

CORRESPONDENCE

Two new species of *Flavoperla* (Plecoptera: Perlidae) from China

Ruijun Liu¹, Wenliang Li², Weihai Li^{3, 4 *}, Yasen Shali^{1 *}

¹College of Agriculture, Xinjiang Agricultural University, 311 Nongda East Road, Urumqi, 830052, China

²College of Horticulture and Plant Protection, Henan University of Science and Technology, Luoyang, Henan 471023, China

³Department of Plant Protection, Henan Institute of Science and Technology, Xinxiang, Henan 453003, China

⁴Henan Engineering Research Center of Biological Pesticide & Fertilizer Development and Synergistic Application, Henan Institute of Science and Technology, Xinxiang, Henan 453003, China

*Corresponding authors, E-mails: lwh7969@163.com; 359749356@qq.com

Abstract In this paper, two new species are described and illustrated from China: *Flavoperla separata* Liu, Li & Shali, **sp. nov.** from Hubei and Shaanxi Provinces and *F. qinlinga* Liu, Li & Li, **sp. nov.** from Shaanxi and Sichuan Provinces, with the discussion of their congeners. All type specimens are deposited in the Entomological Museum of China Agricultural University (CAU) and the Henan Institute of Science and Technology (HIST).

Key words Taxonomy, China, new species, Perlidae.

Flavoperla Chu, 1929 is a small genus of the Perlidae including 16 species (DeWalt *et al.*, 2020). It was once treated as a synonym of *Gibosia* Okamoto, 1912 (Wu, 1935). However, Uchida (1990) considered it as a valid genus, then Stark & Sivec (2008) followed the treatment. Seven species have been reported in China (Klapálek, 1913; Chu, 1929; Wu, 1935, 1948; Uchida, 1990; Du, 1999; Yang & Li, 2018; Chen, 2019; Liu *et al.*, 2019, 2020; Mo *et al.*, 2020). In present paper, two species of the genus *Flavoperla* are described as new to science, from Shaluli Mountains of Sichuan Province, Dabie Mountains of Hubei Province and Qinling Mountains of Shaanxi Province, respectively.

The specimens were collected by using a sweep net or a light trap, and preserved in 75% ethanol. Specimens were examined with the aid of Leica S8APO dissecting microscope. The color illustrations were made with Leica M205 FA dissecting microscope. Photos were optimized and processed both with in Adobe Photoshop CC® (64 Bit) 2019. All specimens are deposited in the Entomological Museum of China Agricultural University, Beijing (CAU) and the Henan Institute of Science and Technology, Xinxiang (HIST). The morphological terminology follows that of Stark & Sivec (2008) and Mo *et al.* (2020).

Flavoperla separata Liu, Li & Shali, **sp. nov.** (Figs 1–2)

Diagnosis. The new species is characteristic by: General colour yellowish brown, head with a wide Y-shaped dark brown patch, and bearing a small triangular brown marking forward of M-line; hammer drop-like, with rounded base and triangular tip in ventral view and the rectangular epiproct sclerites separated by a wide membranous band.

Description. Adult. Body length ($n=4$) 11.5–13.2 mm, forewing length 9.7–10.8 mm, hindwing length 8.0–8.9 mm. Body color yellowish brown. Head mostly pale with a wide Y-shaped dark brown patch, and bearing a small triangular brown marking forward of M-line (Figs 1A, 2B), anterolateral part of Y-shaped patch obscure in a teneral male (Fig. 2A); slightly wider than pronotum. Compound eyes black. Biocellate; antennae brown. Pronotum brownish with pale rugosities,

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rectangular, corners obtuse (Fig. 1A). Wings transparent, veins brownish. Cerci brown.

Tergum 10 with a pair of dark brown subtriangular spines on posterior margin, obviously sclerotized, set far from each other, located close to paraprocts. Epiproct rectangular, medially interrupted by a wide membranous band. Paraprocts hook-shaped, dark brown, curved forward; finger-shaped in lateral view (Figs 1B, 1D). Hammer basal half brown, anteriorly with brown extensions; generally drop-like, with rounded base and triangular tip in ventral view, apex pale and parallel-sided in lateral view (Figs 1C–D, 2F–G). Everted aedeagus mostly membranous and unpigmented, ventrally with two oval lobes at base connected by a thin transverse brown strip, medially constricted, apex trilobed (Figs 2C–E).

Female. Unknown.

Material examined. Holotype ♂ (CAU), China, Shaanxi Province, Yuling Town, Jiefang Village, light trap, 1133 m, 110°43'07"N, 33°87'47"E, 11 July 2014, Chufei Tang. Paratypes. 3♂ (CAU & HIST), China, Hubei Province, Yingshan County, Taohuachong forest park, light trap, 694 m, 116°02'30"N, 30°98'42"E, 25 June 2014, Mengchao Tan.

Distribution. China (Shaanxi, Hubei). Elevation of habitats ranges from ca. 700–1100 m.

Etymology. The name *separata* (from the Latin word *separatus*, means divided, separated) refers to the epiproct sclerites being separated medially.

Remarks. The new species is similar to *F. galerispina* Mo, Wang & Li, 2020 from Guangxi, by having similar epiproct. However, the hammer and the shapes of the everted aedeagi of both species are distinctive. In *F. galerispina*, the hammer has a swollen apex in lateral aspect, and the aedeagus bears a cap-shaped patch of brown triangular spines (Mo *et al.*, 2020: figs. 2b–c, 3a–c), while the new species has the hammer parallel-sided in lateral aspect and the aedeagus lack distinct spines (Figs 1C–D, 2C–E).

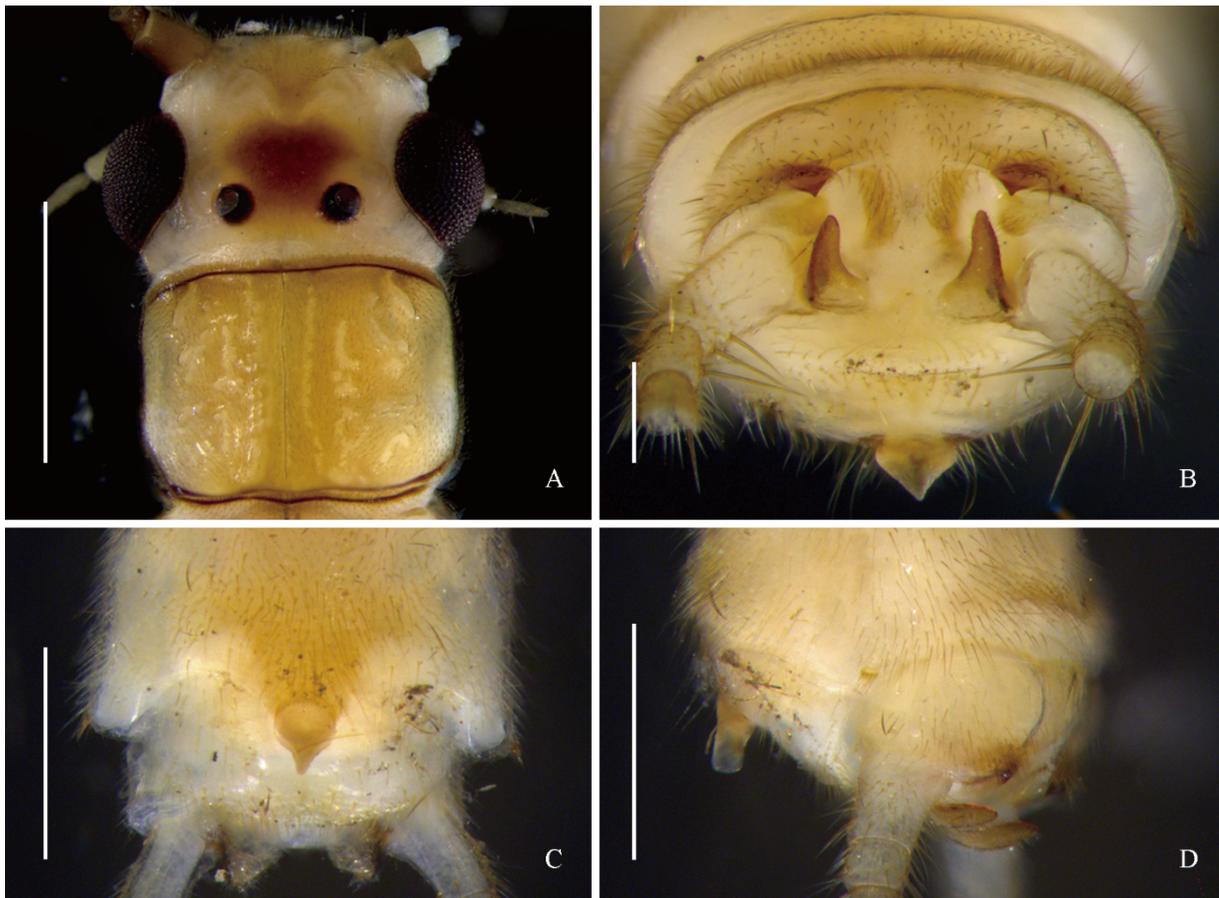


Figure 1. *Flavoperla separata* Liu, Li & Shali, **sp. nov.**, holotype. A. Head and pronotum, dorsal view. B. Terminalia, dorsal view. C. Terminalia, ventral view. D. Terminalia, lateral view. Scale bars: A=1.0 mm; B=0.2 mm; C–D=0.5 mm.

***Flavoperla qinlinga* Liu, Li & Li, **sp. nov.** (Figs 3–4)**

Diagnosis. The new species is characteristic by: General colour pale, head without distinct markings; male terminalia

with a bell-shaped hammer, a pair of hook-shaped paraprocts and the triangular epiproct with a small membranous triangular median area.

Description. Adult. Body length 13.0–14.3 mm ($n=8$), forewing length 11.5–12.5 mm, hindwing length 10.1–11.0 mm. Body color pale. Head pale, occiput elongated, compound eyes black. Biocellate. Antennae pale. Pronotum brownish and rectangular with paler rugosities, corners obtuse (Fig. 3A). Wings transparent, veins brownish. Legs generally pale, femur paler. Cerci pale brown.

Tergum 10 with a pair of brown subtriangular spines on posterior margin, apex sharp and separated far from each other, about in position of paraprocts. Epiproct triangular and divided by small membranous triangular area (Fig. 3B). Paraprocts hook-shaped, curved forward, pointed (Fig. 3B). Hammer bell-shaped, sometimes tapering to a nipple-like brown pigmented apex as shown in Fig. 4D in ventral view; apex swollen and curved upward dorsally in lateral view (Figs 3C–D, 4D–E). Aedeagus generally membranous, sub-rectangular in ventral view, about 3X longer than wide, with a pair of basolateral lobes and meso-lateral processes, respectively. Caudally with a brown “bell-shaped” marking and a pair of “comb-shaped” marking (Figs 4A–C).

Female. Unknown.

Material examined. Holotype ♂ (HIST), China, Shaanxi Province, Qinling Mountains, Ningshan County, Huoditang of Pingheliang Forestry Station, light trap, 1500 m, 33°28'N, 108°29'E, 12 July 2012, Weihai Li. Paratypes. 6♂, same data as holotype; 1♂ (CAU), China, Sichuan Province, Liangshan Prefecture, Yanyuan City, Zhulin Village, sweep net, 1572 m, 107°77'41"N, 27°30'53"E, 27 August 2019, Longbing Wang.

Distribution. China (Shaanxi, Sichuan). The types in Qinling of Shaanxi Province were trapped near a wide stream. Elevation of habitats ranges from ca. 1500–1570 m.

Etymology. The specific name refers to the type locality, Qinling Moutains.

Remarks. The new species is similar to *F. basomarginata* Chen, 2019 from Sichuan, by having similar color pattern and hammer. But it can be easily separated from *F. basomarginata* by the aedeagus apically with a brown “bell-shaped” marking, a pair of “comb-shaped” marking and lacking ventral lobes while the latter has heart-shaped lobe in ventral view and a pair of lateral spines at apex.

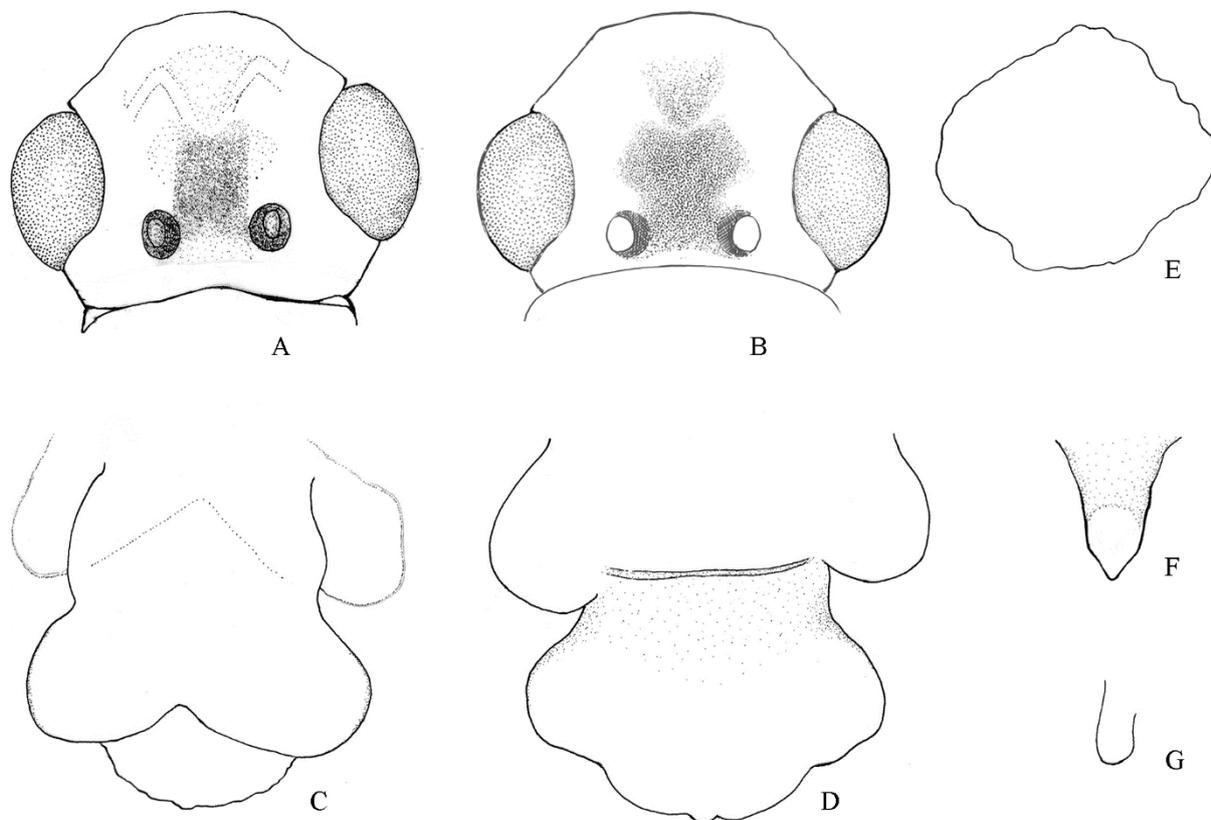


Figure 2. *Flavoperla separata* Liu, Li & Shali, **sp. nov.** A–B. Head showing variations of colour pattern, dorsal view. C. Aedeagus, dorsal view. D. Aedeagus, ventral view. E. Aedeagus, caudal view. F. Hammer, ventral view. G. Hammer, lateral view.

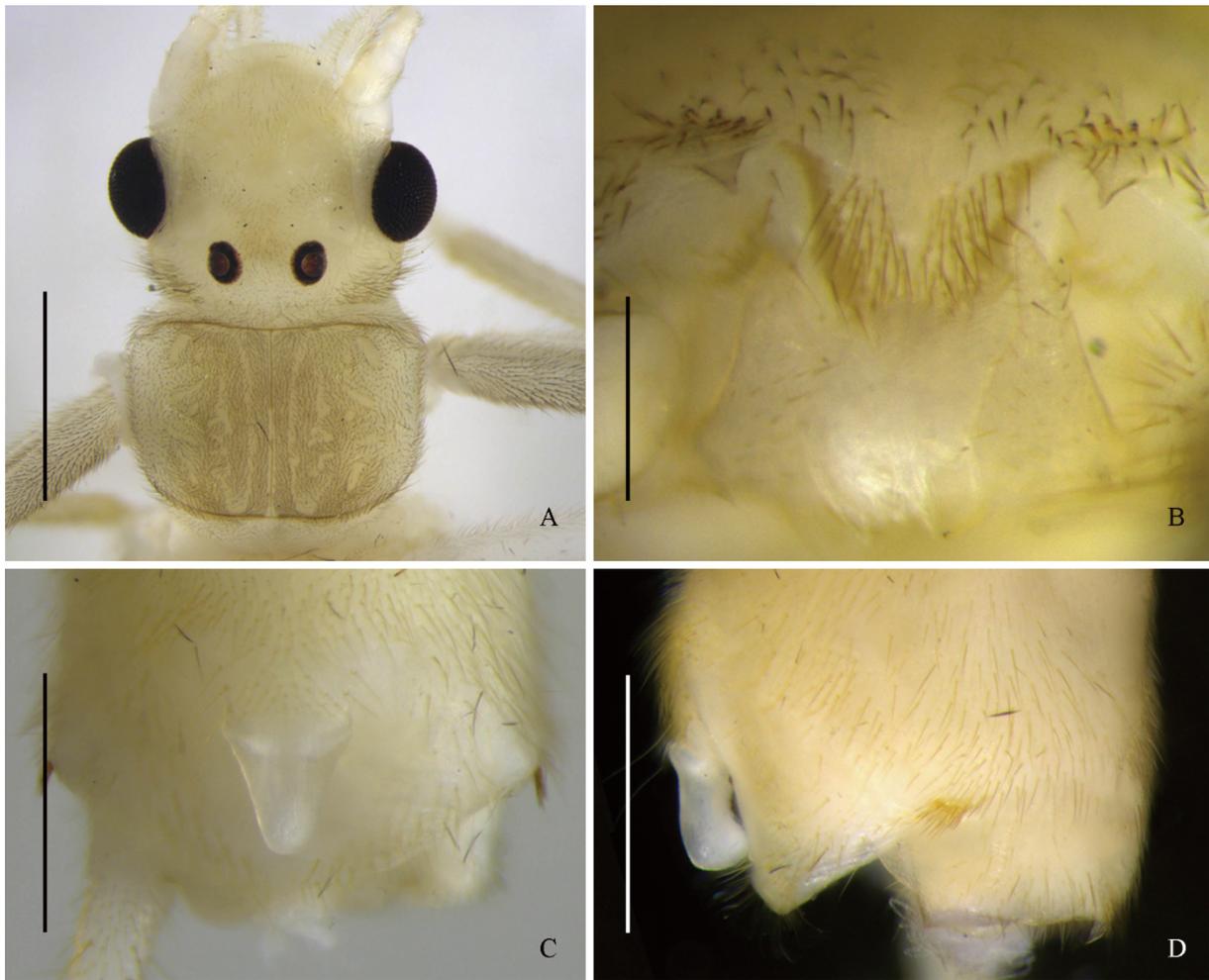


Figure 3. *Flavoperla qinlinga* Liu, Li & Li, **sp. nov.**, paratype. A. Head and pronotum, dorsal view. B. Terminalia, dorsal view. C. Terminalia, ventral view. D. Terminalia, lateral view. Scale bars: A=1.0mm; B=0.2mm; C–D=0.5mm.

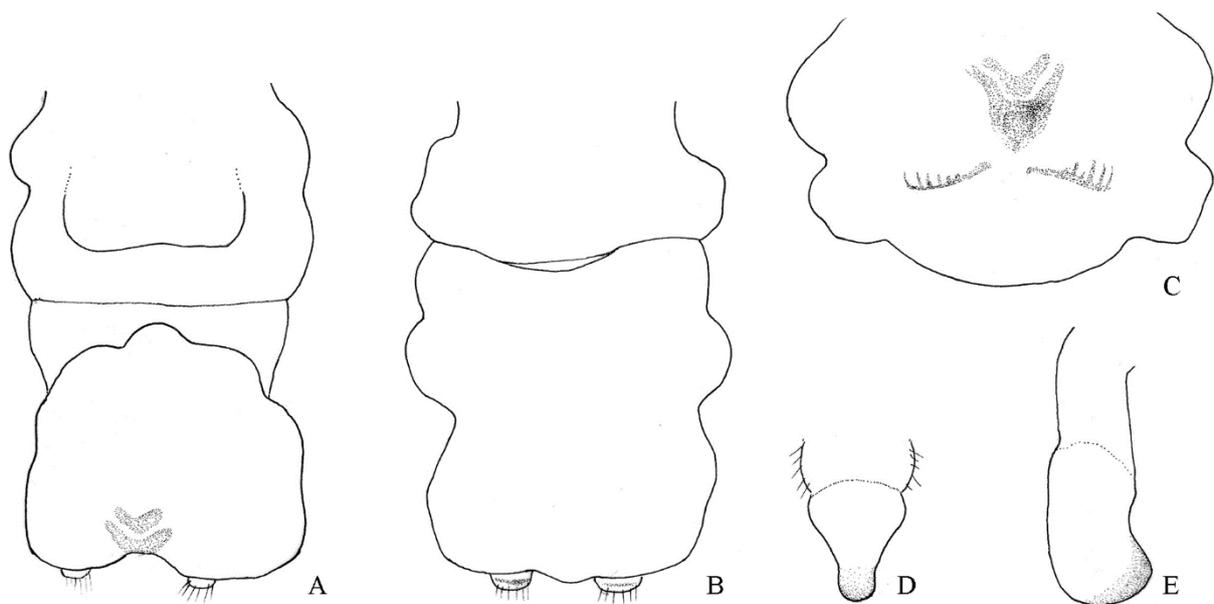


Figure 4. *Flavoperla qinlinga* Liu, Li & Li, **sp. nov.** A. Aedeagus, dorsal view. B. Aedeagus, ventral view. C. Aedeagus, caudal view. D. Hammer showing variation of its apex, ventral view. E. Hammer, lateral view.

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