length fore leg: femur 1.25, tibia 1.67, tarsomerses I–II: 0.48, 0.36; length mid leg: femur 1.22, tibia 1.79, tarsomerses I–II: 0.54, 0.36; length hind leg: femur 1.25, tibia 2.62, tarsomerses I–II: 0.83, 0.36; forewing length 4.94, width 2.26; R 0.42, R2 2.83, Rs 3.81, M+CuA 0.66, M 1.07, M1+2 2.56, M1+a 2.38, CuA 2.02, CuA1 1.07, CuA2 0.30; cell m1+2 2.50, cell cua1 0.77. Paratype, ♂, CNU-PSY-NN2011018: Body length 6.31, maximal width of body 1.50; head length 0.25, width 0.56; antennal length 2.13; length fore leg: femur 1.19, tibia 2.08, tarsomerses I–II: 0.59, 0.40; length mid leg: tibia 2.28, tarsomerses I–II: 0.59, 0.40; length hind leg: femur 1.49, tibia 3.66, tarsomerses I–II: 0.84, 0.40; forewing length 3.81, width 1.88; R 0.31, R2 2.19, Rs 2.88, M+CuA 0.81, M 0.69, M1+2 1.94, M1+4 1.63, CuA 1.06, CuA1 0.81, CuA2 0.28; cell m1+2 1.88, cell cua1 0.63.

Material: Holotype, male, CNU-PSY-NN2011008pc (part and counterpart), a well-preserved specimen, with body mainly preserved and a rather clear forewing; paratype, male, CNU-PSY-NN2011018.

Etymology: The name of the new species refers to the setae on the antennae, legs and wings, which derives from Latin hirsuta (“hairy”).

Horizon and locality: Jiulongshan Formation, Middle Jurassic, Daohugou Village, Ningcheng County, Inner Mongolia, China.

Remarks: The new species is assigned to Poljanka due to the following features: apical flagellomere longer than second; R1 reduced; vein R slightly shorter than M+CuA; CuA with two branches. Poljanka differs, in addition, from Cicadellopsis Martynov, 1937 in the reduced R, and from Carpenterella Bekker-Migdisova, 1968 and Karatawopsyllidium Bekker-Migdisova, 1968 in CuA bearing two branches.

Compared with P. shurabensis: forewing length 4.94 mm (vs. 6.50 mm); Rs bent at the apex abruptly (vs. Rs slightly bent at the apex); M1+2 bent (vs. M1+2 straight); branches of M short, about 2.22–2.39 times longer than M (vs. M branches longer, about 2.93–3.07 times as long as M).

Compared with P. ventriculosa: veins with short or long setae, (vs. without setae); first tarsomere of hind legs slightly longer than first tarsomere of mid legs (vs. the former seven times longer than the latter); forewing length 4.94 mm (vs. 4.00–4.20 mm); branches of M 2.22–2.39 times length of vein M (vs. branches of M 3.40–3.50 times length of vein M); CuA1 curved (vs. CuA1 straight).

Compared with P. kukalovae: vertex without any setae (vs. with dense hair); hind tibiae 2.10 times as long as hind femora (vs. 1.27 times); forewing length 4.94 mm (vs. 3.00 mm); Rs bent at the apex abruptly (vs. Rs nearly straight).

Compared with P. sharovi: apical flagellomere slightly shorter than flagellomere seven (vs. apical flagellomere longer than flagellomere seven); hind tibiae 2.10 times as long as hind femora (vs. 1.57 times); forewing length 4.94 mm (vs. 2.80–3.20 mm); vein Rs bent at the apex abruptly (vs. Rs nearly straight); bifurcation of M before bifurcation of CuA (bifurcation of M after bifurcation of CuA); branches of M longer than vein M (vs. M1 slightly shorter than M); CuA1 curved (vs. CuA1 straight).

Compared with P. sp.1: tarsi of hind legs distinctly longer than tarsi of mid legs (vs. tarsi of hind and mid legs subequal in length); forewing length 4.94 mm (vs. 3.10 mm); veins M1+2, M1+4 and CuA1, all bent more or less (vs. veins M1+2, M1+4 and CuA1 nearly straight).

Compared with P. sp.2: rostrum stout (vs. rostrum relatively slim); femora nearly subequal in length (vs. hind femora longer than fore and mid femora); first tarsomere of fore legs slightly longer than second segment (vs. first about twice as long as second); forewing length 4.94 mm (vs. 4.00 mm); CuA1 3.60 times as long as CuA2 (vs. CuA1 2.50 times as long as CuA2).
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