



The class Diplopoda in Mongolia, with description of a new species

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Abstract

The class Diplopoda appears to be represented in Mongolia by eight species from 4 genera, 2 families (Polyzoniidae and Diplomaragnidae) and 2 orders (Polyzoniida and Chordeumatida). One species is described here as new to science: *Shearia longa* sp. nov. Genus *Shearia* Mikhaljova, 2000 is new to the fauna of Mongolia. All currently known Diplopoda taxa from Mongolia are keyed, including the new species. The distributions of all Mongolian diplopod species are mapped.

Key words: Millipede, new species, description, taxonomy, key, distribution, Mongolia

Introduction

Knowledge of the millipede fauna of the Mongolia is still highly patchy and incomplete. The first data on diplopods of the country derive from the paper of Golovatch (1977) in which the new genus *Ancestreuma* Golovatch, 1977, of the order Chordeumatida, and two new species are described; the new genus was described in a new family Ancestreumatidae including Mongolian, Altai and Sayan species. After 13 years another four new chordeumatid species of *Diplomaragna* Attems, 1907 genus (family Diplomaragnidae, order Chordeumatida) from Mongolia were described (Shear 1990). In addition, in his publication of 1990 Shear treated Ancestreumatidae as a junior synonym of Diplomaragnidae and *Ancestreuma* as a junior synonym of *Diplomaragna*. Then *Ancestreuma* was revalidated, four Mongolian species were transferred to this genus while the remaining two Mongolian species were assigned to the new genus *Asiatyla* Mikhaljova, 2000 (Mikhaljova 2000). Later, *Angarozonium amurense* (Gerstfeldt, 1859) of the order Polyzoniida, family Polyzoniidae, was recorded from Mongolia (Mikhaljova & Marusik 2004). In addition, information on morphological variation in Mongolian-Siberian *Ancestreuma longibrachiatum* (Shear, 1990) was published (Mikhaljova 2002). Summarized data on the species distributed both in Mongolia and Siberia can be obtained from reviews of diplopods of the Asian part of Russia and Siberia proper (Mikhaljova 1993; 2004; Mikhaljova & Golovatch 2001).

The present paper provides a description of a new species as well as a review of, and key to, the Diplopoda taxa occurring in Mongolia. The distributions of all Mongolian diplopod species are mapped.

Material and methods

Material treated here has been collected and kindly entrusted for study by K. Ulykpan (Pavlodar State University, Pavlodar, Kazakhstan) and B. Bayartogtokh (National University of Mongolia, UlaanBaatar, Mongolia). This material has been deposited in the collections of the Institute of Biology and Soil Science, Far Eastern Branch of the Russian Academy of Sciences, Vladivostok, Russia (IBSS), Pavlodar State University, Pavlodar, Kazakhstan (PU), National University of Mongolia, UlaanBaatar, Mongolia (NUM) and Zoological Museum, State University of Moscow, Russia (ZMUM), as indicated in the text.

Specimens were kept in 70–75% ethanol. In the process of studying the material, the gonopods and some other parts were dissected from a limited number of males and mounted in glycerin as temporary micropreparations.

SEM micrographs were prepared at the Centre of Collective Use “Biotechnology and Gene Engineering” of the IBSS in Vladivostok, Russia using a Zeiss Evo 40 scanning electron microscope. Mounts for SEM were made through air-drying after transfer to acetone via 96% alcohol, mounting on stubs, and coating with gold and platinum. After examination, SEM material was removed from stubs and returned to alcohol, all such samples being kept at IBSS.

Authorships and dates of the order and family taxa are given after Shelley (2003).

Taxonomic part

Polyzoniida Cook, 1895

Polyzoniidae Newport, 1844

Angarozonium amurense (Gerstfeldt, 1859)

Angarozonium amurense — Mikhailjova and Marusik 2004: 3.

Angarozonium amurense — Mikhailjova 2004: 45–48, 46: figs 22–27, 47: map 3.

Remarks. This species, originally described by Gerstfeldt (1859) from near the mouth of the Songari River, China as *Platydesmus amurensis*, then transferred first to *Polyzonium* (Mikhailjova 1979) and finally to *Angarozonium*, with the trans-Siberian *Polyzonium cyathiferum* Mikhailjova, 1981 as a junior subjective synonym (Shelley 1998). Slightly later the formal synonymy was confirmed by the re-examination of samples of what might be considered as near-topotypes (Mikhailjova 1998). This species appears to be widespread throughout the Asian part of Russia, including the northernmost known record of Diplopoda in Northern Hemisphere: Republic of Sakha, Yana River middle flow, ca 67°40'N (Mikhailjova and Marusik 2004). At present the species is known from Siberia (Krasnoyarsk Province, Irkutsk Area, Chita Area, Buryatia, Republic of Sakha (=Yakutia)), Russian Far East (southern part of Khabarovsk Province, Jewish Autonomous Region, Kamchatka Peninsula, northern and central parts of Sakhalin Island), Northeast China (near the mouth of Songari River) and Mongolia (environs of UlaanBaatar).

Chordeumatida Pocock, 1894

Diplomaragnidae Attems, 1907

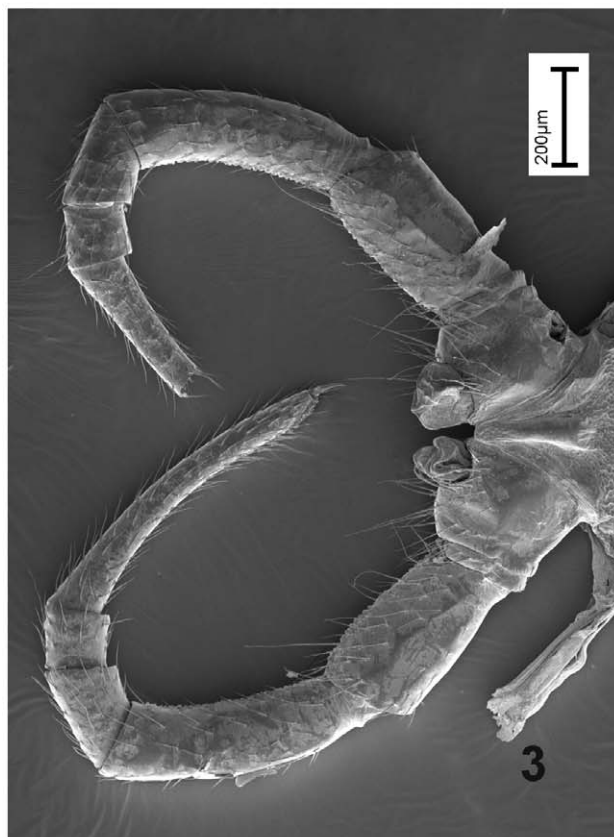
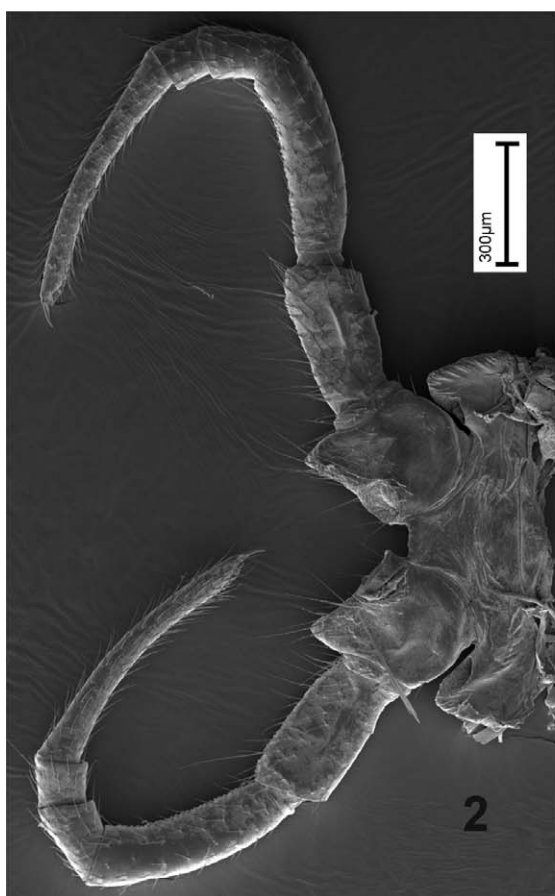
Shearia longa sp. nov.

Figs 1–11

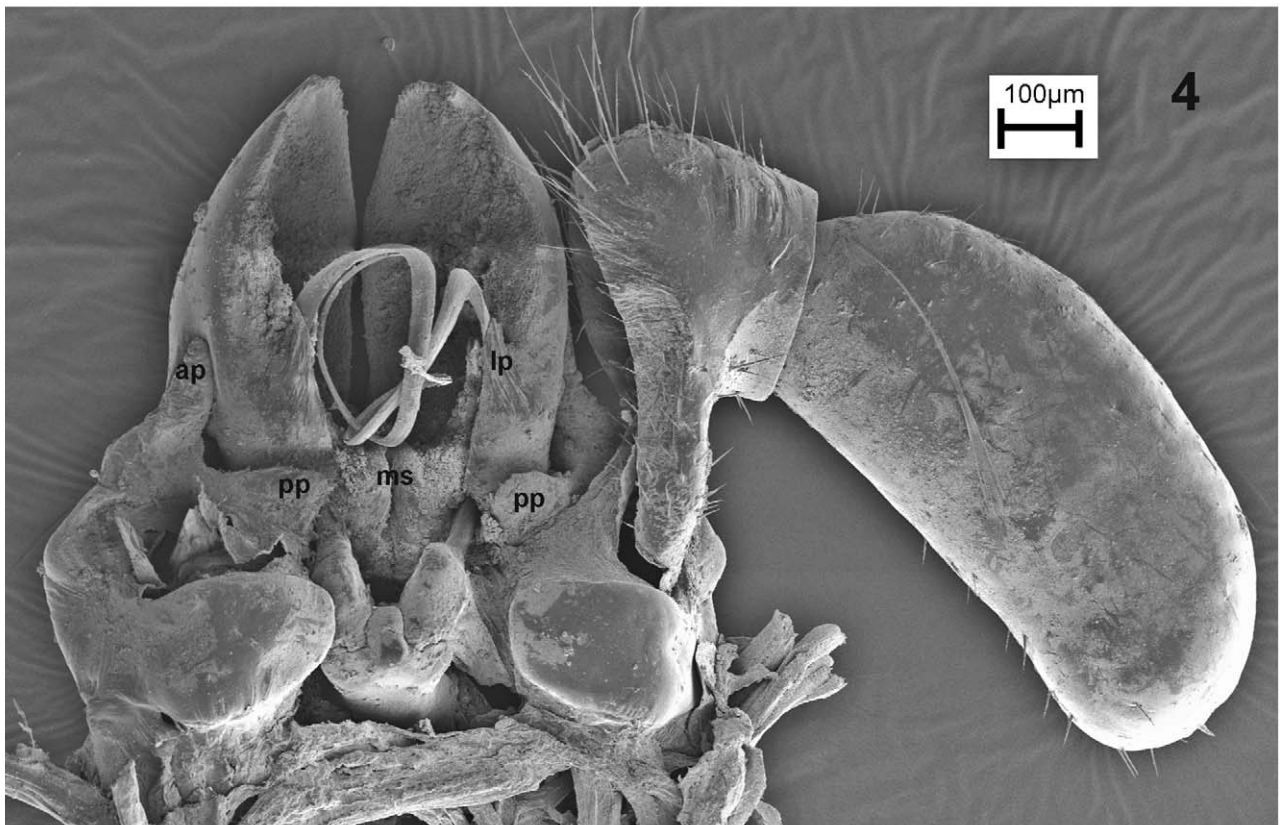
Material examined. *Holotype*: male (IBSS), Mongolia, Altai, Bayan-Ulegeyskii Aimak, Tsengel Somon, 2100–2300 m a.s.l., *Larix* forest, 15 July 2010, leg. K. Ulykpan and B. Bayartogtokh; *Paratypes*: 3 males, 3 juveniles (IBSS), same locality as in holotype, July 2010; 2 males, 1 female (IBSS), together with holotype, 15 July 2010; 3 males, 1 female (ZMUM), 1 female (IBSS), same locality as in holotype, 19 July 2010; 2 males, 1 female, 4 juveniles (IBSS), 1 male, 1 female (NUM), same locality as in holotype, 20 July 2010; 9 males, 2 females, 1 fragment (IBSS), 1 female (PU), same locality as in holotype, 22 July 2010; 6 males, 1 female (IBSS), same locality as in holotype, 23 July 2010; 3 males (PU), same locality as in holotype, 30 July 2010; all leg. K. Ulykpan and B. Bayartogtokh.

Diagnosis. Differs from congeners mainly by the long, twisted anterior gonopod telopodites, short anterior angiocoxal branches and the shape of the posterior gonopod colpocoxite and shallow cup-shaped structure into which both mesal sheath processes merge.

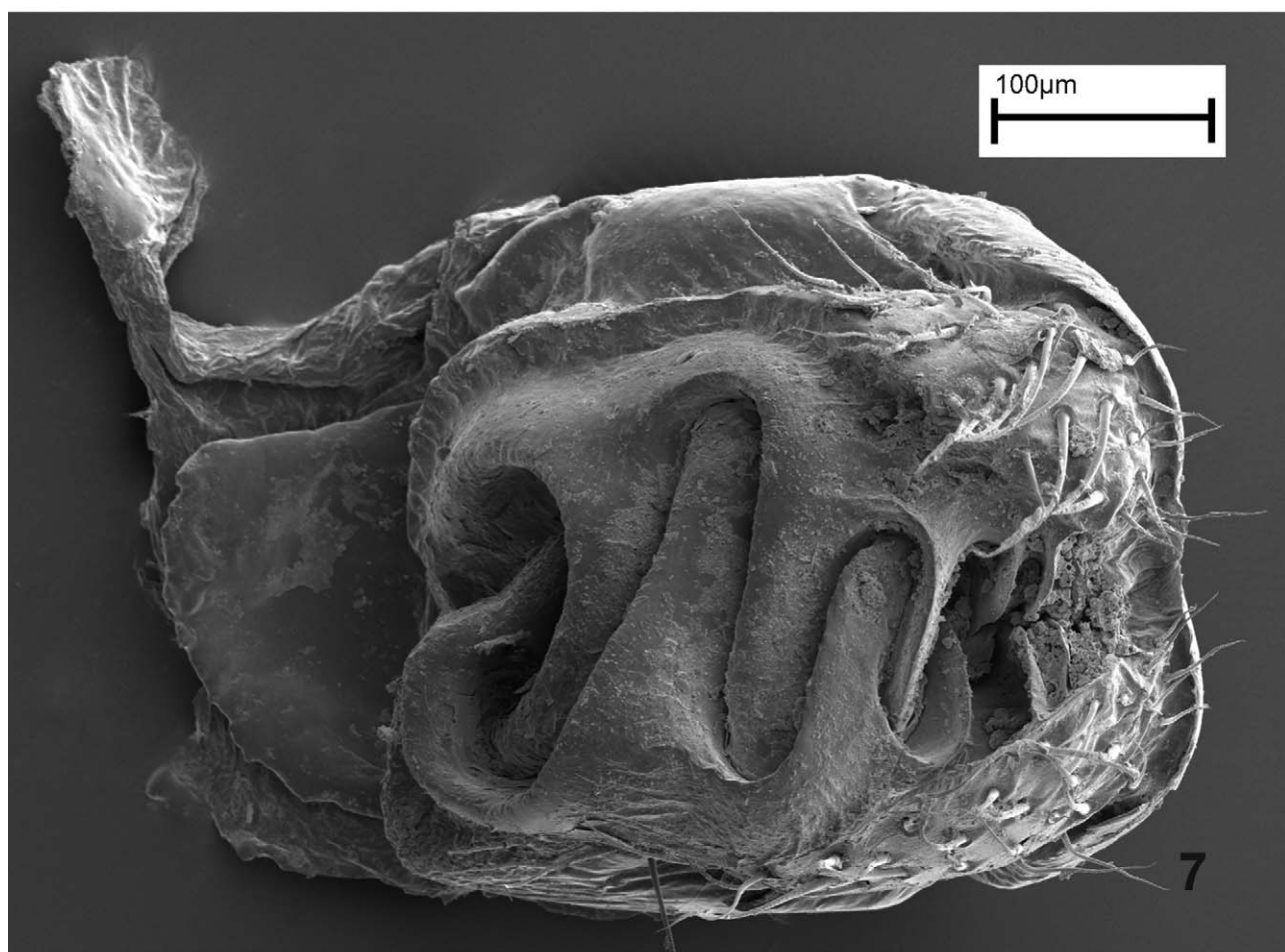
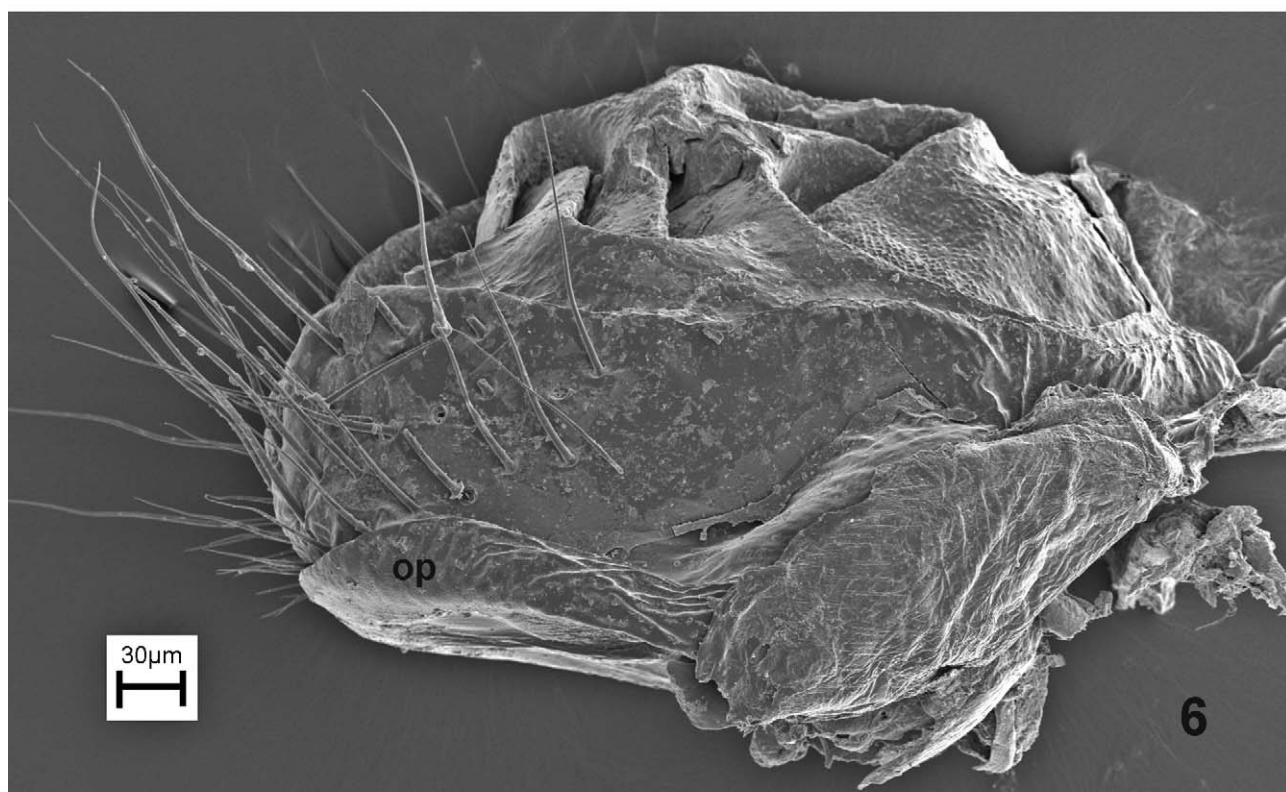
The new species seems to be particularly closely related to *Shearia rybalovi* Mikhailjova, 2000 from Russia, Siberia, Krasnoyarsk Province, but differs by longer twisted telopodites of anterior gonopods, narrower posterior gonopod colpocoxites (especially in their distal parts), smaller excavation in distal part of each colpocoxite, narrower anterior angiocoxal processes of posterior gonopods and shorter branches of the anterior angiocoxal processes.



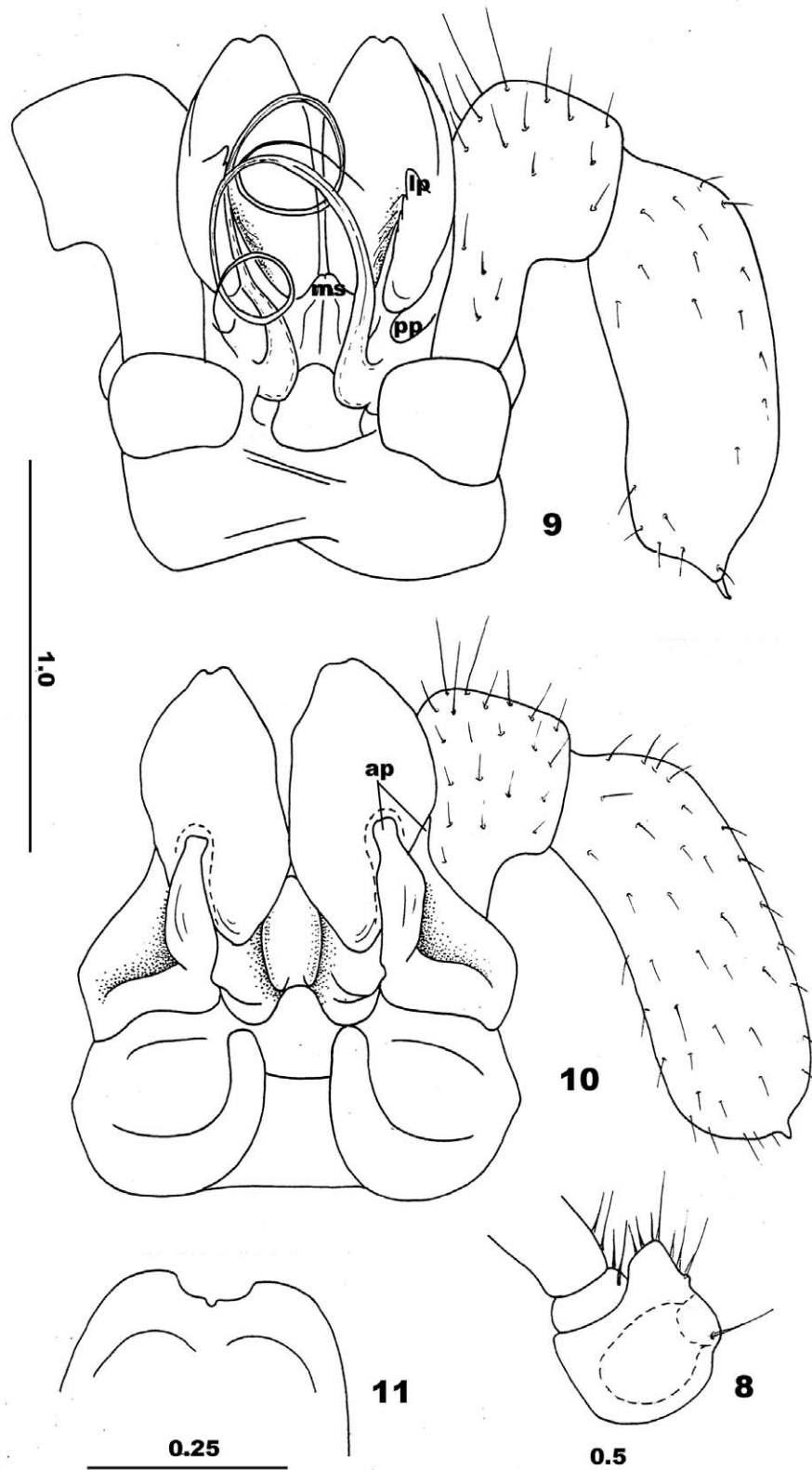
FIGURES 1–3. *Shearia longa* sp. nov., male paratype. 1, distal part of leg 10; 2, leg pair 10, front view; 3, leg pair 11, front view.



FIGURES 4–5. *Shearia longa* sp. nov., male paratype. 4, gonopods, caudal view; 5, gonopods, front view; **ms**, mesal sheath processes of posterior gonopod colpocoxites; **lp**, lateral sheath process of posterior gonopod colpocoxite; **pp**, posterior process of posterior gonopod angiocoxite; **ap**, anterior process of posterior gonopod angiocoxite.



FIGURES 6–7. *Shearia longa* **sp. nov.**, female paratypes. 6, right vulva, lateral view; 7, right vulva, ventral view; **op**, operculum.



FIGURES 8–11. *Shearia longa* sp. nov., male paratypes (8–10), female paratype (11). 8, coxa 10, caudal view; 9, gonopods, caudal view; 10, gonopods, front view; 11, apical margin of vulva operculum; **ms**, mesal sheath processes of posterior gonopod colpocoxites; **lp**, lateral sheath process of posterior gonopod colpocoxite; **pp**, posterior process of posterior gonopod angiocoxite; **ap**, anterior process of posterior gonopod angiocoxite. Scales in mm.

Description. Male. Length 14–16 mm, width with paraterga 1.9–2.0 mm. Coloration in alcohol brown-tan, legs weakly marbled, ocellaria black.

Body with 32 segments. Anterior part of head covered with sparse, relatively long and short setae. Each eye patch composed of at least 25 ocelli. Collum semi-circular. Body width gradually increasing until somite 7, body parallel-sided on somites 8–23(24), thereafter gradually tapering. Paraterga beginning on somite 2, well developed on somites 4(5)–27, onward missing. Numerous macrochaetae broken off, remaining ones relatively long, pointed apically.

Leg pairs 3–7 enlarged. Legs of anterior body part (including leg pairs 10 and 11) with a small group of funnel-shaped tarsal papillae apically near claw. Tarsal papillae gradually growing reduced towards posterior body end; at least midbody and hindmost legs devoid of any tarsal papillae. Claw of legs 5–7 at base without dorsal additional claws, but with a long setoid filament ventrally. Claw of legs 10 (Fig. 1) and 11 as well as following midbody legs at base with two small additional claws dorsally and a long setoid filament ventrally (to see two additional claws, it is necessary to look above; if you look at it sideways, only one such claw can be seen). However, claws of hindmost legs at base without dorsal additional claws; ventral filament either present or absent.

Legs 10 and 11 with coxal glands. Coxa 10 with a caudoventral subconical setose process (Figs 2, 8). Coxa 11 normal, without process (Fig. 3).

Anterior gonopod telopodite 1-segmented, flagelliform, ribbon-shaped with a longitudinal furrow, very long, its middle part positioned inside colpocoxite sheaths with elevated edges, its distal part twisted (Figs 4, 9). Telopodite base and distal part of coxosternum attached to adjacent mesal portion of posterior gonopod. Posterior gonopod colpocoxites fused basally, each with a small excavation in distal part. Mesal sheath processes closely approximated medially into a single cup-shaped structure (**ms**). Lateral sheath process (**lp**) as a narrow plate. Angiocoxite with a globule in posterior view. Posterior angiocoxal process (**pp**) small plate-shaped. Angiocoxite depressed centrally in anterior view (Figs 5, 10), supplied with two relatively short branches (**ap**). Outer branch somewhat shifted onto lateral face of colpocoxite. Posterior gonopod telopodites 2-segmented, setose; femur relatively long, its apex can be supplied with a claw vestige.

Female. Length 14–15(16) mm, width with paraterga 1.9–2.0 mm. Body with 32 segments. Each eye patch composed of at least 25 ocelli. Unlike males claws of hindmost legs at base with two small additional claws dorsally and a long setoid filament ventrally. Other nonsexual characters as in male. Vulvae small, subglobular (Figs 6, 7). Bursa setose. Groove spirally twisted. Operculum (**op**) devoid of setae, with rounded bilobate apical margin (Figs 6, 11).

Name. The specific epithet refers to the very long telopodites of anterior gonopods.

Ancestreuma longibrachiatum (Shear, 1990)

Diplomaragna longibrachiata Shear, 1990: 15–16, 14: figs 9–12.

non Diplomaragna longibrachiata — Mikhaljova 1993: 25.

Ancestreuma longibrachiatum — Mikhaljova 2000: 155–156; 2002: 203–204, 205: figs 20–34; 2004: 110–113, 111: figs 235–253, 112: map 15; Mikhaljova & Golovatch 2001: 109.

Remarks. This species, originally described in *Diplomaragna* (Shear 1990), has since been transferred to the restored *Ancestreuma* (Mikhaljova 2000). Hitherto the species is known from Russia (Siberia: Krasnoyarsk Province, Irkutsk area, Republic of Tyva) and Mongolia (Khubsugul Lake, River Ongolich). The record in Evenkia (Mikhaljova 1993) actually refers to *Ancestreuma ryvkini* (Shear, 1990). This conclusion was confirmed by the re-examination of a sample from the locality being kept at IBSS (1 male, Russia, Krasnoyarsk Province, Evenkia, 140 km upstream of Velmo River, 10.VIII.1990, leg. A.B. Ryvkin). The erroneous information about the record of this species in Evenkia (Mikhaljova 1993) was accepted in subsequent publications (Mikhaljova 2000; 2002; 2004).

Ancestreuma ryvkini (Shear, 1990)

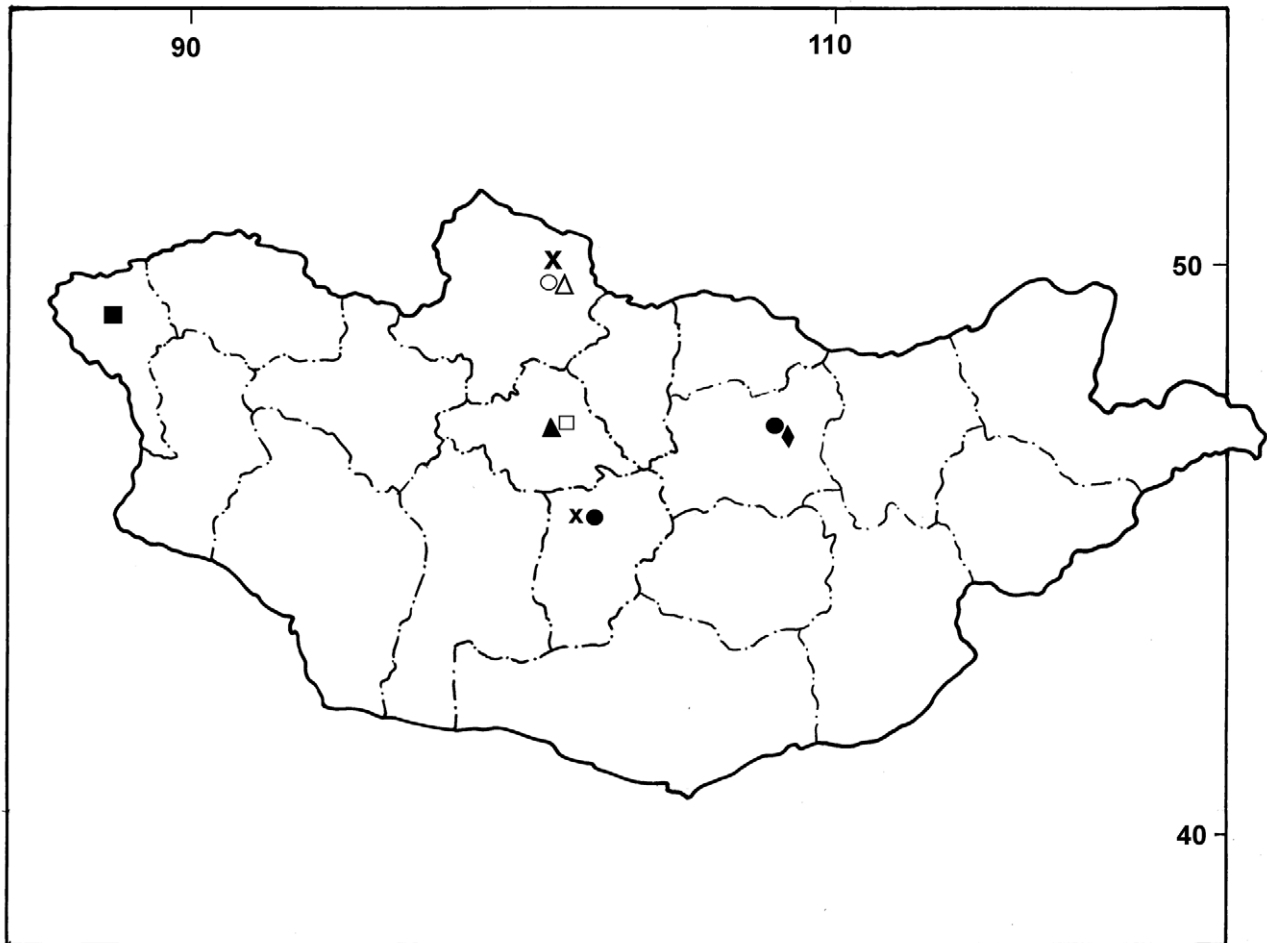
Diplomaragna ryvkini Shear, 1990: 15, 14: figs 6–8.

Diplomaragna ryvkini — Mikhaljova 1993: 25.

Diplomaragna longibrachiata — Mikhaljova 1993: 25.

Ancestreuma ryvkini — Mikhaljova 2000: 156; 2002: 204; Mikhaljova & Golovatch 2001: 109.

Remarks. Originally described in *Diplomaragna* (Shear 1990), this species has since been transferred to the restored *Ancestreuma* (Mikhaljova 2000). The species is known from different regions of Siberia (Buryatia, Irkutsk Area, Republic of Tyva, Republic of Sakha (=Yakutia), Krasnoyarsk Province) as well as Mongolia (Khubsugul Lake, River Ongolich).



MAP 1. Distribution of Diplopoda species in Mongolia. Borderlines show borders between the aimaks. Filled diamond: *Angarozonium amurense*, filled square: *Shearia longa* **sp. nov.**, open square: *Asiatyla communicantis* (Golovatch, 1977), filled triangle: *Ancestreuma principale* Golovatch, 1977, open triangle: *Ancestreuma longibrachiatum* (Shear, 1990), filled circle: *Asiatyla ulykpani* (Shear, 1990), open circle: *Ancestreuma ryvkini* (Shear, 1990), cross: *Ancestreuma sardyk* (Shear, 1990).

Ancestreuma sardyk (Shear, 1990)

Diplomaragna sardyk Shear, 1990: 13–15, 14: figs 2–5.

Ancestreuma sardyk — Mikhaljova 2000: 156.

Remarks. Originally described in *Diplomaragna* (Shear 1990), this species has since been transferred to the restored *Ancestreuma* (Mikhaljova 2000). The species is only known from Mongolia (Khubsugul Aimak: Munkhu-Sardyk Mountains; Uburkhangai Aimak: Ulaantsugalan Waterfalls).

***Ancestreuma principale* Golovatch, 1977**

Ancestreuma principalis (sic!) Golovatch, 1977: 715–717, 716–717: figs 1–2.

Diplomaragna principalis — Shear 1990: 16–17, 17: fig. 13.

Ancestreuma principale — Mikhaljova 2000: 155: figs 1–4.

Remarks. This species, originally described in *Ancestreuma* (Golovatch 1977), has since been transferred first to *Diplomaragna* (Shear 1990) and then to the restored *Ancestreuma* (Mikhaljova 2000). The species is only known from Mongolia (Ara-Khangai Aimak: Tevshruulekh Somon).

***Asiatyla ulykpani* (Shear, 1990)**

Diplomaragna ulykpani Shear, 1990: 16–18, 17: figs 14–17.

Asiatyla ulykpani — Mikhaljova 2000: 159.

Remarks. Originally described in *Diplomaragna* (Shear 1990), this species has since been transferred to *Asiatyla* (Mikhaljova 2000). The species is only known from Mongolia (Uburkhangai Aimak: Bat-Ulziy Somon; Tuve Aimak: UlaanBaatar).

***Asiatyla communicantis* (Golovatch, 1977)**

Ancestreuma communicantis Golovatch, 1977: 717–719, 718: fig. 3.

Diplomaragna communicantis — Shear 1990: 18, 17: figs 18–19.

Asiatyla communicantis — Mikhaljova 2000: 159; 2004: 114–115, 114: figs 254–262; Mikhaljova & Golovatch 2001: 109.

Remarks. This species, originally described in *Ancestreuma* from Mongolia (Golovatch 1977), has since been transferred first to *Diplomaragna* (Shear 1990) and then to *Asiatyla* (Mikhaljova 2000). The species is known from Mongolia, its *terra typica* (Ara-Khangai Aimak: Tevshruulekh Somon) and Russia (Siberia: Irkutsk Area) (Mikhaljova & Golovatch 2001). The Siberian record of the species requires confirmation.

Conclusion

The millipede fauna of Mongolia is still very poorly studied. At the moment 8 species (including the new species described above) from 4 genera, 2 families and 2 orders (Polyzoniida and Chordeumatida) are known from this country. The order Polyzoniida is represented by only one species, *Angarozonium amurense* from family Polyzoniidae. This species is widespread in the Asian part of Russia, including one of the northernmost records of Diplopoda in the Holarctic, being also known from north-eastern China and northern Mongolia. The order Chordeumatida is represented by the single Palaearctic family Diplomaragnidae, with 3 genera and 7 species. Genus *Shearia* is recorded in the fauna of Mongolia for the first time. In addition, it is known from Russia (Siberia: Sayan and Altai Mts). The evolutionarily most primitive diplomaragnid genera *Ancestreuma* and *Asiatyla* occur in East Siberia (Russia) and Mongolia.

At the moment, the rate of endemism of Diplopoda in Mongolia amounts to 50% at the species level, but there are no endemic genera, families or orders there. The distribution of known species is given in Map 1. It expresses the degree of study of Mongolian Diplopoda. One has only to note that most of the identified species were found in the highland *Larix* forests. Some of them are also recorded under the moss and logs around a waterfall. *A. ulykpani* has also been found in a hothouse (Shear 1990). The millipede fauna of Mongolia requires comprehensive investigation.

Key to Diplopoda orders, families, genera and species occurring in Mongolia (based only on males)

- 1(2) Head very small, elongated anteriorly into a rostrum. Body strongly flattened dorsoventrally, without paraterga and macrochaetae. order Polyzoziida, family Polyzoziidae, genus *Angarozonium*, *A. amurense*
- 2(1) Head larger, more or less ovoid, devoid of a rostrum. Body more or less cylindrical, with paraterga and 3+3 macrochaetae order Chordeumatida, family Diplomaragnidae
- 3(4) Anterior gonopod telopodite flagelliform, very long, twisted genus *Shearia*, *S. longa* **sp. nov.**
- 4(3) Anterior gonopods telopodites not flagelliform, shorter, not twisted 5
- 5(12) Telopodites of anterior gonopods broad or thick all along their extent. *Ancestreuma*
- 6(7) Posterior angiocoxal process present *A. ryvkini*
- 7(6) Posterior angiocoxal process absent 8
- 8(9) Lateral process of posterior gonopod colpocoxite present. It very long, subspatulate *A. longibrachiatum*
- 9(8) Lateral process of posterior gonopod colpocoxite absent 10
- 10(11) Body length about 10 mm. Tip of anterior gonopod telopodite not plumose *A. sardyk*
- 11(10) Body length about 19 mm. Tip of anterior gonopod telopodite plumose *A. principale*
- 12(5) Telopodites of anterior gonopods broadened only at base, distal part acuminate. genus *Asiatyla*
- 13(14) Colpocoxite lateral sheath process is free from the colpocoxite for its distal half *A. ulykpani*
- 14(13) Colpocoxite lateral sheath process is not free from the colpocoxite for its distal half *A. communicantis*

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