

## THE MAYFLIES OF CHINA\*

(ORDER EPHEMEROPTERA)

YIN-CHI HSU (徐蔭祺)

(Department of Biology, Yenching University, Peiping)

### *Ephemera pulcherrima* Eaton<sup>28</sup>

1892—Eaton—Trans. Ent. Soc. Lond. 1892, p. 185.

1925—Ulmer—Arch. f. Naturg. 91, A (5), p. 86.

1935—Wu—Cat. Ins. Sin. I: 248.

**MEASUREMENTS:** Length of body ♂ imago 11-12 mm., ♀ imago 12-15 mm.; length of wing ♂ imago 10-12 mm., ♀ imago 12-15 mm.; wing expanse ♂ imago 21-25 mm., ♀ imago 25-31 mm.; length of tails 23-26 mm.

#### ♂ Imago (dried)

**HEAD:** Yellowish ochraceous, eyes black, anterior border dark brown, ocelli brownish black.

**PRONOTUM:** An elongate black spot on each side.

**METANOTUM:** A brownish black or black longitudinal streak on each side, a black dot above the hind coxa.

**LEGS:** Light yellow; fore tibia and tarsus somewhat dark, more ochraceous yellowish; fore femur somewhat brown; the basal and distal ends of tarsus and the first tarsal segment black, the following tarsal segments black brown. Hind coxa with three black dots, one at anterior margin and two at posterior margin; fore femur somewhat longer than second tarsal segment; 4th tarsal segment  $1\frac{1}{2}$  times as long as the 5th, 3rd segment  $2\frac{1}{2}$  times as long as the 5th.

**WINGS:** Fore wing transparent, with very small spots, sometimes a violet black spot on the bulla of Sc, another one on the bulla of R<sub>1</sub>, a third one in a straight line with these on the last sectorial branch, and a fourth one at the base of the outer fork (Of); three more very small dots all in the middle of the three last cross veins of the radial area; in the costal area the base of 2 or 3 cross veins showing a dark dot; the wing base light brown. The hind wings not spotted, its hind margin usually brown, veins for the greater part dark brown, the fine veins light brownish yellow, the costal brace strong and dark. In the costal

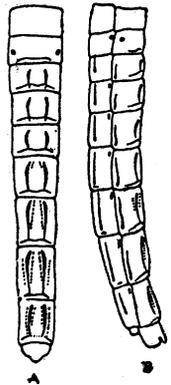


Fig. 25. *Ephemera pulcherrima* Etn. ♂  
Sub. Abdomen A. dorsal, B. lateral.  
(After Ulmer)

\* Continued from Vol. II, Part 3, pages 287-296.

<sup>28</sup> Adapted from Ulmer, Arch. f. Naturg. 91, A (5), p. 86, 1925.

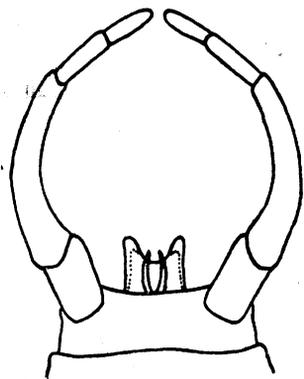


Fig. 26. *Ephemera pulcherrima*  
Eaton. ♂ Genitalia ventral  
(After Ulmer)

area of the fore wing about nine cross veins before the bulla, 2 or 3 at the bulla, and 18-19 from the bulla to the apex. In the hind wing the veins finer and lighter than in the fore wing.

**ABDOMEN :** Light yellow, somewhat transparent; the last 2 or 3 segments brownish yellow, not transparent; details of the abdominal coloration shown in Fig. 25.

**TAILS :** Yellowish brown to light reddish brown; lateral tails with only slightly dark segments at base, only the 3rd or 4th segment black, the distal part ringed with black; middle tail with black rings in the basal part.

**GENITALIA :** Forceps light yellow with basal ends yellowish brown; the two terminal segments together slightly over half the length of the second segment, third segment still somewhat shorter than the first segment, distal segment the shortest. Penial lobes short, fused, flat and of normal form; titillators present. (Fig. 26).

#### ♀ Imago (dried)

**GENERAL COLORATION :** Dirty light ochraceous yellowish, on the whole very similar to the male.

**LEGS :** Fore leg with femur darker than the tibia ; basal and distal ends of tibia distinctly black or violet black.

**WINGS :** Fore wing with less color pattern than the male, sometimes without spots ; the bulla spots often disappearing at the tip of the Sc ; of the last three cross veins of the radial area either one or two or all of them with violet black spots ; veins all quite light yellowish, only the cross veins of the first three areas stronger and darker (more black brown) than the rest. The costal brace of the fore wing not always black sometimes yellowish or gray yellow.

**ABDOMEN :** Light reddish yellow.

#### ♀ Subimago (dried)<sup>24</sup>

**HEAD :** With edge of the occiput on each side behind the eyes black.

**THORAX :** With two longitudinal streaks from the pronotum (where they parallel with each other) to the tip of the scutellum, angulated on the mesonotum and confluent just before their termination with a rounded pitch-brown spot on the remaining part of the notum on each side, Each side of the thorax with a small spot in front of the base of the costa, and a minute spot just above the coxa at the posterior angle of the metapleuron.

**LEGS :** Yellowish ochraceous with black markings. The basal and the posterior margins of the hind coxa black. The fore tibia narrowly at both extremities black.

<sup>24</sup> Adapted from Eaton, Trans. Ent. Soc. Lond. 1892, p. 185.

**WINGS:** Very light yellow ochraceous, subopaque; fore wing sparsely marked with small violet-black spots, situated one each at the bullae of the subcosta and radius, one in line with these on the sector, a small one in the axil of the outer fork (of) and three others, one in the middle of each of the last three cross veins immediately behind the radius. Hind wings spotless, unicolorous. Venation in both wings concolorous with the membrane (but opaque), excepting a few cross veins in the submarginal area of the hind wing. (this area being grayish towards the subcosta) and some in the fore wing, viz., the cross veins in front of the sector, many of those in front of R<sub>4</sub> in the basal half of the wing, and a few of those nearest the base in the areas between R<sub>4</sub> and 1A (first axillary vein); the large cross vein between the subcosta and the radius black.

**ABDOMEN:** Details of abdominal coloration shown in Fig. 25.

**TAILS:** Fuscous, opaque at the joints, and some of the segments here and there with blackish color.

**TYPES:** 1♂, 5♀, and 5 subimagos in Mell's Collection; 1♂ and many subimagos in Hamburg Museum. Collected from Mahn tsi shan, Lo fau shan in Fukien and Kwangtung Provinces.

*E. tyandyn*

### ***Ephemera purpurata* Ulmer<sup>25</sup>**

1919—Ulmer—Arch. f. Naturg. 85, A (11), p. 9 f. 6-7.

1925—Ulmer—Arch. f. Naturg. 91, A (5), p. 95.

1935—Wu—Cat. Ins. Sin. I: 248

**MEASUREMENTS:** Length of body ♂ imago 13-15 mm., length of wing ♂ imago 15 mm., wing expanse ♂ imago 32 mm.

#### **♂ Imago (dried)**

**HEAD:** Light or dark yellow brown, hind margin with a black spot, the middle somewhat light.

**PRONOTUM:** Yellow brown, sometimes pure yellow; each side with a broad, black longitudinal streak extending from the black head spot to its hind margin and parallel to the edge; the part between the two black longitudinal streaks small, not broader than a side streak.

**MESONOTUM:** Yellow brown, here and there dark brown, on each side there is a small black brown longitudinal streak extending to near the wing base; dark brown under the wings.

**METANOTUM:** Brownish yellow.

**LEGS:** Fore leg with coxa, trochanter, and femur yellow brown to brown, tibia brown black with the exception of the brown base, tarsus black brown, claws black. Hind legs

25 Adapted from Ulmer, Arch. f. Naturg. 85, A (11), p. 9, 1919.

light amber yellow, coxa dark. Fore femur longer than 2nd tarsal segment, 4th tarsal segment nearly  $1 \frac{2}{3}$  times as long as the 5th, 3rd tarsal segment  $2 \frac{1}{3}$  times as long as the 5th.

**WINGS:** Transparent with dark to black purple spots, the veins of the fore wing brown black, veins of the wing base and the fine veins of the cubito-anal area yellowish, the distal half of the costal area dark purple, an oblique small transverse stripe before the bulla of the subcosta to over the outer fork (Of), the outer margin of the fore wing light grayish brown. Hind wings weak greenish yellow, more distinctly in the entire subcostal area and at the apex of the costal area, veins in general brown, in the middle of the wing a dark purple spot reaching from the base of the fork of  $R_2$  over the following cross vein to the cubitus.



Fig. 27. *Ephemera purpurata* Ulmer. ♂ Abdomen dorsal. (After Ulmer)

**ABDOMEN:** Above yellowish brown with black colorations shown in Fig. 27.

**TAILS:** Light brown; middle tail distinctly lighter than the lateral ones, somewhat shorter and not ringed; lateral tails indistinctly fringed with dark brown.

**GENITALIA:** Forceps long and slender; the second segment very long; 3rd segment somewhat as long as the first, narrow; 4th segment somewhat shorter than the 3rd; the two distal segments together longer than half of the second segment. Penial lobes long and narrow, fused at base, sharply pointed at the spear-shaped tip (Fig. 28).

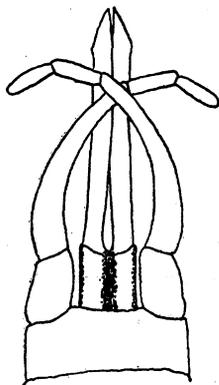


Fig. 28. *Ephemera purpurata* Ulmer. ♂ Genitalia ventral. (After Ulmer)

**HOLOTYPE:** 1 ♂ imago from Kouy-Tohéou in Paris Museum. Collected by Péré Cavalerie in 1908.

**PARATYPES:** 2 ♂ imagos and 1 subimago from the same locality, date, and collector, and in the same Museum.

### *Ephemera sauteri* Ulmer<sup>26</sup>

1812—Ulmer—Ent. Mitt. I, p. 369.

1925—Ulmer—Arch. f. Naturg. 91, A (5), p. 92.

1935—Wu—Cat. Ins. Sin. I: 248.

**MEASUREMENTS:** Length of body ♂ imago 18-21 mm., ♀ imago 19-22 mm.; wing expanse ♂ imago 30-35 mm., ♀ imago 36-40 mm.

## ♂ Imago (dried)

**HEAD:** Brownish black.

**PRONOTUM:** On the sides dark (dark reddish brown to blackish), in the middle lighter (yellowish, gray yellow, yellowish, brown or gray reddish).

**MESO- & META-NOTUM:** Pitch brown, the sutures yellow.

**LEGS:** Fore leg with dark brown to blackish brown femur, black tibia, pitch black tarsus and black claws; mid and hind legs with brown femora with their edges transparent yellow, yellow tibiae, yellow brownish tarsi, and brown claws.

**WINGS:** Hyaline, colorless with black veins; fore wing without spots (only the veins in the neighborhood of bulla and the base of Rs. somewhat thickened), the base of costal area yellow greenish, the apical half of the wing and the entire subcostal area brown to dark brown; apical margin of hind wing not dark. In the fore wing the base of  $M_2$  is often fused with base of  $Cu_1$ .

**ABDOMEN:** Dark grape red, the side lines blackish, black longitudinal streaks on the dorsal and also on the ventral surfaces, details of the abdominal coloration shown in Fig. 29.

**TAILS:** Middle one somewhat shorter than the lateral ones, dark yellowish brown, not ringed; the lateral ones dark reddish brown, with black small rings.

**GENITALIA:** Forceps yellow red to red brown.

## ♀ Imago (dried)

**GENERAL COLORATION:** Lighter than male.

**HEAD:** Brownish yellow.

**PRONOTUM:** Yellow, on the sides red brown.

**MESONOTUM:** In the anterior half gray yellow, on the sides red brown, in posterior half entirely sulphur yellow.

**LEGS:** Fore leg with brownish femur and tibia, and with dark brown tarsus. Mid and hind legs yellow, their femora dark yellow.

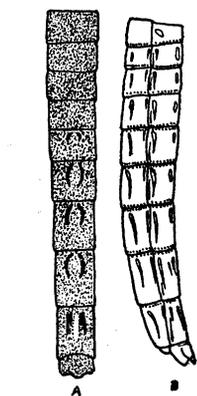


Fig. 29. *Ephemera sauteri* Ulm. ♂  
Abdomen A. dorsal,  
B. lateral (2 examples)  
(After Ulmer)

**WINGS:** Costal and subcostal streaks of the fore wing not so dark, more yellow greenish; the cross veins of these two areas even black as in the male.

**ABDOMEN:** Coloration of the dorsal side similar with male. The black longitudinal streaks distinct, 8th segment often yellow; ventral surface gray yellow to yellow, with distinct black longitudinal streaks; posterior part of 8th and 9th sternites mostly more red brownish, 10th sternite very red brown.

**TAILS:** Similar to the male, but uniform gray yellow to light yellow brown.

**♀ Subimago (dried)**

**GENERAL COLORATION:** Darker than the whitish imago.

**THORAX:** Above gray yellow, dark only in between the wings.

**LEGS:** Brown yellow; fore femur light brown, tibia and tarsus black brown.

**WINGS:** Light gray, opaque; costal and subcostal streaks of the fore wing gray reddish, dull.

**ABDOMEN:** Red brownish with gray gleam.

**TAILS:** Dark brown.

**MATERIALS:** 24 ♂♂, 14 ♀♀. 1 ♀ subimago collected in May, 1912 from Lo fau shan, Canton. In Deutsch. Entomological Museum and in Ulmer's Collection.

***Ephemera serica* Eaton<sup>27</sup>**

1871—Eaton—Trans. Ent. Soc. Lond. 1971, p. 75, t. 4, f. 12, 12a.

1875—McLachlan—Trans. Ent. Soc. Lond. 1875, p. 169.

1883—Eaton—Trans. Linn. Soc. (2) III, p. 73.

1925—Ulmer—Arch. f. Naturg. 91, A (5), p. 89.

1935—Wu—Cat. Ins. Sin. 1-248.

**MEASUREMENTS:** Length of body ♂ imago 11-15 mm., ♀ imago 12-19 mm.; length of wing ♂ imago 11-15 mm., ♀ imago 12-19 mm.; wing expanse ♂ imago 24-32 mm., ♀ 26-40 mm., length of tails ♂ imago 30 mm., ♀ imago 20 mm.

**♂ Imago (dried)**

**HEAD:** Light brown-ochraceous, reddish brown in the vicinity of the ocelli.

**THORAX:** Brown-ochraceous, with an elongate black spot on each side of the pronotum.

**LEGS:** Fore femur deep raw-umber brown and pitch-black at its distal end, tibia and tarsus light brown-ochre; fore coxa, and mid and hind legs very light yellow-ochraceous, all with a black spot on the coxa. Fore femur much shorter than second tarsal segment; 4th tarsal segment nearly twice as long as the 5th segment, 3rd tarsal segment  $2\frac{1}{2}$  times as the 5th; tibia much shorter than tarsus, shorter than 2nd and 3rd tarsal segments together.

**WINGS:** Vitreous, fore wing with the venation in a larger measure golden brown, but with the cross veins before the sector and those behind it in the basal  $\frac{1}{3}$  of the disk pitch-black, some of them spotted with sepia-brown in correspondence with the markings of the subimago. Hind wings spotless with light venation.

<sup>27</sup> Adapted from Ulmer, Arch. f. Naturg. 91, A (5), p. 89, 1925

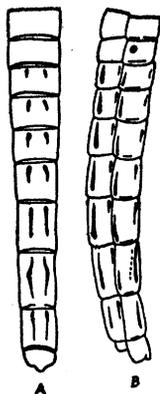


Fig. 30. *Ephemera serica*  
Etn Abdomen A. ♀  
dorsal, B. ♂ lateral.  
(After Ulmer)

♀ Imago (dried)

**FORM:** Very much similar to that of male.

**THORAX:** Pronotal spots smaller. Mesonotum sometimes with a dark line on each side over the wing base. Metanotum sometimes darker.

**LEGS:** Very light yellow-ochraceous; fore femur slightly darker; tip of fore femur, two ends of fore tibia and the basal joint of the fore tarsus pitch-black; the flat claw blackish on every tarsus.

**WINGS:** Spots very indistinct, almost effaced.

**ABDEMEN:** Coloration similar to male as shown in Fig. 30.

♀ Subimago (dried)

**WINGS:** Very light yellowish gray, with dull light yellowish veins; in the fore wing most of the cross veins between the costa and the sector, and many of those posterior to this last vein in the basal third of the disk of the wing black, a few bordered with black; in the area posterior to the submarginal area 3-5 cross veins beyond the bulla marked each in the middle with a round black spot.

**HOLOTYPE:** 1♂ from North China.

**ALLOTYPE:** 1♀ from North China.

**PARATYPES:** 1 subimago from Hongkong in British Museum (it has no spots on the pronotum); 1♂, 2♂ subimagos, 26 ♀ (imagos and subimagos) from Lofaushan, Tsha Yün San, Lien Chao (Kwangtung) in Berlin Museum; 2♀ in Paris Museum.

**ABDOMEN:** Pale yellow-ochraceous, marked with black lines; details of the abdominal coloration shown in Fig. 30.

**TAILS:** Ochraceous, lateral ones annulated with black.

**GENITALIA:** Forceps yellow, basal segment short, second segment at least 3 times longer, two terminal segments long and slender together at least  $\frac{3}{4}$  as long as the second segment, third segment somewhat longer than the 4th segment. Penial lobes short and broad, widely separated, titillators present. (Fig. 31).

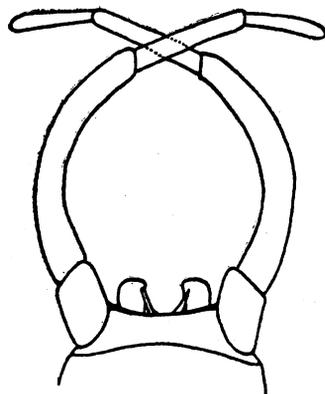


Fig. 31. *Ephemera serica*  
Eaton. ♂ Genitalia  
ventral.  
(After Ulmer)

***Ephemera shengmi* n. sp.**

**MEASUREMENTS:** Length of body: Holotype ♂ imago 14 mm., other males 15 to 16 mm.; length of tails: Holotype ♂ imago 17 mm.

♂ Imago (In alcohol)

**HEAD:** Yellowish brown with brown spots between lateral ocelli and antennae. Eyes grayish black, quite separated apart. Lateral ocelli well developed and prominent, median ocellus vestigial. Antennae with dark brown rings at base.

**PRONOTUM:** Yellowish brown with dark brown patches.

**MESONOTUM:** Yellowish brown.

**LEGS:** Fore leg brownish, tarsus I  $1\frac{1}{3}$  longer than tibia, tarsal formula 1-5-4-3-2. Mid and hind legs yellowish. Hind coxa with one black spot.

**WINGS:** White, costal margin brown, cross veins of costal area brown.

**ABDOMEN:** 1st tergite without coloration; 2nd to 6th tergites each with a pair of median black spots (in anterior segments) or streaks (in posterior segments), and two elongate streaks on each side above the side line; 7th to 9th tergites each with three pairs of curved black longitudinal streaks, inner pair the shortest, and one black long streak on each side above the side line; 10th tergite with four very short basal streaks; 2nd to 9th sternites each with a pair of black longitudinal streaks, shorter in anterior segments and gradually becoming very long in posterior segments. (Fig. 32).

**TAILS:** Yellow brown, lateral ones with dark rings throughout, median one with such rings only at distal half.

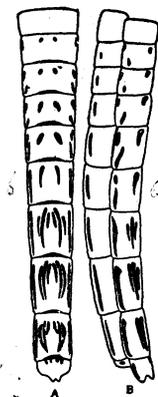


Fig. 32. *Ephemera shengmi* n. sp.  
♂ Abdomen A, dorsal,  
B, lateral. (Original)

**GENITALIA:** Forceps yellowish, distal half of each joint brown, basal segment long, only slightly shorter than the 2nd, second joint subequal the length of the two distal joints together, 3rd joint slightly longer than the distal one. Penial lobes small, separate, narrow, without titillators. (Fig. 33).

♂ Subimago (In alcohol)

**GENERAL COLORATION:** Very similar to the male.

**HOLOTYPE:** One male from Sheng Mi (生米), Kiangsi, collected on June 7, 1930 by W. I. Yang.

**PARATYPES:** 6 ♂ subimagos from Nanchang, Kiangsi, collected on June 18, 1930 by W. I. Yang. All in Yin-chi Hsu's Collection.

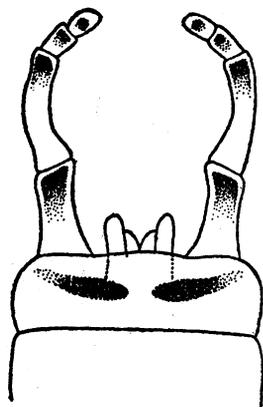


Fig. 33. *Ephemera shengmi* n. sp. ♂ Genitalia ventral (Original)

(To be continued)