

# THE MAYFLIES OF CHINA\*

(ORDER EPHEMEROPTERA)

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## *Ephemera kirinensis* Hsu

1931—Hsu—Peking Nat. Hist. Bull. 6:40.

1935—Wu—Cat. Ins. Sin. 1:247.

1936—Ulmer—Peking Nat. Hist. Bull. 10:203.

*Umanella* (10) *caucaspica* Hsu  
*Umanella kirinensis* (9) 1937, no number  
of *Umanella* Hsu counts.

**MEASUREMENTS:** Length of body ♂ imago 16 mm., ♀ imago 18 mm.; length of wing ♂ imago 13.5 mm., ♀ imago 16 mm.; length of tails ♂ imago 29 mm., ♀ imago 34 mm. ??

### ♂ Imago (In alcohol)

**HEAD:** Brown-ochraceous above. Eyes grayish black, widely separated. Antenna with basal segment armed with a black brown ring both at its distal and basal ends.

**PRONOTUM:** Brown-ochraceous above, with two black brown spots at its anterior margin and two black brown longitudinal streaks running to the posterior margin.

**MESO- AND META- NOTUM:** Brown-ochraceous.

**LEGS:** Fore tibia black-brown, femur vitreous brown, tarsus light gray; mid and hind legs white.

**WINGS:** Greenish brown; fore wing with greenish brown to black brown veins, a longitudinal blotch of dull brown area at the middle from costal margin to the base of outer fork (Of), costal marginal area dull brown, outer marginal area light greenish brown. Hind wing with outer marginal area pale greenish brown. (Fig. 8).

**ABDOMEN:** Light yellowish brown above and light yellow below, with linear longitudinal markings. Details of the abdominal coloration shown in Fig. 12.

**TAILS:** Yellowish brown, with black brown rings at the joints.

**GENITALIA:** Forceps with second joint long and elbow-shaped, twice as long as the distal two joints together; penial lobes small, tittillators large nearly as long as the penial lobes. (Fig. 13).

### ♀ Imago (In alcohol)

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

**LEGS:** Fore leg white, with black brown patches at distal ends of tibia and femur, and basal end of tibia.

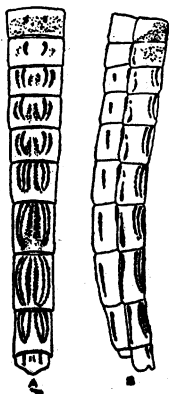


Fig. 12. *Ephemera kirinensis* Hsu. ♂ Abdomen A. dorsal, B. ventral. (Original)

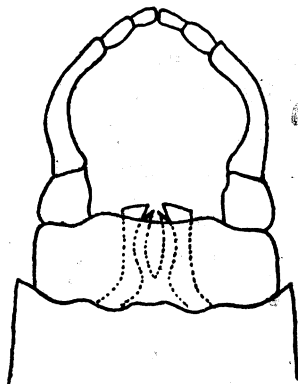


Fig. 13. *Ephemera kirinensis* Hsu. ♂ Genitalia ventral. (Original)

**WINGS** : Vitreous, with black brown cross veins only in the costal marginal area.

**HOLOTYPE** : 1♂ from North Hill, Kirin Province, collected on June 18, 1929 by H. T. Feng, in Nankai University Collection.

**ALLOTYPE** : 1♀ subimago from the same locality and date, by the same collector, and in the same Collection.

**PARATYPES** : 18♂, and 6♀ imago from North Hill, Kirin, collected on June 18, 21, 1929; Kiangnan Garden, Kirin, collected on June 20, 1929, all by H. T. Feng, in Yin-chi Hsu's Collection. Many subimagos collected by S. W. Ling and C. F. Wu from Peiping in Ulmer's Collection.

*Ephemera lineata* Eaton<sup>16</sup>

- 1839—Burmeister—Handb. Entom. II, p. 804 (*lutea*).  
 1843-5—Pictet—Hist. Nat. Ephem. p. 130, t. 7, f. 1-4 (*danica*).  
 1871—Eaton—Trans. Ent. Soc. Lond. p. 1.  
 1871—Eaton—Trans. Ent. Soc. Lond. p. 71, t. 4, f. 7.  
 1883—Eaton—Trans. Linn. Soc. (2) III, p. 63.  
 1909—Klapalek—in Brauer's Susswasserfauna Deuts. VIII, p. 9.  
 1925—Ulmer—Arch. f. Naturg. 91, A (A), p. 86.  
 1935—Wu—Cat. Ins. Sin. 1:247.  
 1936—Ulmer—Peking Nat. Hist. Bull. 10:201.

**MEASUREMENTS** : Length of body ♂ imago 15-20 mm., ♀ imago 21-25 mm.; length of wing ♂ imago 16 mm., ♀ imago 20-21 mm.; length of tails ♂ imago 30 & 35-36 mm., ♀ imago 24 & 26 to 25 & 24 mm., subimago 15 mm.

♂ Imago (In living condition)

**HEAD** : Eyes dark sepia-brown above.

**THORAX** : Pitch-brown above

**LEGS** : Fore leg with the femur piceous, the tibia and tarsus black. Mid and hind legs greenish gray with a black spot on each side of the end of the femur; and with the coxa, the tip and the ends of the tarsal segments black.

**WINGS** : Vitreous, fore wing with blackish gray marginal and submarginal areas, and also the broad apical margin.

**ABDOMEN** : Greenish gray above, modified with bistre brown in the anterior segments, but lutescent in the hinder segments; the segments marked with longitudinal curved or slightly sinuous, black streaks tapering at the ends, the anterior segments each having 2 long streaks on each side of the middle of the back, and the posterior segments each having 2 short lines from the base between the two pairs of the streaks; ventral surface bilineated lengthwise with black.

**TAILS** : Fuscous with black rings at the joints.

<sup>16</sup> Adapted from Eaton, Revis. Monogr. p. 63.

**GENITALIA:** Forceps lutescent. (Fig. 14).

♀ **Imago (In living condition)**

**HEAD:** Yellowish ochraceous, about the ocelli brown-ochraceous, eyes intermediate in color between bistre and sepia brown.

**PRONOTUM:** Greenish gray, with a black longitudinal streak on each side.

**MESO- AND META-NOTUM:** Brown-ochraceous, with two dark longitudinal streaks between the wings.

**LEGS:** Fore leg sepia-brown; distal end of femur, both extremities of tibia, and distal ends of tarsal joints black.

**WINGS:** Vitreous, costal marginal and submarginal areas tinted with greenish gray; longitudinal veins greenish gray, cross veins black.

♂ and ♀ **Subimago (In living condition)**

**WINGS:** Greenish gray, broadly tinted with light gray along its apical margin; cross veins black, some of them in the midst of the fore wing bordered with black-brown so as to give rise to a series of spots.

**MATERIALS:** Many ♂♂, ♀♀, and subimagos from Peiping, Soochow, Hunan, Kiangsi in Ulmer's and Yin-chi Hsu's Collections.

***Ephemera lota* Navás<sup>17</sup>**

1934—Navás—Notes d'Ent. Chinoise (14), p. 6.

1935—Wu—Cat. Ins. Sin. 1:248.

**MEASUREMENTS:** Length of body 13.5 mm., length of fore wing 12 mm., length of hind wing 4 mm., length of tail about 10 mm.

♀ **Subimago (dried)**

**GENERAL COLORATION:** Similar to *E. pيلي* Navás, yellow, upper surface weakly dark.

**HEAD:** Upper surface yellow; eyes black; antennae black, basal segments and tips yellow.

**PRONOTUM:** Strongly transverse, golden yellow, with dark brown longitudinal streaks on the sides, and 2 dark brown spots along anterior margin.

**MESONOTUM:** Underneath fuscus dusky, with a black spot before the insertion of the wing, and with fuscus longitudinal streak in the humeral lobe.

**LEGS:** Yellow, a small dark spot on fore coxa, a larger black spot on hind coxa.

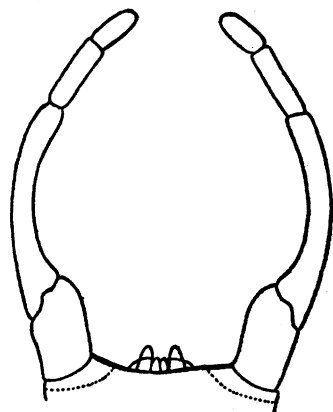


Fig. 14. *Ephemera lineata* Etn. ♂  
Genitalia ventral.  
(Adapted from Ent.)

<sup>17</sup> Adapted from Navás, Notes d' Ent. Chinoise, 1 (14), p. 6 (1934) and redescribed with the type specimen in Musée Heude.

**WINGS:** Weakly yellow colored, reticulation yellow. Fore wing with many black veinlets in costal, subcostal, and radial areas. Hind wing without spots internally, marginal intercalaries weakly forked, membrane hyaline.



Fig. 15. *Ephemera tota*  
Navás. Abdomen dorsal.  
(After Navás)

**ABDOMEN:** Upper surface golden yellow, posterior margin of segments paler, yellow, no transverse dark line in front of the posterior margin; details of the abdominal coloration shown in Fig. 15.

**TAILS:** Golden yellow, with black rings.

**ALLOTYPE:** 1 ♀ Subimago collected by Piel from Loubou on August 12, 1933;

**PARATYPES:** From Kuling July 10, 1935; July 16, 1935, August 6, 1935 by Waong-keh-zeng. In Musée Heude, Shanghai.

***Ephemera media* Ulmer<sup>18</sup>**

1936—Ulmer—Peking Nat. Hist. Bull. 10:204.

**MEASUREMENTS:** Length of body ♂ imago 13 mm., ♀ imago 13-17 mm.; length of wing ♂ imago 11-12 mm., ♀ imago 12-17 mm.

♂ Imago (dried)

**HEAD:** Ochraceous yellow, the surroundings of ocelli blackish.

**PRONOTUM:** In the anterior half ochraceous brown, in the posterior dark yellowish brown with a black longitudinal band on each side.

**MESO- & META- NOTUM:** Dark yellowish brown, only the apex of the latter yellowish.

**LEGS:** Coxa and trochanter of fore leg brownish yellow, femur a little darker with blackish longitudinal lines above, tibia and tarsus smoke-colored with basal and distal ends still darker, tarsal segments somewhat darker. Hind leg ochraceous like the abdomen with only the coxa lighter brownish. The mid coxa dark brown on the outer surface and the hind coxa with a distinct black spot on the outer surface. The femur of fore leg somewhat longer than the second tarsal segment; third tarsal segment only a little shorter than the second segment,  $2\frac{1}{2}$  times as long as the 5th segment, 4th tarsal segment nearly twice, as long as the 5th segment; tibia shorter than the tarsus, somewhat as long as the 1st to 3rd tarsal segments together.

**WINGS:** Fore wing transparent, colorless, only the first two spaces distinctly umber brownish, particularly the apical part and before the large cross veins. Veins of both wings umber brown, only the small veins at the apical border and at the base, and particularly in the anal field of the hind wing being light; in the basal third

the cross veins somewhat thickened, black at the middle and the rest a little rust-brown shaded; in the apical part the cross veins of the subcosta and the radial branches somewhat stronger than the rest; the large cross veins somewhat lighter than the neighboring ones; the bullae and a small spot at the base of the outer fork (of) reddish brown, often still another small spot at the base of the medial space also reddish brown. Hind wing transparent, colorless, the base of costa and subcosta with weak yellowish rings. In the fore wing  $M_2$  united with  $Cu_1$  at base by a short streak, a character known in many other species of this genus. The cross veins in the costal space strongly branched at the pterostigmatic region and united with one another.

**ABDOMEN:** Translucent, ochraceous whitish, the last three segments rust-colored. First and second abdominal tergites all without marks, the rest with distinct marks. Details of the abdominal coloration shown in Fig. 16.

**TAILS:** Ochraceous yellowish; the middle tail with no dark segments, the first five segments only faintly dark ringed, in the following segments brownish black rings being present but almost irregular, from segments 6 to 13 only segments 7, 10, 13 being strongly ringed and the rest unringed, the next 6 or 8 segments being alternately strongly and weakly ringed, all the segments at the distal end being distinctly ringed.

**GENITALIA:** The forceps ochraceous yellowish somewhat brownish, segments weak black, similar to the genitalia of *Ephemera sauteri*, etc., the two distal segments short.

♀ **Imago (dried)**

**GENERAL COLORATION:** Very similar to the male, however somewhat clearer and with more yellow strains on the body.

**HEAD:** Gray yellowish or brownish yellow with a short black longitudinal streak on each side of the dorsal surface behind the eyes.

**PRONOTUM:** Very light, as in ♂ with close longitudinal streaks.

**MESONOTUM:** Likewise light, the lateral furrow above the wing base blackish brown.

**LEGS:** Light yellow to yellow, only both ends of fore leg black and also the claws more or less dark, hind coxa distinctly armed with black spots.

**WINGS:** Fore wing with the membrane of first two spaces lighter than in ♂, more yellowish; the costa, subcosta and radius particularly light, lighter than the rest of the veins, nearly ochraceous colored, the large cross veins also very light.

♂ and ♀ **Subimago (dried)**

**WINGS:** Dull gray brownish, the veins dark gray, only the first longitudinal vein yellowish and the strong cross veins black.

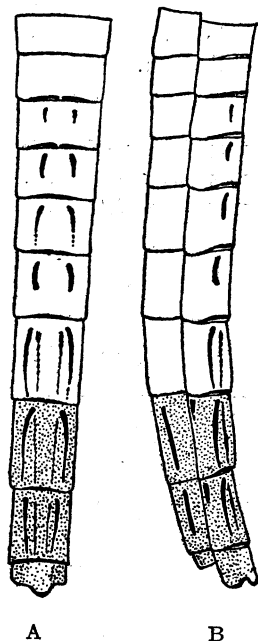


Fig. 16. *Ephemera media*  
Ulmer ♂ Abdomen A,  
dorsal, B. ventral. (After  
Ulmer)

**MATERIALS:** 2♂ from Canton, collected by Mell on June 17, and 27, 1914; 4♀ from Lofaushan (Canton), collected by Mell on June 16 and 19, and July 4, 1914; 1 subimago from Canton, collected by Mell on March 18, 1920; 2♀, 4 subimagos from Canton; 1♀, 1♂ subimago, and 1♀ subimago from Peiping, collected by C. F. Wu. All in Ulmer's Collection.

### *Ephemera pictipennis* Ulmer<sup>19</sup>

1924—Ulmer—Konowia 3:28, f. 1-2.

1925—Ulmer—Arch. f. Naturg. 91 A (5): 93

1935—Wu—Cat. Ins. Sin, I: 248

**MEASUREMENTS:** Length of body ♂ imago 15-20 mm., length of wing ♂ imago 17-20 mm., wing expanse 36-42 mm., length of tails 40-47 mm., middle tail distinctly shorter.

#### ♂ Imago (dried)

**HEAD:** Black above, greater part of the ventral side yellow brown, antennae also entirely yellow brown.

**PRONOTUM:** With black circular ring; middle part yellow brown, this part not quite reaching the anterior margin, but reaching the hind margin, the posterior part somewhat broader than the anterior part; in general similar to *Ephemera purpurata* Ulmer.

**MESONOTUM AND METANOTUM:** Dark pitch brown to pitch black, only the apices of both segments light yellow brown or ochraceous colored. Lateral sides and ventral surface of the thorax black on the heavily chitinized parts, brownish yellow in the furrows and cuticular folds.

**LEGS:** Fore leg with coxa and trochanter yellow brown, coxa with a black longitudinal stripe, femur and tibia somewhat darker more brick colored, apical end of tibia always darker gradually becoming black to the tip, tarsal segments dark brick colored, the first segment and the ends of the other segments black, claws black. Mid and hind legs dirty amber yellow, apical part of femur more brownish, the coxa with black longitudinal streaks. Fore femur somewhat shorter than second tarsal segment; fourth tarsal segment scarcely  $1\frac{1}{2}$  times as long as the fifth, third tarsal segment somewhat  $2\frac{1}{6}$  times as long as the fifth.

**WINGS:** Transparent; veins of fore wing brownish black to black; the wing base and the fine veins of the cubito-anal area lighter, somewhat umber brown; the cross veins in the costal and subcostal areas thickened; these areas dull brown; the entire apical part of the fore wing brown. In the hind wing only the costa, subcosta, and radius black; the remaining veins, especially the apical ones, darker red brown.

**ABDOMEN:** White, often very light ochraceous whitish, with black patterns, all the side lines deep black, details of the abdominal coloration shown in Fig. 17.



Fig. 17. *Ephemera pictipennis* Ulmer.  
♂ Abdomen lateral.  
(After Ulmer)

<sup>19</sup> Adapted from Ulmer. Konowia 3:28, (1924).

**TAILS:** Yellow brown, becoming distinctly ringed with black brown; the middle tail shorter, similar to the lateral ones.

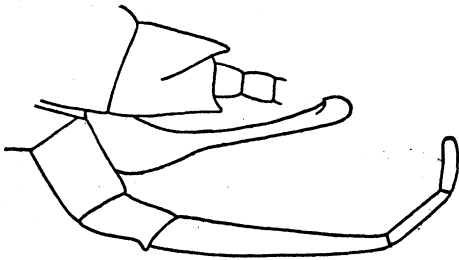


Fig. 19. *Ephemera pictipennis* Ulmer  
♂ Genitalia lateral.  
(After Ulmer)

**GENITALIA:** Forceps with basal segment and basal half of the second segment brownish yellow, the distal half of the second segment and the two distal segments brown black. Penial lobes long and slender; fused at base; with a lateral, short, pointed tooth at the tip. (Figs. 18 & 19).

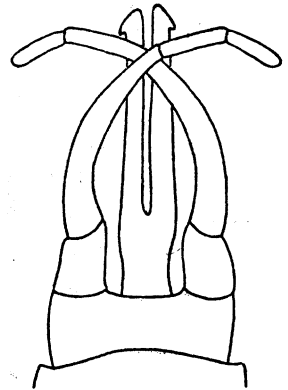


Fig. 18. *Ephemera pictipennis* Ulmer.  
♂ Genitalia ventral. (After Ulmer)

**HOLOTYPE:** 1 ♂ from Shanghai, June 1919, H. Hoene collector.

**PARATYPES:** 1 ♂ from Kuling and 1 ♂ from Mokanshan. Both in Ulmer's Collection.

#### *Ephemera pictiventris* McLachlan<sup>20</sup>

1904—McLachlan—Ann. Mag. Nat. Hist. (6) 13:428.

1925—Ulmer—Arch. f. Naturg. 91, A (5), p. 93.

1929—Ulmer—Deutsch. Ent. Zeitschr. III, p. 162.

1935—Wu—Cat. Ins. Sin. 1:248.

**MEASUREMENTS:** Length of body ♂ imago 15 mm., ♀ imago 14-17 mm.; length of wing ♂ imago 17 mm., ♀ imago 19-22 mm.; wing expanse ♂ imago 35 mm., ♀ imago 39-46 mm.; length of tails ♂ imago 36 mm., ♀ imago 18 mm.

♂ Imago (dried)

**HEAD:** Above and beneath shiny ochraceous yellow.

**PRONOTUM:** Light gray brownish; sides yellow each with a broad, elongate, brown black spot.

**MESO- AND META-NOTUM:** Light rust brown, anterior margin black brown, yellow and black brown on the sides. Mesosternite black brown.

**LEGS:** Fore leg with coxa, trochanter, and base of femur yellow, the apical part reddish brown and rust brown above, the edges pitch black; tibia dark pitch brown or dark rust brown. Mid and hind legs yellow, tarsal segments light brown, claws brown.

**WINGS:** Transparent; in the fore wing the subcostal area light yellowish; pterostigmatic region more gray brownish; bulla of Sc, bulla of sector, and outer fork (Of) each with a small spot of blackish brown color; veins black at base, light yellow in the cubito-anal

<sup>20</sup> Adapted from Ulmer, Deutsch. Ent. Zeitschr. III, p. 162, 1929.

area ; in the pterostigmatic area the cross veins partly united with each other. Hind wings entirely without patterns, veins colored.

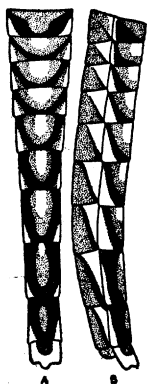


Fig. 20. *Ephemera pictiventris* McLachlan. ♂ Abdomen A. dorsal, B. ventral. (After Ulmer)

**ABDOMEN:** Light above, some parts yellow, some parts reddish transparent with dark background and black patterns. The details of the abdominal coloration shown in Fig. 20.

**TAILS:** Dark rust brown, apical end lighter.

**GENITALIA:** Forceps dark rust brown, second segment lighter and transparent ; the segmentation of the two distal joints indistinct ; first segment short, second segment about  $2\frac{1}{2}$  times as long as the first, third segment  $\frac{2}{3}$  as long as the second, 4th segment shorter than the first. Penial lobes transparent, rust brown; long, narrow, spear-shaped, sharply pointed at the tip, not fused together. (Figs. 21 & 22).

♀ Imago

**HEAD:** Shining yellow, a broad black band connecting the eyes. Antennae with the second and third segments black, the bristle whitish.

**PRONOTUM:** With a broad oblong black spot on each side.

**MESONOTUM:** Shining fuliginous in front ; a black line in the sulcus bordering the raised median portion; a black spot on each side contiguous to the posterior angle of the pronotum; an elongate spot on each side above the base of the

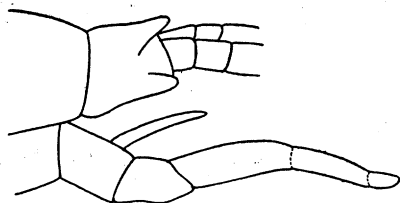


Fig. 22. *Ephemera pictiventris* McLachlan ♂ Genitalia lateral. (After Ulmer)

fore wing ; a curved blackish streak on each side above the mid leg, appearing to be trifid, or quadrifid posteriorly, and with blackish markings above the hind leg.

**LEGS:** Yellow ; fore femur blackish on the edges, the tibia and tarsus entirely black ; mid and hind tarsi dusky.

**WINGS:** Hyaline, iridescent. In the fore wing the subcostal area faintly tinted with yellow ; only a blackish nodal spot on the subcosta, a smaller one below it on the sector, and a third one at the base of the outer fork (of). Veins black, passing into yellowish white at the extreme base and in the cubital region ; the pterostigmatic area with two rows of irregular cellules. Hind wings without markings, the basal portion of the subcosta conspicuously deep black.

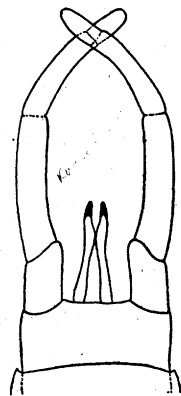


Fig. 21. *Ephemera pictiventris* McLachlan ♂ Genitalia ventral. (After Ulmer)



**ABDOMEN:** Yellow; with black crescent shaped markings, becoming more elliptical on the apical segments as in the subimago, but broader and more intense, the sides of each marking dilated and connected with the oblique black lines on the ventral surface, these lines being more intense and complete.

♀ **Subimago**<sup>21</sup>

**HEAD:** Opaque whitish above, more tinted with yellowish beneath. Eyes black, and connected by a black band. Antennae with the second joint black, those following slightly paler.

**THORAX:** A black line on each side from below the eyes to the base of the fore wing, and a large round-oval black spot below the black line on each side of the mesothorax.

**LEGS:** Yellowish white; fore femur with a dusky line internally, and dusky externally towards the apex; the fore tibia and tarsus dusky, the latter almost blackish; mid and hind tarsi with distal joints dusky.

**WINGS:** Opaque whitish, the costal margin tinted with yellow up to the radius. Venation black, but yellow at the extreme base; the cubital and anal reticulation pale.

**ABDOMEN:** Yellow each segment with a complete crescent-shaped marking above, becoming more elliptical on the posterior segments; ventral surface with an oblique black streak on the sides of each segment, becoming straighter and more parallel on the antepenultimate and penultimate segments. (Fig. 23).

**TAILS:** Black, lateral ones with yellow basal joints, clothed with fuliginous hairs, hairs becoming longer and denser toward the distal end,

**HOLOTYPE:** 1 ♀ from Ta-chien-lu, Szechuen. In McLachlan's Collection.

**PARATYPES:** 1 ♂ from Siao-Lou, Szechuen, 3 ♀ subimagos from Ta-chien-lu, Szechuen, and 1 ♀ subimago from Siao-Lou, Szechuen. All in McLachlan's Collection.

***Ephemera pieli* Navàs**<sup>22</sup>

1934—Navàs—Notes d'Ent. Chinoise, I (14), p. 5.

1935—Wu—Cat. Ins. Sin. I: 248.

**MEASUREMENTS:** Length of body 12 mm., length of fore wing 11.5 mm., length of hind wing 4.5 mm., length of tail about 10 mm.

♂ **Subimago (dried)**

**GENERAL COLORATION:** Yellow. paler beneath.

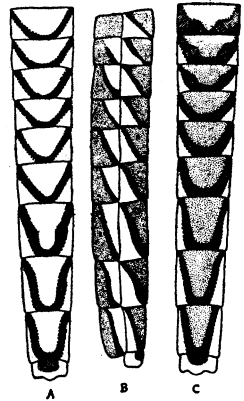


Fig. 23. *Ephemera pictiventris* McLachlan. Abdomen A. subim. dorsal, B. subim. ventral, C. ♀ dorsal. (After Ulmer)

<sup>21</sup> Adapted from McLachlan, Ann. Mag. Nat. Hist. (6) 13:428 (1904).

<sup>22</sup> Adapted from Navàs, Notes d'Ent. Chinoise, I (14), p. 5, (1934), and redescribed with the type specimen in Musée Heude.

**HEAD:** Upper surface dusky; eyes black.

**PRONOTUM:** Transverse, with two dark brown longitudinal lines.

**LEGS:** Yellow, claws black, distal end of fore femur and basal end of tibia black.

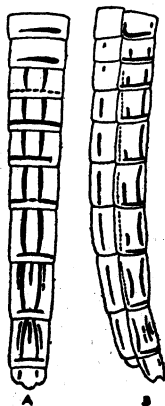


Fig. 24. *Ephemera pieli*  
Navás. Abdomen A.  
dorsal, B. ventral.  
(After Navás)

**WINGS:** Very light yellow, reticulation yellow. Fore wing with numerous black veinlets before media, many of them fuscus edged; others at the middle forming a short ridge; outer fork (of) forked behind; Cu, usually with 5 curved and forked marginal branches. Hind wing usually with two spots at the middle usually joined together beyond the radial sector fork, outer margin umber subfuscus edged.

**ABDOMEN:** Yellowish, tergites with black transverse lines near the posterior margin of each segment, details of the abdominal coloration shown in Fig. 24.

**TAILS:** Yellow, with black rings.

**HOLOTYPE:** 1♂ subimago collected by Piel from Loubou on August 12, 1933. In Musée Heude, Shanghai.

**PARATYPE:** 1♂ subimago collected by Piel from the same locality on Aug. 11, 1933. In Musée Heude, Shanghai.

(To be continued)