

## TWO SYNONYMS AND ONE NEW SPECIES OF THE GENUS EPHEMERA FROM CHINA (EPHEMEROPTERA, EPHEMERIDAE)

ZHOU Chang-Fa<sup>1</sup>, ZHENG Le-Yi<sup>2</sup>

1. Institute of Genetic Resources, College of Life Sciences, Nanjing Normal University, Nanjing 210097

2. Department of Biology, Nankai University, Tianjin 300071

**Abstract** Two new synonyms: *Ephemera serica* Eaton, 1871 (= *E. zhangjiagensis* Zhang, Gui et You, 1995), and *E. wuchowensis* Hsu, 1938 (= *E. hunanensis* Zhang, Gui et You, 1995) from China are recognized. The larval and imaginal stages of another new species (*Ephemera rufomaculata* sp. nov.) are described.

**Key words** Ephemeroptera, Ephemeridae, *Ephemera*, synonym, new species, China.

The mayflies of China have been seriously studied in recent years (Zhou et al., 2000; Zhou and Zheng, 2003; Zhou and Zhou, 2003). The taxonomy of Chinese members of the genus *Ephemera* is generally well known (Eaton, 1871, 1883-1888; Ulmer, 1926; Hsu, 1931, 1936a-b, 1937a-c; Kang and Yang, 1994; Zhang et al., 1995; You and Gui, 1995; Zhou et al., 1998), but some problems remain. This paper describes two synonyms and one new species of this genus from mainland China. All specimens are deposited in Nanjing Normal University.

### 1 *Ephemera serica* Eaton, 1871: 75

*Ephemera zhangjiagensis* Zhang, Gui et You, 1995: 73. New Synonym.

Eaton (1871) described the species *Ephemera serica* from specimens collected in China. This species has a unique genitalia and paler abdominal stripes than other species of the genus. It has been frequently collected in southern China by various authors (Ulmer, 1926; Hsu, 1937b, etc.). Zhang et al. (1995) described *E. zhangjiagensis* based upon male subimagos. After examining the holotype and paratypes of *E. zhangjiagensis* deposited in Nanjing Normal University, China, and comparing the genitalia and body color pattern, we discovered that both species are identical, therefore, we consider the latter species as new synonym of *E. serica* Eaton.

**Remarks.** Zhang et al. (1995) argued that the male subimago of *E. zhangjiagensis* had 2 pairs of brown stripes on terga 7-8 while *E. serica* had only 1 pair. However, in Ulmer (1926) s original figures,

terga 7-8 of *E. serica* each have two pairs of stripes. In our collection, the abdominal color pattern of *E. serica* is varied. Some individuals have two stripes on terga 7-8 but the outer pair are indistinct. Most importantly, the male genitalia of both species are identical. *E. serica* has unique genitalia with a combined length of forceps segments 3-4 subequal to segment 2 and with the penis lobes tapered and incurved mesally.

### 2 *Ephemera wuchowensis* Hsu, 1937c: 54

*Ephemera hunanensis* Zhang, Gui et You, 1995: 74. New Synonym.

*E. wuchowensis* was established by Hsu (1937c) based on subimagos. Zhang et al. (1995) described *E. hunanensis* upon imagos. In comparing the types of the latter species with original descriptions of *E. wuchowensis*, we found them to be color variations of the same species.

**Remarks.** Both the holotype and original description of *E. hunanensis* are essentially the same as that of *E. wuchowensis*, particularly in the structure of male genitalia.

*E. wuchowensis* can be distinguished from other species of the *Ephemera* by the genitalia and abdominal markings: two dark dots on tergum 1 (sometimes meeting on the posterior margin); two pairs of dark round dots on tergum 2 (median pairs sometimes small and invisible); terga 3-5 with 2 brown stripes (outer pairs sometimes indistinct), terga 6-9 each with 3 pairs of stripes; tergum 10 with 2 pairs of dark dots (median pair may be small and indistinct).

Foundation item: supported by a postdoctoral fellowship from Nanjing Normal University and an 'Education Grant' of the National Natural Sciences of Foundation of China (108).

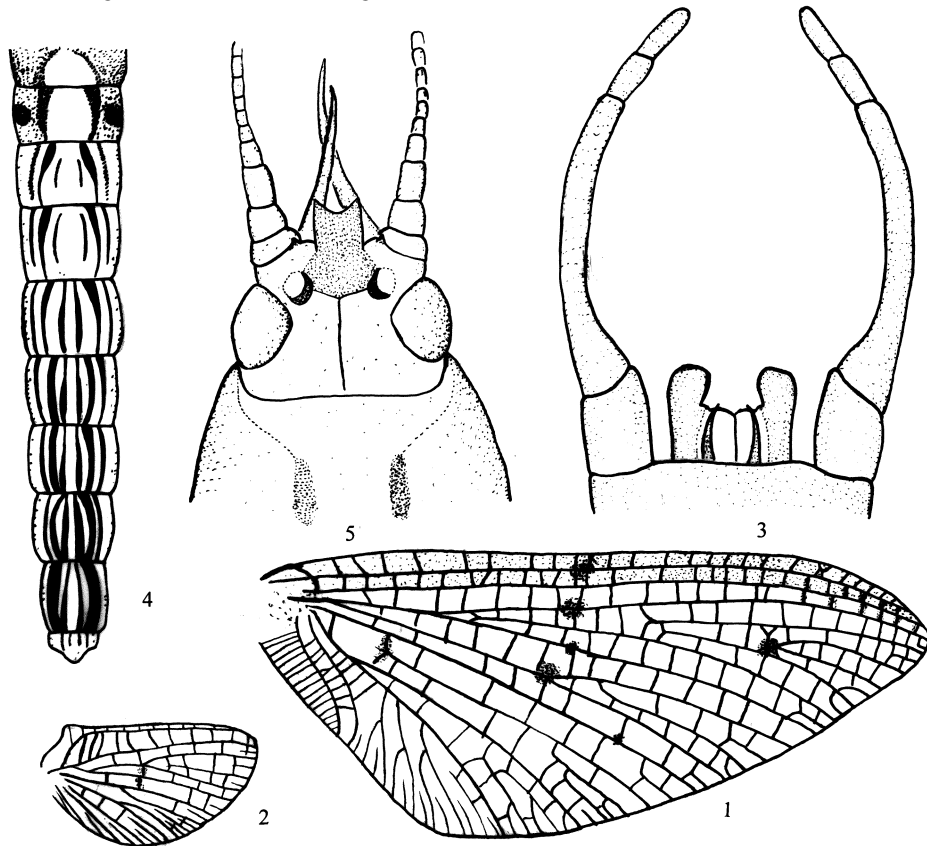
Received 4 Mar. 2003, accepted 23 June 2003.

### 3 *Ephemera rufomaculata* sp. nov. (Figs. 1-5)

Male imago (in alcohol). Body reddish yellow with different dark stripes and markings. Body length 13.0 mm, forewing 12.0 mm, hindwing 4.5 mm, foreleg 13.0 mm, caudal filaments 32.0 mm. Eyes dark basally, gray apically. Ocellus dark at base, apex pale. Pedicel and scape of antenna each with a dark dot. Flagella pale yellow, base broadened. Pronotum with two pairs of dark stripes, one pair located on anterior half of pronotum, the other on the posterior half, a transverse dark stripe in the middle of them. Mesonotum and metanotum washed with various dark markings dorsally. Mesocoxae and metacoxae each with a dark dot, the other parts of the legs pale. Forewing with different dark brown marks (Fig. 1). Crossveins in sc and c cells pigmented significantly, those in stigma region detached.  $MP_2$  fused with CuA basally. Hindwings with clear dark dots, crossveins obviously pigmented (Fig. 2). Abdominal terga 1-2

mostly reddish brown and with a median pale portion. In some individuals, one pair of oblique stripes and one pair of additional round dark dots can be seen on tergum 2 dorsally. Terga 3-9 each with 3 pairs of longitudinal stripes. On terga 8-9, outer 2 pairs of stripes broadened and fused together. Tergum 10 with 2 pairs of dark dots dorsally (Fig. 4). Posterior margins of each terga dark, lateral margins with dark stripes. Sterga 2-9 each with a pair of dark longitudinal stripes. Genitalia (Fig. 3): combined length of the forceps of segments 3-4 shorter than half the length of segment 2, penis with distinct titillator, posterolateral apex of penis lobe expanded backwards to into projections.

Female imago (in alcohol). Body length 15.0 mm, caudal filaments 19.0 mm. Body paler than male, abdominal color pattern similar to male, but the median pair of stripes of dorsal terga may be very thin and indistinct.



Figs. 1-5. *Ephemera rufomaculata* sp. nov. 1-4. Male. 1. Fore wing. 2. Hind wing. 3. Genitalia. 4. Abdomen. 5. Larval head and prothorax (dorsal view).

Mature larvae (in alcohol) (Fig. 5). Body length 11.0-13.0 mm, caudal filament 6.0-8.0 mm. Length of frontal process slightly longer than its width, anterior margin with shallow emargination, lateral margins

straight. Frons dark brown. Pronotum with a pair of broad marks. Terga color pattern same as in adult. Body with dense golden hairs.

Remarks. The adult was associated to the larva on

the basis of external genitalia dissected from mature male larva and by the similarity of their abdominal color pattern.

Diagnosis. This species can be separated easily from the other species of the genus by the following combined characters: 1)  $MP_2$  fused with  $CuA$  basally; 2) color pattern of wings, in particular pigmented crossveins of hindwings; 3) shape of genitalia: penis lobes with round apexes and strong titillators; 4) color pattern on abdominal terga. The markings on abdominal terga 1-2 and the penes of male imagos are unique in the genus.

The larvae can be distinguished by abdominal color pattern, the shape of frons and relatively short mandible tusks.

Etymology. Ruf-: Latin prefix, red; maculata: feminine form of Latin word maculatus, spot; indicates adults of new species possessing various red spot and pigmentations on body.

Materials examined. Holotype, Mengxing, Mengla County (21.29°N, 101.33°E), 20 Mar.; paratypes: 3, 10, 1 larva, same as holotype; 8, 8, Menglun, Mengla County, 24 Mar.; 1 larva, Mengla County, 17 Mar.; 10, Mengban, Mengla County, 28 Mar.; 10, 20, 60 larvae, Fengshan, Jinggu County, 10 Apr.; 2, 10, 1 larva, Puwen, Jinghong City, 2 Apr.; 3 larvae, Longjie, Jingdong County, 12 Apr.; 2 larvae, Jingdong County, 14 Apr. (above all leg. by ZHOU Chang-Fa from Yunnan Prov. in 2001); 1, 5 (subimago), 5 (subimago), Jingdong County, Yunnan Prov., 16 May 1994 leg. by ZHENG Le-Yi; 2 larvae, Ren-Li, Huaping County, Yunnan Prov., 30 May 1996, leg. by WANG Bei-Xin and ZHOU Chang-Fa; 1, 1, Libo County, Guizhou Prov., 5 July 1994, leg. by DU Yu-Zhou; 1, Longtian County, Guizhou Prov., 2 Aug. 1982, leg. by GUI Hong; 5, Mt. Fanjin, Guizhou Prov., 19 June 1994, leg. by DU Yu-Zhou. Acknowledgements We are indebted to Dr. John C. Morse (Clemson University, USA) and Prof. YANG Lian-Fang (Nanjing Agricultural University) for partly funding our 1996 collection trip. We thank

Dr. DU Yu-Zhou (Yangzhou University), Dr. WANG Bei-Xin (Nanjing Agricultural University) and LI Chuan-Ren (Hubei Agricultural College) for their help in field collection and for providing some specimens. Sincere thanks are expressed to Dr. Janice Peters and Mr. Bart Richard (Florida A and M University, USA) for their improvement and comment on the manuscript.

## REFERENCES

- Eaton, A. E. 1871. A monograph on the Ephemeridae. Transactions of the Entomological Society of London, 1: 1-164. 6 pl.
- Eaton, A. E. 1883-1888. A revisional monograph of recent Ephemeridae or mayflies. Transactions of the Linnean Society of London, Second series, Zoology, 3: 1-352, 65pl.
- Hsu, Y-C 1931. Two new species of mayflies from China. Peking Natural History Bulletin, 6 (2): 39-41.
- Hsu, Y-C 1936a. Mayflies of Hong Kong with descriptions of two new species (Ephemeroptera). Hong Kong Naturist, 7: 233-238.
- Hsu, Y-C 1936b. The mayflies of China (order Ephemeroptera). Peking Natural History Bulletin, 11 (2): 129-148.
- Hsu, Y-C 1937a. The mayflies of China (order Ephemeroptera). Peking Natural History Bulletin, 11 (3): 287-296.
- Hsu, Y-C 1937b. The mayflies of China (order Ephemeroptera). Peking Natural History Bulletin, 11 (4): 433-440.
- Hsu, Y-C 1937c. The mayflies of China (order Ephemeroptera). Peking Natural History Bulletin, 12 (1): 53-56.
- Kang, S-C and Yang, C-T 1994. Ephemeroidea of Taiwan (Ephemeroptera). Chinese J. Entomol, 14: 391-399.
- Ulmer, G. 1926. Beiträge zur Fauna sinica. Trichopteren und Ephemeropteren. Archiv für Naturgeschichte (A), 91 (5): 19-110.
- You, D-S and Gui, H 1995. Economic Insect Fauna of China. Fasc. 48. Ephemeroptera. Science Press, Beijing. pp. 152.
- Zhang, J, Gui, H and You, D-S 1995. Studies on the Ephemeridae (Insecta: Ephemeroptera) of China. J. Nanjing Normal University (N. S.), 18: 68-76.
- Zhou, C-F, Gui, H and Su, C-R 1998. A new species of genus Ephemera (Ephemeroptera: Ephemeridae). Entomologia Sinica, 5: 139-142.
- Zhou, C-F, Su, C-R and Gui, H 2000. The first record of the genus Torleya in China with description of a new species (Ephemeroptera, Ephemerellidae). Acta Zootaxonomica Sinica, 25 (3): 312-314. [动物分类学报]
- Zhou, C-F and Zheng, L-Y 2003. The first record of the genus Paraleptophlebia Lestage from mainland China with description of a new species (Ephemeroptera, Leptophlebiidae). Acta Zootaxonomica Sinica, 28 (1): 84-87. [动物分类学报]
- Zhou, C-F and Zhou, K-Y 2003. The research status on phylogeny of Palaeoptera (Insecta: Pterygota). Acta Zootaxonomica Sinica, 28 (2): 192-195 [动物分类学报].

## 中国蜉蝣属两异名及一新种记述 (蜉蝣目, 蜉蝣科)

周长发<sup>1</sup> 郑乐怡<sup>2</sup>

1. 南京师范大学生命科学学院遗传资源研究所 南京 210097

2. 南开大学生物学系 天津 300071

**摘要** 我国大陆蜉蝣科蜉蝣属 *Ephemera* 中的张家界蜉 *E. zhangjiajiensis* Zhang, Gui et You, 1995 实际是绢蜉 *E. serica* Eaton, 1871 的同物异名 (新异名), 湖南蜉 *E. hunanensis* Zhang, Gui et You, 1995 是梧州蜉 *E. wuchowensis* Hsu, 1938 的异名 (新异名)。本文还报道 1 新种——红斑蜉 *Ephemera rufomaculata* sp. nov. 的成熟稚虫和成虫。本种成虫腹部为

棕红色, 腹部背板 1~2 节具大面积的色块, 腹部 3~9 节背板各具 3 对黑色纵纹, 雄性外生殖器具发达的阳端突以及阳茎端部明显向后突出而十分独特, 极易与已知种区分。本种稚虫因具有与成虫相似的腹部背板斑纹以及较小的上颚突起也易识别。

**关键词** 蜉蝣目, 蜉蝣科, 蜉蝣属, 同物异名, 新种, 中国.

**中图分类号** Q969.211.3