



A poorly known species and new records of Plecoptera from the Eastern Tien Shan, Xinjiang Uygur Autonomous Region, China

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Abstract

Nemoura lepnevae Zhiltzova, 1971, *Amphinemura mirabilis turkestanica* Zhiltzova, 1978, *Capnia* s.l. *longicauda* Zhiltzova, 1969 and *Mesoperlina pecirkai* Klapálek, 1921 are reported for the stonefly fauna of China for the first time. The species were collected in the Bogdo-Ula and Karlyktag Ranges of the Eastern Tien Shan Mountains, the Xinjiang Uygur Autonomous Region. In addition, a detailed redescription of *Filchneria wusuensis* Chen, 2019 including new illustrations is provided.

Key words: *Amphinemura*, *Nemoura*, *Capnia* s. l. *longicauda*, *Filchneria*, *Mesoperlina*, Eastern Tien Shan, China

Introduction

In July 2017, specimens were collected by Dmitry M. Palatov (D.M.P) from a glacier in the Xinjiang Uygur Autonomous Region of China as well as mountain streams at an altitude of 2,356–3,500 m above sea level in the Bogdo-Ula and Karlyktag Ranges belonging to the Eastern Tien Shan Mountain System. The specimens consisted of *Nemoura lepnevae* Zhiltzova, 1971, *Amphinemura mirabilis turkestanica* Zhiltzova, 1978, *Capnia* s.l. *longicauda* Zhiltzova, 1969, and *Mesoperlina pecirkai* Klapálek, 1921, all new country records for China. These species were previously reported for the Central and Western Tan Shan, as well as Pamir, Hindu Kush, the Eastern Himalayas, and Karakoram (Zhiltzova 1969, 1970, 1971, 1978; Zwick & Sivec 1980). Our findings significantly expand the distribution of these species to the east. We provide supplementary descriptions for previously unknown external and internal structures for both sexes of *N. lepnevae*, *A. mirabilis turkestanica* and *Capnia* s.l. *longicauda*. We also provide a novel redescription and illustrations of *Filchneria wusuensis*, recently described from very few teneral specimens. The argument for *F. wusuensis* redescription was the need for a more precise and detailed description of its main diagnostic features.

Materials and methods

All adults were collected by sweeping or handpicking from the stones and ice and preserved in 75% ethanol. The abdomens of males were removed and soaked in 10% NaOH overnight and rinsed with distilled water. Illustrations were produced using digital cameras (Nikon Coolpix 995 and ToupView 3.7), the stereomicroscope Olympus SZX16, digital camera Olympus DP74, and stacked using Helicon Focus software. The final illustrations were post-processed for contrast and brightness using Adobe® Photoshop® software.

Eggs were placed in 95% ethanol, cleaned in an ultrasonic cleaner; air dried, and fixed on specimen stubs with double-sided tape. Eggs were carbon coated and were investigated in the Center of Collective Use of FSC Biodiversity FEB RAS, using a Zeiss Merlin SEM. Specimens stored in the Federal Scientific Center of the East Asia Ter-

restrial Biodiversity Far Eastern Branch, Russian Academy of Sciences, Vladivostok. Morphological terminology follows that of Baumann (1975), Zwick (1997), and Murányi et al. (2014).

Results and discussion

Amphinemura mirabilis turkestanica Zhiltzova, 1978

Figs. 1–5

Zhiltzova, 1978:39, plate 1 (figs. 5–8, 10, 12), plate 2 (2); Zhiltzova, 2003:163, figs. 211–215; Teslenko & Zhiltzova, 2009: 116, figs. 700–703.

Material examined. China, the Xinjiang Uygur Autonomous Region, Eastern Tien Shan: 1 male (damaged), Bogdo-Ula Range, Urumqi city, Dabancheng District. Zienzan stream in the upper reaches of the confluence of the Malu River, an altitude 2,443 m above sea level. 09.VII.2017, N 43°49.738', E 88°10.351', leg. D.M.P.



FIGURES 1–5. *Amphinemura mirabilis turkestanica*, male, cleared. 1. Projection of tergum 9, dorsal. 2. Hypoproct and vesicle, sternum 9. 3. Middle paraproct lobe, ventral. 4. Epiproct, dorsal. 5. Epiproct, ventral.

Supplementary description. Only a damaged *A. mirabilis turkestanica* male was collected, but all structures are consistent with the original description (Zhiltzova 1978). Tergum 9 modified posteromedially forming a relatively short, V-shaped outgrowth (Fig. 1). Hypoproct elongate and broad, lateral margins parallel at base, narrowed distally to a short tongue-shaped extension between the inner lobes of the paraprocts, posteriorly with thin transverse wrinkles (Fig. 2). Vesicle large, widest distally with rounded angles (Fig. 2). Median paraproct lobe resembles inverted Arabic numeral two, and is large, elongate with rounded darkly sclerotized posterior angle, medial edge

covered with black hairs (Fig. 3). The distal portion of the median lobe recurves upward then downward, apex bears two stout spines. Outer paraproct lobe short, strongly sclerotized with pointed tip (Fig. 3). Epiproct bilaterally symmetrical, membranous dorsally except for the base, which is darkly sclerotized and subtriangular, broadest basally, narrowed to rounded apex, and covered with tiny scales (Fig. 4). The paired dorsal sclerite is triangular, large, and broad at the base, extending dorsolaterally as paired long darkly sclerotized lateral arms that narrow gradually toward the apex, with the apical portion of the lateral arms rounded, directed medially, slightly extending above the ventral sclerite and bearing small, sclerotized scales (Fig. 4). The lateral arms ventrally support a pair of large membranous folds covered inside with stout scales close to the bases of the lateral arms and lateral edges of the ventral sclerite (Fig. 5). The ventral sclerite is lanceolate, heavily sclerotized, broad basally, narrowed at apex. In the dorsal view, its lateral edges roll up to the dorsal side and are covered with small, stout spines. In the ventral view, the ventral sclerite forms a median ridge that is densely covered with heavily sclerotized small stout spines (Fig. 5). The apical portion of the ventral sclerite is bifurcated and composed of two thin sclerotized tips covered by tiny sclerotized scales.

Distribution and ecology. *Amphinemura mirabilis turkestanica* is widespread in the mountains of Central Asia, from the Tien Shan to the Kopetdag and Pamir. It is one of the most common and numerous subspecies in the Tien Shan, and in the Pamir it may be the only stonefly inhabiting streams and rivers at altitudes of 1,000–4,200 m above sea level. *A. mirabilis turkestanica* was found at an altitude of 2,443 m above sea level in the Zeinzan mountain stream with substrates consisting of large boulders and the riparian area being of coniferous forest (Fig. 36).

Note. *A. mirabilis turkestanica* was established as a Central Asian subspecies of the nominative form, *A. mirabilis* (Martynov, 1928), widespread in the Caucasus, Himalaya, and Iranian Plateau. Perhaps, our finding is a novel record for the stonefly fauna of China. Prior to our discovery, only *A. mirabilis* was known without subspecies identification from the Xinjiang Uygur Autonomous Region (Yang et al. 2015, Yang & Li 2018). According to D. Murányi (personal communication), *A. mirabilis* (Yang & Li 2018, fig. 164) should be considered as the Central Asian subspecies *A. mirabilis turkestanica*. Further research may confirm or refute these assumptions.

Nemoura lepnevae Zhiltzova, 1971

Figs. 6–7

Zhiltzova, 1971:358, figs. 25–28; Grizay, Zhiltzova, 1973:25; Zwick, 1973:338; Zhiltzova, 1984:714; Zhiltzova, 2003:284, figs. 470–472; Teslenko, Zhiltzova, 2009: 158, figs. 925–927.

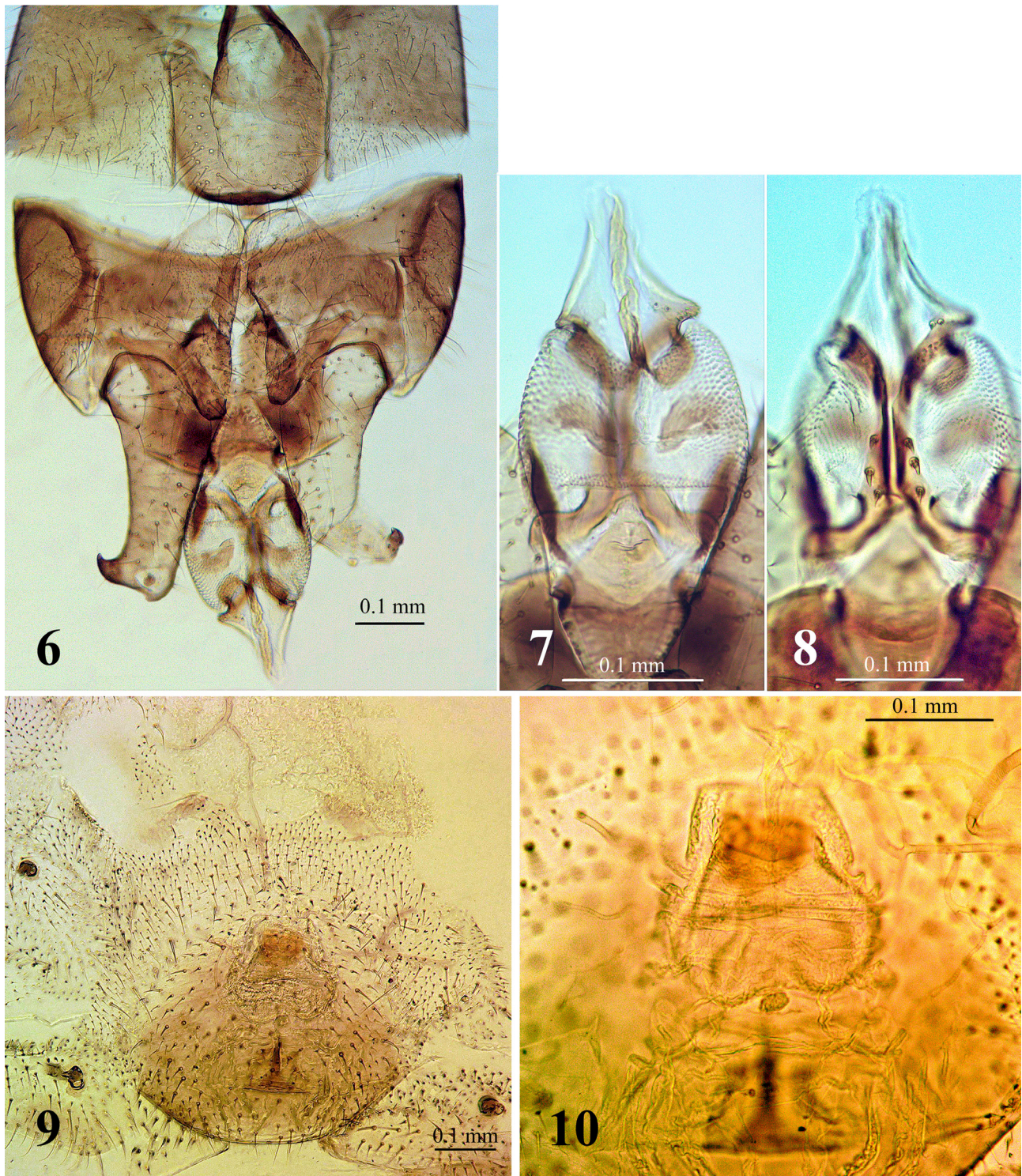
Material examined. China, the Xinjiang Uygur Autonomous Region, Eastern Tien Shan: 1 male, 1 female, 1 nymph, Bogdo-Ula Range, Urumqi city, Dabancheng District, Sangecha Stream, 35 km N of Dabancheng, an altitude 2,356 m above sea level, 13.VII.2017, N 43°40.583', E 88°17.006', leg. D.M.P.; 2 males, Karlyktag Range, Hami city, Ayar-Gol Stream, 60 km NE of Hami, an altitude 2,426 m above sea level, 21.VII.2017, N 43°12.225', E 94°07.128', leg. D.M.P.

Supplementary description. Male. Epiproct oval (Fig. 6), distally elongate, rapidly narrowing to the narrow apex, and slightly constricted in distal third (Fig. 7). Basal sclerites are triangular. Lateral arms of dorsal sclerite finger-like, half-rounded with a truncated tip, directed obliquely toward middle and slightly sclerotized, whereas the pair of dorsal folds are shallow and covered with comb-like scales that are larger laterally (Figs. 6, 7). Ventral sclerite lanceolate at the base, bearing three to four pairs of strong ventral spines. Ventral sclerite apically developed into a pair of long, heavy sclerotized straps extending upwards and laterally. In the dorsal view, the ventral sclerite appears as a pair of oval and oblique prolonged sclerites (resembling a Peter Pan collar) or moveable prongs forming a ring, interrupted dorsomedially, directed downward that is visible through the lateral folds of the dorsal sclerite (Fig. 8). Outer angles of ring rectangular and rounded (Figs. 7, 8).

There are moveable prongs or a ring surrounding the apical sclerite and an arrow-shaped membranous projection of the ventral sclerite, extending forward (Figs. 7, 8). Each apical sclerite is elongated anteriorly, with membranous folds contacting along the inner edge. The base extends beyond the dorsal folds of dorsal sclerite with paired triangular lobes at the basolateral edges (Figs. 7, 8). Each lobe is delicately sclerotized and bears a few small spines directed outward at the corner.

Female. The pregenital plate has a shallowly rounded posterior margin (Fig. 9). In cleared slide-mounted genitalia, the subgenital plate of sternum 8 bears a dark, funnel-shaped sclerite (Figs. 9, 10). Paragenital plate lobes

are difficult to distinguish, being hidden beneath the pregenital plate (Fig. 9). The vaginal pouch shell-shaped, the posterior edge concave, and the anterior edge is straight (Figs. 9, 10). The pouch connects with the oviduct in the middle of the anterior edge. Inside the pouch there is a darker sclerite anteriorly and a pair of round, roughened pockets that occupy the posterior half of the pouch (Fig. 10). At least three transverse prolonged folds are visible laterally (Fig. 10).



FIGURES 6–10. *Nemoura lepnevae*, cleared. 6. Abdominal tip, male, ventral. 7. Epiproct, dorsal. 8. Epiproct, ventral. 9. Female subgenital plate, ventral. 10. Female vaginal complex.

Note. The Uygur specimens of *N. lepnevae* agree well with the original description and detailed illustrations of the external genital structures (Zhiltzova 1971, 2003). There are differences in the shapes of some of the epiproct

sclerites, especially the apical sclerites. The apical sclerites basally bear paired triangular lobes that appear when the specimen is mounted (Figs. 7, 8); at rest triangular lobes are folded and touch each other; therefore, the basal part of the apical sclerite has a smooth outer edge (as Zhiltzova 2003, fig. 472).

Distribution and ecology. *Nemoura lepnevae* was originally described from a stream on the north slope of Dolon Pass (altitude of 3,030 m above sea level) located between the Songköl Too and Bayduluu Ranges in Central Tien Shan, Naryn Region, Kyrgyzstan (Zhiltzova 1971). The Naryn Region borders Xinjiang Uygur Autonomous Region of China in the southeast. Records of *N. lepnevae* in the streams in Bogdo-Ula and Karlyktag Ranges significantly expand our understanding of the distribution of this species to the east. This abundant and widespread species inhabits mountain streams of the western, central, and northern Tien Shan Ranges and Pamir Mountains at altitudes of 800 to 3,300 m and has an extended period of emergence from June to August (Zhiltzova 2003). This is the first report of *N. lepnevae* in Eastern Tien Shan and the stonefly fauna of China. Specimens were collected along with *F. wusuensis* and *M. pecirkai* in the forest Sangecha stream with boulders at the bottom, and in the Ayar-Gol stream, whose bank is covered with coniferous trees at an altitude of 2,356–2,426 m above sea level (Figs. 35, 37).

***Capnia* s.l. *longicauda* Zhiltzova, 1969**

Figs. 11–12

Zhiltzova, 1969:596, figs. 1–4; Zwick, 1973:374; Zwick & Sivec, 1980:72, figs. 7a, d; Zhiltzova, 2003:360, figs. 603–605; Teslenko & Zhiltzova, 2009: 203, figs. 1124–1126; Muranyi, Li & Yang, 2015:379.

Material examined. China, the Xinjiang Uygur Autonomous Region, Eastern Tien Shan: 9 males, 1 female, 3 exuviae, Bogdo-Ula Range, Urumqi city, Dabancheng District, Lake Sangecha, altitude 3,503 m above sea level, 12.VII.2017, N 43°48.228', E 88°16.339', leg. D.M.P.

Notes. This species was originally described from Aksu-Zhabagly Nature Reserve, Kazakhstan (Zhiltzova 1969). Zwick & Sivec (1980) provided a supplementary description from Himalayan specimens.

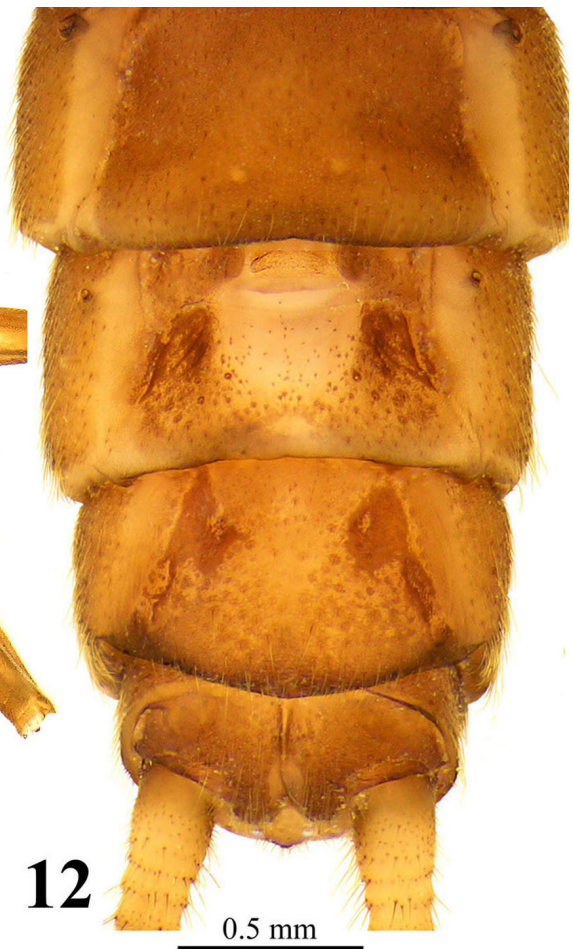
Male. Body is 6.8–9.3 mm in length, antenna length 8.6–10.4 mm, cerci length 8.2–9.7 mm (n=8). The wings are reduced, their length not exceeding 0.5 mm. Tergum 9 bears two spoon-shaped projections posteriorly; projections elongated, darkly sclerotized dorsally, with rounded margins, and divided with rectangular notch (Figs. 11–11b). Basal sclerite large, longitudinally elongated, slightly sclerotized (Fig. 11a). Main epiproct sclerite elongated, sharply curved basally, directed forward and upward, slightly widened in the middle of the length; apex rounded and open (Figs. 11–11b). Laterobasal sclerite fused with main epiproct sclerite, resembling a small, pigmented acute-angled protrusion (Figs. 11, 11a). Subgenital plate narrowed and rounded posteriorly (Fig. 11b). Paraprocts triangularly curved, wide basally and noticeably narrowed to the apices (Fig. 11b). Fusion plate fused to paraprocts in their basal half. Fusion plate relatively long, reaching basal portion of main epiproctal sclerite ventrally (Figs. 11–11b).

Female. Body length 11.7 mm, wings extend beyond the tip of the abdomen, fore wing length 11.6 mm, wingspan 24.9 mm. Sternum 8 unevenly pigmented, median, rounded pale spot flanked by a pair of dark brown patches laterally; posterior margin of sternum is straight (Fig. 12). Subgenital plate greatly shortened, occupying $\frac{1}{4}$ of the sternum 8 length. Subgenital plate is pale, with almost straight posterior margin. A pair of elongate-oval brown lateral sclerites fused with lateral edges and is directed to brown patches (Fig. 12). Genital opening broad, inner sclerite thin, longitudinal, weakly sclerotized, it is visible through the subgenital plate medially (Fig. 12).

Distribution and ecology. *Capnia* s.l. *longicauda* has the widest distribution among the Capniidae known in the Palaearctic and Oriental Realm (Muranyi et al. 2015). The species was reported in the Western and Central Tien Shan, the Eastern Himalayas, and Karakoram (Zwick, Sivec, 1980). The species occurs at altitudes of 2,000–5,150 m above sea level at the foot of glaciers and in glacial lakes, in the upper reaches of mountain streams and rivers. The emergence is extended from late May to late July. *Capnia* s.l. *longicauda* is recorded for the Eastern Tien Shan and stonefly fauna of China for the first time. This species was collected in alpine glacial Sangecha Lake, the Bogdo-Ula Range at an altitude 3,503 m above sea level. Sangecha Lake is fed by a melting glacier and lies in a glacial cirque that is 900 m long and 700 m wide (Figs. 33, 34). The rocky shores are formed by the moraine and talus. Even in July the Sangecha Lake is covered with ice. There is no vegetation on the shore line, with the exception of rare rosettes of alpine flowers (Figs. 33, 34).



11



12



11a



11b

FIGURES 11–12. *Capnia* s.l. *longicauda*. 11. Male, habitus. 11a. Male abdominal tip, dorso-caudal. 11b. Male abdominal tip, caudal. 12. Female, abdominal tip, ventral.

Filchneria wusuensis Chen, 2019

Figs. 13–30

Chen, 2019:512, figs. 1–7.

Material examined. China, the Xinjiang Uygur Autonomous Region, Eastern Tien Shan: 1 male, 1 female, 1 nymph, Bogdo-Ula Range, Urumqi city, Dabancheng District, Zienzan stream in the headwaters of the Malu River, an altitude 2,443 m above sea level, 09.VII.2017, N 43°49.738', E 88°10.351', leg. D.M.P.; 2 males, 1 female, Bogdo-Ula Range, Urumqi city, Dabancheng District, Sangecha Stream, 35 km N of Dabancheng, an altitude 2,356 m above sea level, 13.VII.2017, N 43°40.583', E 88°17.006', leg. D.M.P.; 6 males, 1 female, Karlyktag Range, Hami city, Ayar-Gol Stream, 60 km NE of Hami, an altitude 2,426 m above sea level, 21.VII.2017, N 43°12.225', E 94°07.128', leg. D.M.P.

Supplementary description. Adult habitus. The head is brown, with an indistinct M-line, tentorial callosities on the clypeus pale, a pair of narrow transverse, and yellow marks above the lateral ocelli and small black spots inside (Figs. 13, 23). The interocellar area has a large, tire-shaped yellow spot that widens anteriorly and is open posteriorly, an almost square, pale-brown spot is present anterior to the median ocellus and a vague M-line. The occipital area bears a transverse yellow band that extends along the epicranial suture (Figs. 13, 23). The submental gills are short. The pronotum is brown, with a large median yellow band that occasionally includes a thin brown stripe along the median pronotal line and two thin incomplete brown stripes laterally (Fig. 13). The lateral arms of the mesofurcasternum reach the posterior corners of the furcal pits, with dark beak-like spots at the inner edges of each furcal pit, a dark brown transverse suture occurs on the mesosternum that is unclear and incomplete antero-medially. The abdomen is covered with colorless clothing hairs (Figs. 13, 14), and segments 1–3 are divided by a pleural membrane laterally. The pleural folds on segment 4 are vague, and the other segments are undivided. The legs are yellow with brown bands (Fig. 13). Dorsally, the femur has a dark brown band that widens basally closer to the inner margin, while the outer margin is pale. The tibia has a dark brown band in the basal quarter (Fig. 13). The cerci are bicolored, each segment with a narrow yellow band basally and a wide brown band distally (Fig. 13). The color pattern of the female is similar to that of the male, with the exception that the interocellar spot is nearly closed posteriorly while the pronotal median band is narrower and widest posteriorly (Fig. 23).

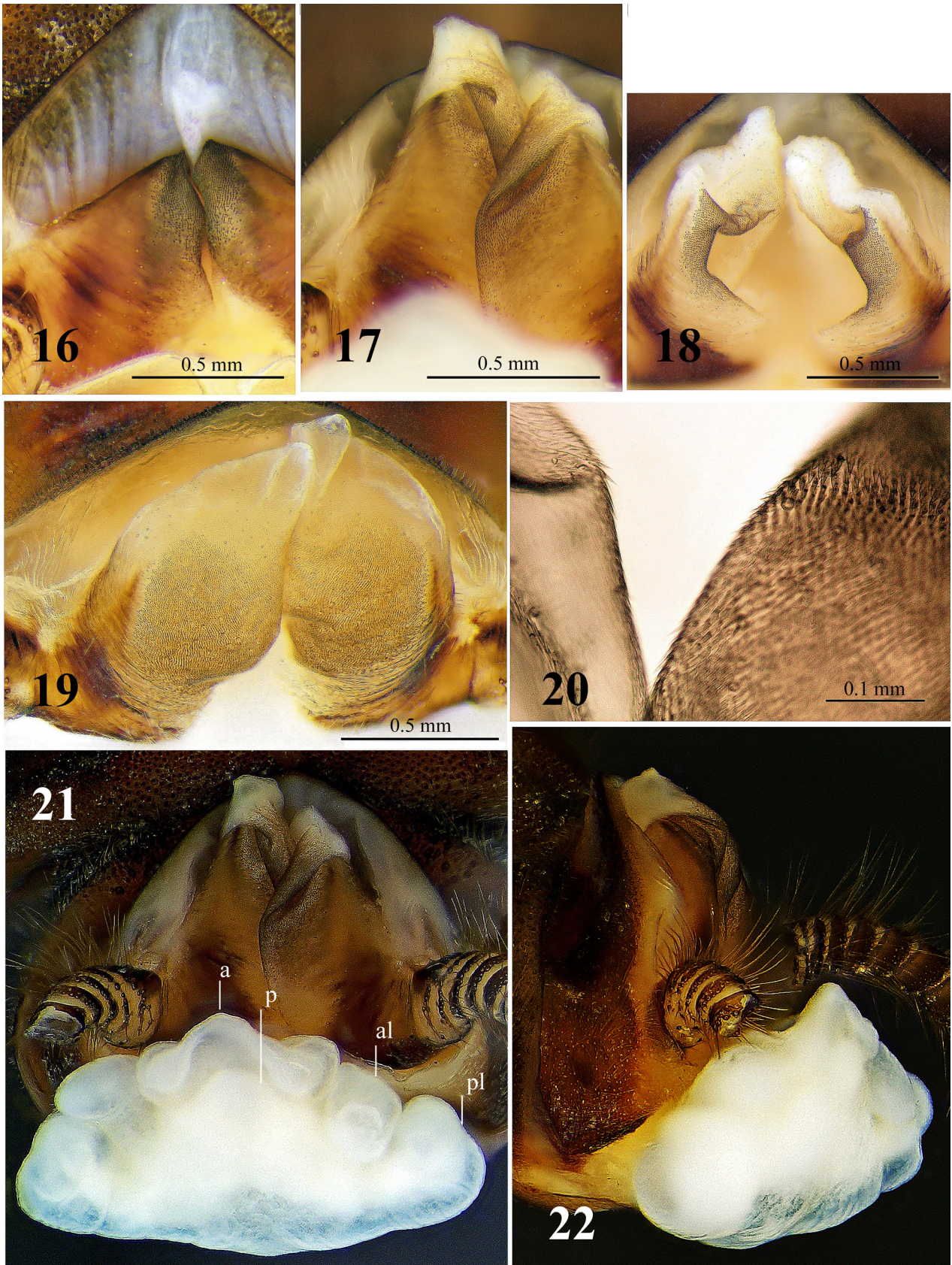
Male. The body is 15.2–19.7 mm in length (n=9). The male is brachypterous, wings not exceeding tergum 6 (Figs. 13, 14). Abdominal terga 6–8 are humped laterally; medial indistinct pale spots expand anteriorly and are divided by a longitudinal, dark brown median band (Fig. 14). Tergum 8 bears two submedial swellings densely covered by short sensilla basiconica and long colorless hairs posterolaterally. Tergum 9 has an anteromedial arrow-shaped membranous area that may be almost hidden under tergum 8 (Figs. 14, 15). Similar but smaller posteromedial swellings occur on tergum 9 and are covered by thick sensilla basiconica and colorless hairs posterolaterally (Fig. 15). The sensilla basiconica appear much less frequently than on tergum 8 and their bases are clearly outlined with pale brown pigments. In the lateral view, posterior margin of tergum 10 is strongly raised, obtusely angled, and directed forward and upward. In the dorsal view, tergum 10 is rounded posteriorly and is mostly pale with small round membranous marks anteromedially and a pair of diffuse paramedial brown spots (Figs. 15, 22). Short sensilla basiconica are distributed radially from the posterior margin to two-thirds of the tergite length in the middle (Fig. 15).

At rest, the paraprocts are triangular with convex dorsomedial edges (Fig. 16). The paraproct sclerite is triangular, wide, heavily sclerotized basally, and narrowed distally with a pointed tip that is occasionally truncated and slightly sclerotized (Figs. 14, 19). In the caudal view, the paraproct sclerite surrounds a gray oval paraproct lobe covered with dense, tiny, dark brown sensory spines and sparse fine sensory hairs (Figs. 16–20). The naturally everted eversible paraproct lobe (EPL) enlarges into a cylindrical membranous lobe with a small papilla atop, and is covered dorsally by sparse fine sensory hairs (Figs. 18, 19). In the caudal view, the EPL margin close to the base bears a small, rounded swelling directed inside that is covered with dense, tiny, dark brown sensory spines and sparse fine sensory hairs (Fig. 19). The naturally everted aedeagus is variable in shape, membranous, short and wide, and bears unpaired anterodorsal and posterodorsal lobes, and has two pairs of lateral lobes (Figs. 21, 22). The anterodorsal lobe looks like a low, wide, and round arch that emerges above the aedeagus with paired small round cuticular swellings laterally (Fig. 21). Each anterolateral lobe is smaller than the posterolateral lobe, with small, round, or papilla cuticular swellings at the apex (Fig. 21). Each posterolateral lobe is extended and rounded laterally, occasionally with round cuticular swellings at the apex directed upward. The posterodorsal lobe is wide at the base with a triangular top reaching the bases of the lateral cuticular swellings of the anterodorsal lobe (Fig. 21).

Female. The body is 23.5 mm in length, macropterous, and has a forewing length of 14.0 mm and a wingspan of 31.0 mm. The forewing is brownish, while the hind wing is paler (Figs. 25, 26). The venation includes an irregular net near the apex comprising three rows of cells. The forewing has three cross-veins between C and Sc and five apical veins between Sc and R_1 (Fig. 25). R_s bears three apical branches. There are seven apical veins between M and Cu_2 , and three anal veins. The hind wing has a large anal area, and A_2 , A_3 and A_5 are forked.

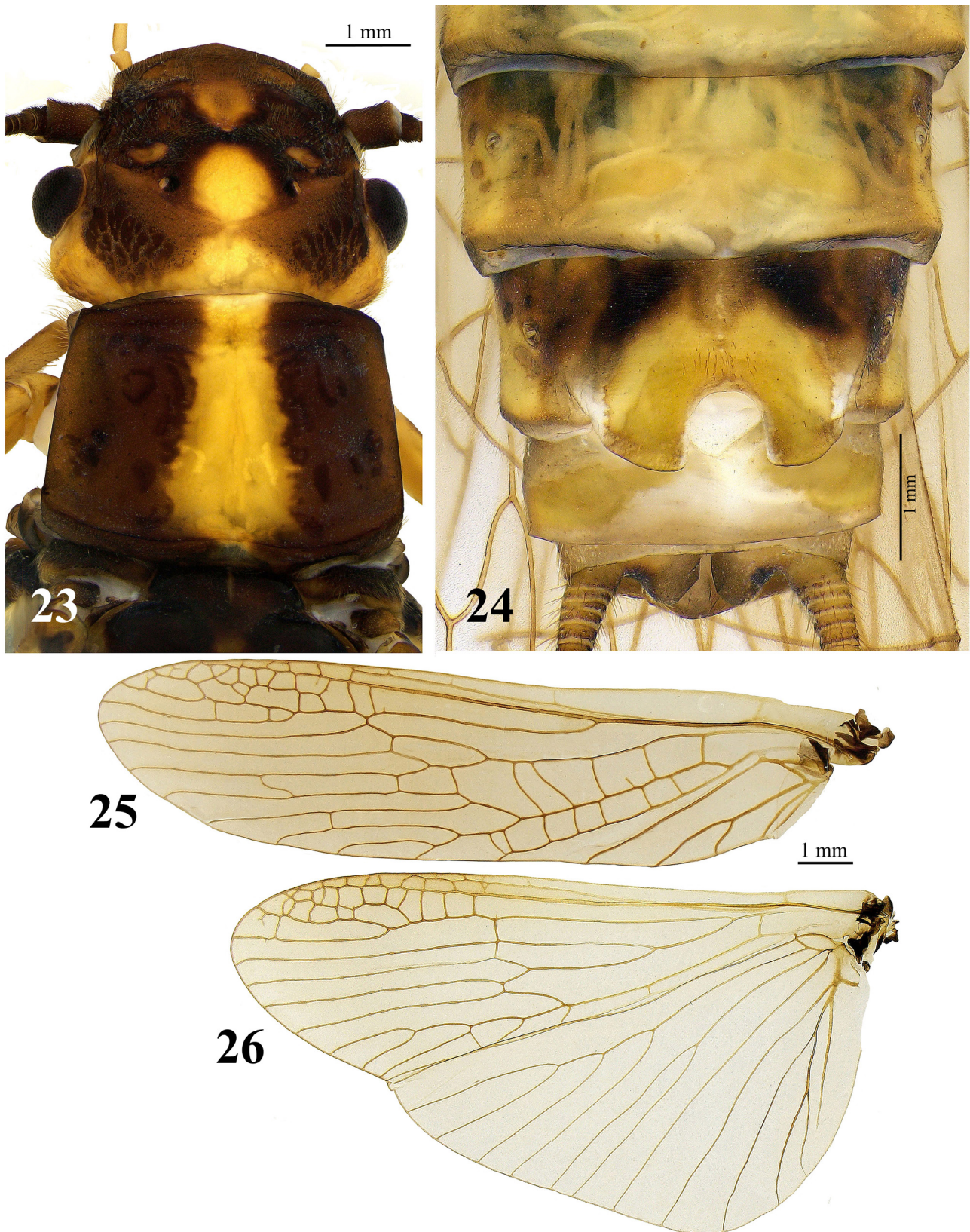


FIGURES 13–15. *Filchneria wusuensis*, male. 13. Habitus. 14. Abdomen, dorsal. 15. Tergum 9–10, dorsal.



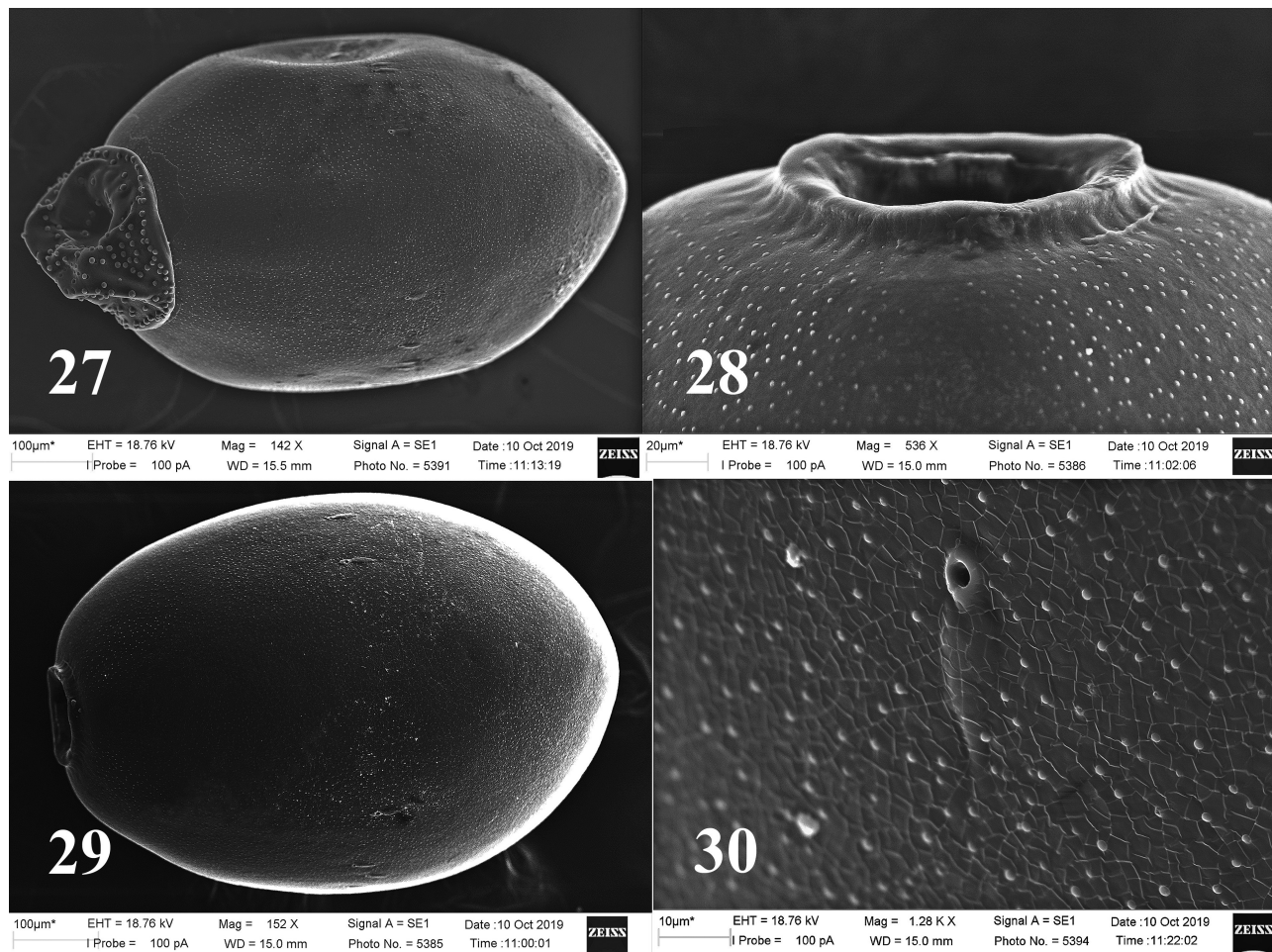
FIGURES 16–22. *Filchneria wusuensis*, male. 16. Paraprocts, not everted, caudal. 17–18. The eversible paraproct lobes, caudal. 19. Eversible paraproct lobes, naturally everted, caudal. 20. Sensory spines and hairs at the tip of the paraproct lobes, ventral. 21. Naturally everted paraproct lobes and aedeagus, caudal: a—anterodorsal lobe, p—posterodorsal lobe, al—anterolateral lobe, pl—posterolateral lobe. 22. Aedeagus, lateral.

Sternum 8 is brown in the anteromedian half, and a pair of oblique dark brown lateral sclerites surrounds a pale subgenital plate anterolaterally (Fig. 24). The subgenital plate is bilobed, large, extending almost half the length of sternum 9. The posterior margin has an U-shaped notch that separates two large lobes with almost straight inner angles. Sparse, tiny, dark setae form a field at the base of the U-shaped notch (Fig. 24). Sparse, tiny, dark setae form a field at the base of the U-shaped notch (Fig. 24).



FIGURES 23–26. *Filchneria wusuensis*, female. 23. Head and pronotum, dorsal. 24. Abdominal tip, ventral. 25. Forewing. 26. Hind wing.

Egg. This is large, rather circular than trilobate in cross-section (the last feature is typical for *Filchneria*) with dimensions of 715×475 μm. The longitudinal ridges are not specially marked (Figs. 27–29). The collar is short and formed by weak, barely noticeable extensions of the three longitudinal ridges, and the inner edges of the collar are slightly curved (Figs. 28, 29). The sides of the collar bear short longitudinal carinae (Fig. 28). The margin of the shoulder transitions smoothly to the egg chorion surface (Fig. 28). A transverse row of two to seven micropyles is subequatorial; micropyles have a small, short lipped orifice (Fig. 30). The anchor is mushroom-shaped, with single globular bodies on the anchor plate (Fig. 27). The margin of the anchor covers the collar completely (Fig. 27). The chorionic surface is rough with small, light tubercles (Fig. 28).



FIGURES 27–30. *Filchneria wusuensis*, eggs. 27. Egg with papillated anchor. 28. Collar with carina and chorionic surface. 29. Micropyle row. 30. Micropylar orifice.

Note. In our material that was collected at an altitude of 2,300–2,400 m, *F. wusuensis* males had a darker, more contrasting body color pattern, especially on the pronotum, than the holotype. This may be due to the maturity of the adults as well as differences in environmental conditions (increased ultraviolet radiation, decreased temperature, etc.) compared with the type locality at 1,700 m above sea level. On the other hand, the male described in our material is identical to the holotype of *F. wusuensis* in its pale color pattern on tergum 10, location of the sensilla basiconica on terga 8–10, cylindrical shape of the naturally everted EPL, and small papilla at the tip of EPL (Fig. 19). In general, the penial armature is similar, but in the male described from our material, the aedeagus is turned out more than in the holotype; therefore, the membranous lobes are more distinct. Females from fresh material were similar to Chen's (2019) paratype. They had a similar color pattern on the head, pronotum, and shape of the notch on the bilobed subgenital plate, with almost straight inner angles as in the paratype (Fig. 24). The collar on the egg in the paratype appeared to be present but was poorly visible due to use of a low magnification and lack of scanning electronic imaging, making it impossible to compare the features of the chorion structure.

Distribution and ecology. The distribution of *F. wusuensis* is limited to the Eastern Tien Shan and was first described in China, in the Xinjiang Uygur Autonomous Region, Wusu City, and Bayingou River located in the Eastern

Tien Shan. Our specimens were collected in the streams of the neighboring locality, in Bogdo-Ula and Karlyktag Ridges. *Filchneria wusuensis* inhabited mountain streams at altitudes of 2,300–2450 m above sea level, including those fed by glaciers (Figs. 35–37). Adults were found in July.

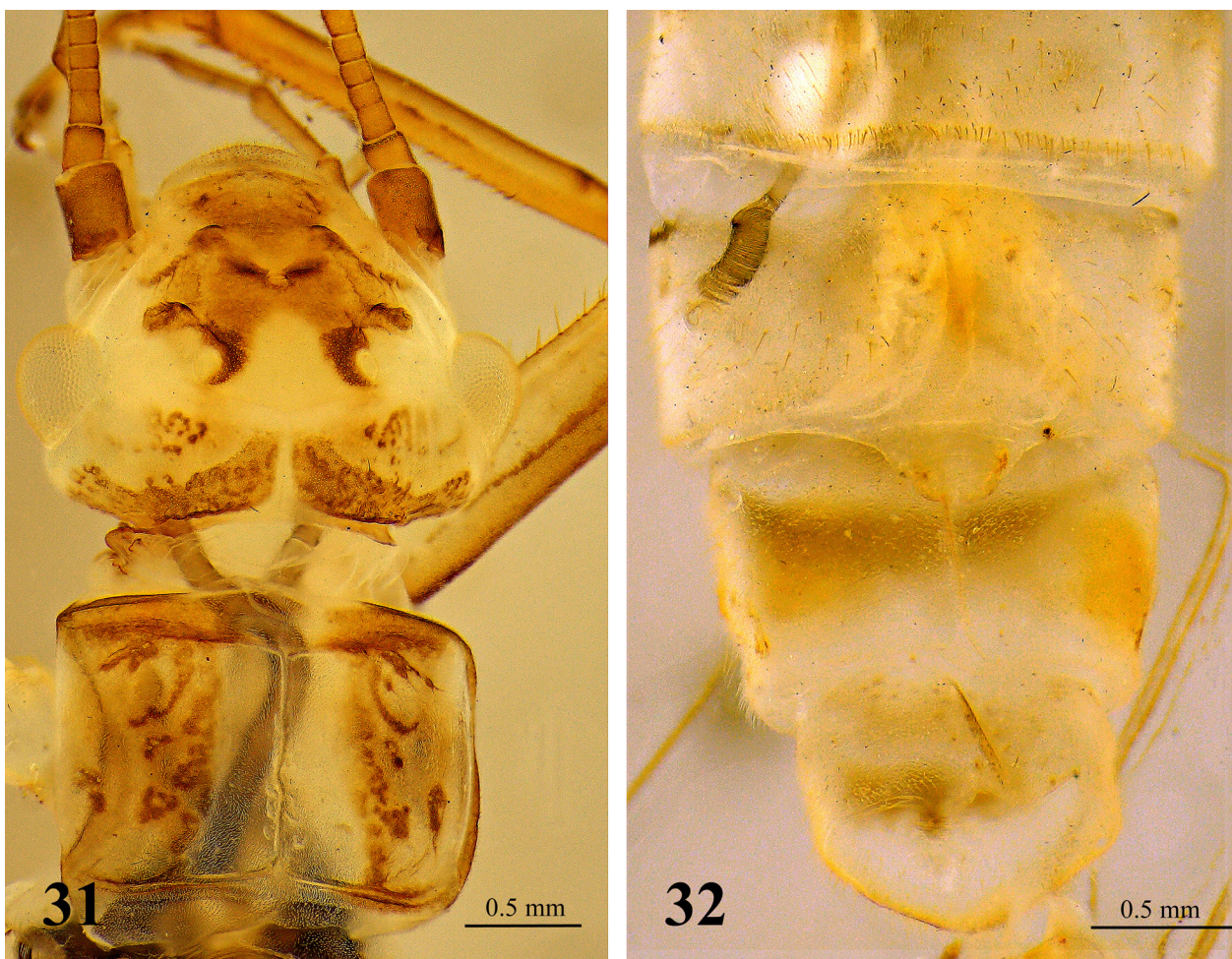
***Mesoperlina pecirkai* Klapálek, 1921**

Figs. 31–32

Klapálek, 1921:148; Illies, 1966:424, 425; Zhiltzova, 1970:587, figs. 14–17; Zwick, 1973:253, 254; Teslenko & Zhiltzova, 2009:49, figs. 272–275.

Material examined. China, the Xinjiang Uygur Autonomous Region, Eastern Tien Shan: 1 female, 1 exuvia, Bogdo-Ula Range, Urumqi city, Dabancheng District, Sangecha River, 35 km N of Dabancheng, an altitude 2,356 m above sea level, 13.VII.2017, N 43°40.583', E 88°17.006', leg. D.M.P.

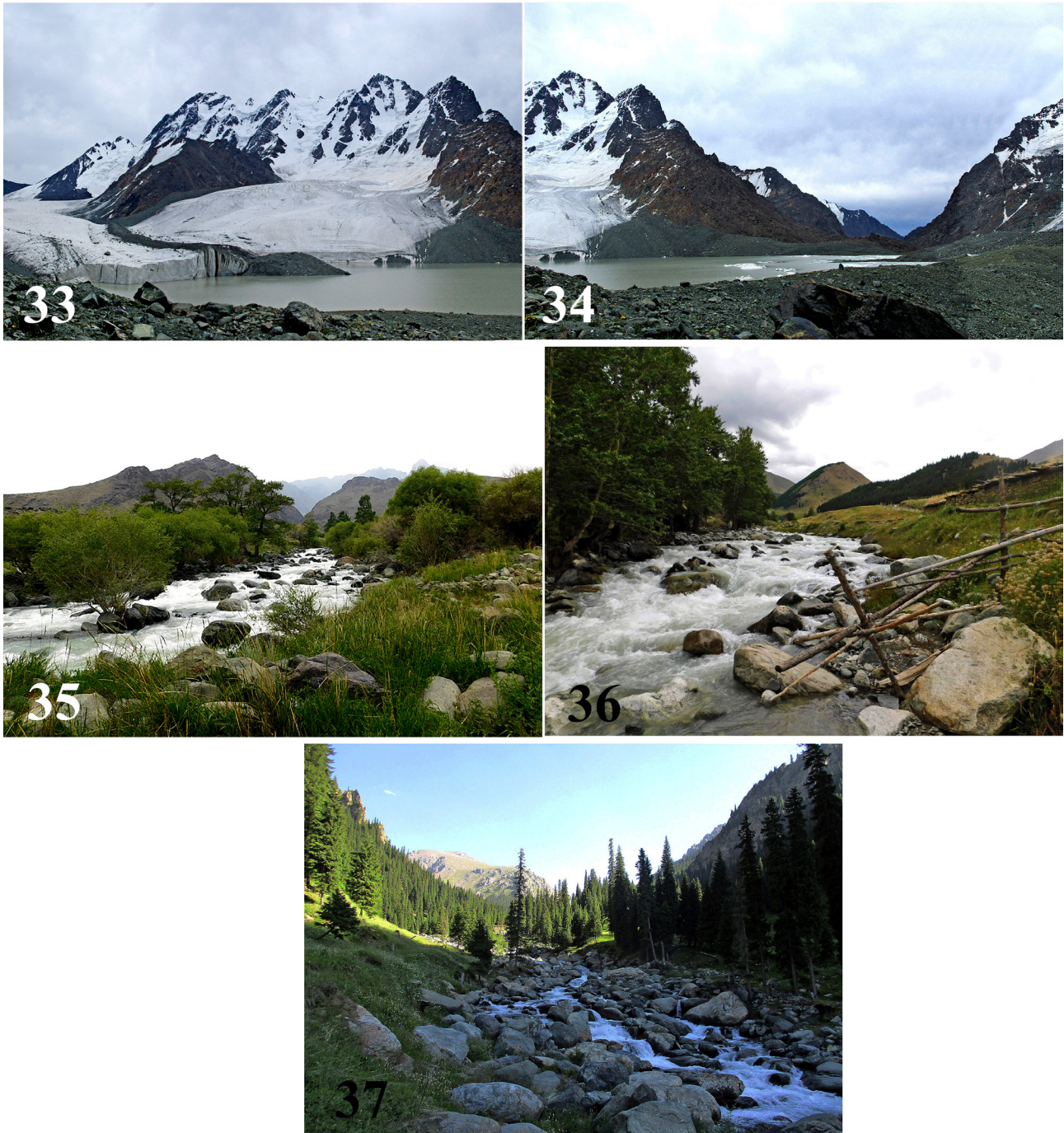
Notes. The assignment of the female to *M. pecirkai* was based on body size, color pattern, and shape of the genital plate. *Mesoperlina pecirkai* differs from other known members of the *Mesoperlina* in having the largest body size and wingspan. The shape of the female genital plate, color pattern of the head, the body and wingspan from Sangecha stream agree with the redescription and illustrations (Zhiltzova 1970).



FIGURES 31–32. *Mesoperlina pecirkai*, female. 31. Head and pronotum, dorsal. 32. Abdominal tip, ventral.

Female. The body is 16.0 mm in length, macropterous, and has a forewing length of 14.1 mm, and wingspan of 30.2 mm. The head bears a distinct brown M-line and brown, arcuate bands connect the posterior ocelli with the tentorial callosities in front (Fig. 31). The clypeus is brownish above M-line corners. The interocellar area is a large, triangular, pale spot, and nearly enclosed by pigment posteriorly (Fig. 31). The lateral margins with pale areas extending from compound eyes to the M-line bases. The occiput has two oval brown spots and two transverse brown

bands curved along the stem and covered with brown spines. The spinule row is interrupted medially. The epicranial suture is pale (Fig. 31). The pronotum is brown, with wide, pale medial stripe, laterally pronotum with dark rugosities on a pale brown background (Fig. 31). The abdomen is paler than other parts of the body. Sternum 8 yellow with a round brown area medially. The subgenital plate is short, round, and extends beyond sternum 8 covering about one third of sternum 9, and bears a few thin transverse wrinkles at the base (Fig. 32). The posterior margin of the subgenital plate is slightly pigmented posterolaterally (Fig. 32).



FIGURES 33–37. Collecting places in the Xinjiang Uygur Autonomous Region, the Eastern Tien Shan. 33. Bogdo-Ula Range, a glacier near Lake Sangecha. 34. Lake Sangecha. 35. Sangecha Stream. 36. Bogdo-Ula Range, Zienzan Stream. 37. Karlyktag Range, Ayar-Gol Stream.

Distribution and ecology. *Mesoperlina pecirkai* is one of the most common and numerous species found in Central Asia. The species is widespread in the running waters of the Pamir, Hindu Kush, the Western and Central Tien Shan, including the Naryn River basin bordering the Xinjiang Uygur Autonomous Region in China where the

female was collected in Bogdo-Ula Range. Emergence extends from mid-May to late July. *Mesoperlina pecirkai* inhabits cold mountain rivers and streams at the altitudes of 800 to 2,700–3,000 m above sea level. Unlike the other species of the genus, *M. pecirkai* may range high into the mountains, without going down beyond the foothill belt (Zhiltzova 1970). This is the first report of *M. pecirkai* in the Eastern Tien Shan and stonefly fauna of China. The female and exuvia were found at the upper section of mountain Sangecha Stream that drains the glacier Sanchecha Lake and flows down between the mountain slopes which are covered with grass at an altitude 2,356 m above sea level (Fig. 35). The Sangecha Stream has a fast current, the substrate consists of large boulders and cobbles, and a riparian gallery of trees (Fig. 35). *Mesoperlina pecirkai* was collected with *N. lepnevae* and *F. wusuensis*.

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