



## Ephemeroptera (Insecta) Fauna of Northeast China

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**Abstract** A comprehensive literature review and examination of mayfly materials from Northeast China resulted in the recognition of 65 species, 28 genera, and 12 families of Ephemeroptera. Checklist, original reference sources, larval diagnoses, measurements, materials examined, distributions, and taxonomic remarks are provided. Macro-photos of larval body (dorsal view) and line-drawings of larval key characters are also provided.

**Key words** Mayflies, taxonomy, checklist

### INTRODUCTION

Northeast China, commonly known as Manchuria, is located in 53–41° N in latitude and 121–135° E in longitude, and comprises Heilongjiang, Jilin, and Liaoning provinces. Ephemeroptera fauna from this area has been known by only several literatures. Hsu (1931–32, 1935–36) described two species of mayflies, and Imanishi (1940) reported 19 species of mayflies from this area. Gui (1985) included three species of mayflies from Jilin province in his "Catalogue of the Ephemeroptera of China." You and Gui (1995) included 10 species of mayfly adults from Northeast China. Bae (1997) presented a historical perspective of mayfly systematics in Northeast Asia. Bae and Liu (1999) reported 33 species of mayflies from Changbaishan area in Jilin province. Bae *et al.* (2000) reviewed the species of Northeast Asian Ephemeroptera in Imanishi's 1940 report. Lee *et al.* (2001) reported 30 species of mayflies (excluding 10 undetermined) from Heilongjiang and Jilin provinces.

The purpose of this study is to review and report mayfly fauna from Northeast China based on comprehensive literature review and materials examination.

### MATERIALS AND METHODS

The materials used in this study include specimens of Seoul Women's University Aquatic Insect Collection, Yeungnam University Collection, and materials collected by the authors in 1999 and 2000 from Heilongjiang and Jilin provinces in Northeast China. Since this study has been concerned mainly on the faunistic survey of Ephemeroptera in the area, larval materials have been exclusively sampled and used, but other distributional records previously reported from this area are also included. Larvae were collected by hand nets and preserved in 80%

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**Table 1.** The abbreviations for larval body (mature) measurement used in this study

BL	: Body length
HL	: Head length
HW	: Head width
AL	: Antenna length
EL	: Longitudinal diameter of compound eye
EW	: Cross diameter of compound eye
DE	: Distance between compound eyes
PL	: Pronotum length
PW	: Pronotum width
CL	: Cerci length
TF	: Terminal filament length

Ethanol. The abbreviations used in larval body measurement are as in Table 1.

## TAXONOMIC ACCOUNT

### Family Ameletidae

#### 1. *Ameletus costalis* (Matsumura) (Figs. 1, 83, 109, 140, 189)

*Chimura costalis* Matsumura, 1931: 1474.

*Diagnosis.* Body brown with pale markings. Labrum with V-shaped marking. Abdominal terga with triangular markings.

*Measurement* (mm). BL: 10.2, HW: 1.4, EL: 0.7, EW: 0.5, DE: 0.3, CL: 3.5.

*Materials examined.* **Heilongjiang** Heihe Sijiazhi (5L, 26 VII 1997, YTQ), Yabuli Shishun (26L, 28 VII 1997, YTQ), Mudanjiangshi Liuchun (25L, 29 VII 1997, YTQ), Ninganxian Dongjingchengzhen (14L, 15 VII 2000). **Jilin** Yanjishi Xidong (2L, 3 VIII 2000, YTQ).

*Distribution.* China (Heilongjiang, Jilin), Japan, Korea, Russia.

#### 2. *Ameletus montanus* Imanishi (Figs. 2, 110)

*Ameletus montanus* Imanishi, 1930: 265.

*Diagnosis.* Body brown. Outer canine of right mandible divided into three processes. Abdominal terga 3–7 with round markings. Cerci with broad band.

*Measurement* (mm). BL: 11.0, HL: 2.1, HW: 1.5, EL: 1.0, EW: 0.6, DE: 0.3, CL: 4.1.

*Materials examined.* **Heilongjiang** Mudanjiangshi Liuchun (2L, 29 VII 1997, YTQ). **Jilin** Antu Toudaobaihe (20L, 3 VI 1997, YJB), Antu Eradaobaihe (5L, 3 VI 1997, YJB), Antu Baihe (22L, 2 VI 1997, YJB), Antu Sandao (108L, 2 VI 1997, YJB), Helong (2L, 6 VI 1997, YJB), Helong Qingshanli (29L, 1 VI 1997, YJB), Helong Songxiaping (9L, 1 VI 1997, YJB).

*Distribution.* China (Heilongjiang, Jilin), Japan, Korea.

### Family Baetidae

#### 3. *Acentrella sibirica* (Kazlauskas) (Figs. 3, 82, 97, 126, 127, 159)

*Pseudocloeon sibiricum* Kazlauskas, 1963: 589.

*Diagnosis.* General body color brown. Vertex with irregular symmetrical brown markings. Maxillary palp 2-segmented; terminal segments apically round. Thorax relatively broad. Legs light brown; articulations brown; femora with single row of long setae along posterior margin; tibiae with single row of long setae dorsally; hindtibiae with additional row of short setae along posterior margin. Terga 1-8 with paired brown spots. Gills 1-7 oval. Terminal filament rudimentary.

*Measurement* (mm). ♂: BL: 3.8, HL: 0.7, HW: 0.92, EL: 0.22, EW: 0.17, DE: 0.62, CL: 2.8. ♀: BL: 3.7, HL: 0.6, HW: 0.8, AL: 1.0, EL: 3.8, EW: 0.17, DE: 0.45, CL: 2.7.

*Materials examined.* Heilongjiang Harbin Chenggaozi (4L, 4 VII 2000, YTQ), Ninganxian Dongjingchengzhen (3L, 15 VII 2000, YTQ).

*Distribution.* China (Heilongjiang), Japan, Korea, Russia.

#### 4. *Baetis fuscatus* (Linnaeus) (Figs. 4, 128, 129, 160, 177)

*Ephemera fuscata* Linnaeus, 1761 No. 1477.

*Diagnosis.* Body brown. Maxillary palp segments 3 not clearly articulated. Terminal segments of labial palp with many hairlike setae. Abdominal terga 2-8 with paired opaque dark spots. Terminal filament well developed.

*Measurement* (mm). ♀: BL: 6.0, HL: 1.1, HW: 0.85, AL: 2.0, EL: 0.37, EW: 0.2, DE: 2.0, CL: 2.5.

*Materials examined.* Jilin Yanjishi Xiaowudao (2L, 27 VII 1997, YTQ), Yanji (63L, 6 VI 1997, YJB).

*Distribution.* China (Heilongjiang, Jilin, Liaoning), Japan, Korea, Mongolia, Russia.

#### 5. *Baetis pseudothermicus* Kluge (Figs. 5, 56, 57, 84, 111, 112, 178)

*Baetis pseudothermicus* Kluge, 1983a: 53.

*Diagnosis.* Body light brown. Apical teeth of mandibles without denticle on outer margin. Maxillary palp with spinule on apex. Abdominal terga 3-4 and 6-8 darker. Gills 1-7 with distinct tracheae. Terminal filament well developed.

*Measurement* (mm). BL: 7.0, HL: 1.3, HW: 1.3, AL: 2.5, EL: 0.5, EW: 0.7, DE: 0.3, CL: 4.5, TF: 3.0.

*Materials examined.* Heilongjiang Daweniuhe (1L, 26 VII 1997, YTQ), Hailinshi Pinghe (4L, 28 VII 1997, YTQ), Harbin (3L, 29 VII 1997, YTQ), Harbin Chenggaozi (7L, 4 VII 2000, YTQ), Ninganxian Dongjingchengzhen (23L, 15 VII 2000, YTQ), Jilin Yanjishi Xidong (64L, 3 VIII 2000, YTQ) Antu Toudaobaihe (46L, 3 VI 1997, YJB), Antu Eradaobaihe (88L, 3 VI 1997, YJB), Antu Baihe (16L, 2 VI 1997, YJB), Antu Sandao (163L, 1 VI 1997, YJB), Helong (1L, 6 VI 1997, YJB), Wolong Xianfeng (100L, 6 VI 1997, YJB), Helong Qingshanli (12L, 1 VI 1997, YJB).

*Distribution.* China (Heilongjiang, Jilin), Korea, Russia.

#### 6. *Baetiella tuberculata* (Kazlauskas) (Fig. 6)

*Pseudocloeon (Baetiella) tuberculatum* Kazlauskas, 1963: 583.

*Diagnosis.* Body brown. Vertex with 3-4 pairs of symmetrical brown markings. Maxillary palp 2-segmented. Pronotum with 2 pairs of dark brown markings medially. Legs articulations brown. Claws brown with denticles and paired long terminal setae. Terminal filament rudimentary.

*Measurement* (mm). ♂: BL: 4.25, HL: 0.8, HW: 0.9, AL: 1.5, EL: 0.5, EW: 0.35, DE: 0.25,

CL: 4.1. ♀: BL: 5, HL: 0.7, HW: 0.8, EL: 0.3, EW: 0.2, DE: 0.38, CL: 4.5.

*Materials examined.* **Heilongjiang** Hailinshi Sanbuluo (27L, 28 VII 1997, YTQ), Shangzhishi Maorshanzhen (5L, 4 VI 1999, YTQ), Mudanjiangshi Liuchun (17L, 29 VII 1997, YTQ), Ninganxian Dongjingchengzhen (36L, 15 VII 2000, YTQ). **Jilin** Yanjishi Xiaowudao (6L, 27 VII 2000; 12L, 30 VII 2000, YTQ).

*Distribution.* China (Heilongjiang, Jilin), Korea, Russia.

#### 7. *Cloeon dipterum* (Linnaeus) (Figs. 7, 58, 183)

*Ephemera diptera* Linnaeus, 1761, No. 1477.

*Diagnosis.* Body brown. Claws with two rows of well developed denticles. Gills 1–6 paired; gills 7 single. Posterior margin of abdominal segment 10 round.

*Measurement* (mm). BL: 4.1, HL: 1.1, HW: 3.4, AL: 2.0, EL: 0.35, EW: 0.32, DE: 0.3, CL: 4.1.

*Materials examined.* **Heilongjiang** Mudanjiangshi Liuchun (2L, 29 VII 1997, YTQ).

*Distribution.* China (Heilongjiang, Jilin, Liaoning), Japan, Korea, Mongolia, Russia.

#### 8. *Procloeon pennulatum* (Eaton) (Figs. 8, 60, 64, 85, 113, 162, 208)

*Centroptilum pennulatum* Eaton, 1870: 2.

*Diagnosis.* Body brown. Claws with two rows of rudimentary denticles basally, with terminal hair. Gills 1–6 paired; gills 7 single. Posterior margin of abdominal segment 10 straight.

*Measurement* (mm). BL: 7.5, HL: 1.1, HW: 1.0, AL: 5.0, EL: 0.32, EW: 0.25, DE: 0.2, CL: 2.5.

*Materials examined.* **Heilongjiang** Hailinshi Pinghe (3L, 28 VII 1997, YTQ). **Jilin** Yanji (3L, 6 VI 1997, YJB).

*Distribution.* China (Heilongjiang, Jilin), Korea, Russia.

### Family Caenidae

#### 9. *Brachycercus* YUa (Figs. 9, 114, 141, 184, 190)

*Diagnosis.* Body light yellow. Head with three projections. Prothorax with sublateral tubercles. Legs slender, with hair-like setae. Abdominal segment 2–9 with posterolateral projections; posterolateral projections 8–9 distinct. Caudal filaments light yellow, with whorls of setae at end of each segment.

*Measurement* (mm). BL: 6.4, HW: 1.2, AL: 1.5, EL: 0.35, EW: 0.32, DE: 0.8, CL: 3.2, TF: 3.8.

*Materials examined.* **Heilongjiang** Sijiazhi (1L, 26 VII 1997, YTQ), Shangzhishi Maorshanzhen (1L, 4 VI 1999, YTQ), Harbin (1L, 29 VII 1999, YTQ).

*Distribution.* China (Heilongjiang).

*Remarks.* This species is distinguished from *Brachycercus tubulatus* Tshernova by the prothorax tubercles and posterolateral projections on the abdominal segments 8–9.

#### 10. *Caenis nishinoae* Malzacher

*Caenis* nb: Imanishi, 1940: 212.

*Caenis nishinoae* Malzacher, 1996: 1.

*Diagnosis.* Body yellowish brown, with dark brown markings. Head with W-shaped black

marking. Legs light, with yellowish brown bands; claws simple.

*Measurement* (mm). BL: 4, HL: 0.7, HW: 0.85, AL: 2, EW: 0.25, DE: 0.45, CL: 3.7.

*Materials examined*. Jilin Yanjishi Yanxiqiao (1L, 2 VIII 2000, YTQ), Yanjishi Xidong (2L, 3 VIII 2000, YTQ).

*Distribution*. China (Jilin, Liaoning), Korea, Japan.

*Remarks*. Imanishi (1940) reported *Caenis* nb from Liaoning province. *Caenis* nb was later associated with *Caenis nishinoae* Malzacher by Hwang and Bae (1999).

#### 11. *Caenis na* (Figs. 10, 138, 139, 161, 191)

*Caenis na*: Imanishi, 1940: 211.

*Diagnosis*. Body brown, with tiny light spots throughout dorsal body. Head with web-like markings. Basal and second antennal segments dark brown. Pronotum with large and acute anterolateral processes. Legs and cerci with brown band.

*Measurement* (mm). BL: 6.4, HL: 1.0, HW: 1.4, AL: 3.0, EL: 0.35, EW: 0.27, DE: 1.0, CL: 6.5.

*Materials examined*. Heilongjiang Sijiazhi (5L, 26 VII 1997, YTQ), Harbin (7L, 29 VII 1997, YTQ). Jilin Yanjishi Yanxiqiao (5L, 2 VIII 2000, YTQ), Yanjishi Xidong (41L, 3 VIII 2000, YTQ).

*Distribution*. China (Liaoning), Korea.

#### 12. *Caenis nc*

*Caenis nc*: Imanishi, 1940: 214.

*Materials examined*. Not available.

*Locality*. Heilongjiang Hailaerhaishuihe (Imanishi, 1940).

*Distribution*. China (Heilongjiang).

### Family Ephemerellidae

#### 13. *Cincticostella levanidovae* (Tshernova) (Figs. 11, 52, 63, 62, 86, 115, 116, 142, 163)

*Ephemerella levanidovae* Tshernova, 1952: 274.

*Diagnosis*. Body brown. Head without occipital tubercles; genae truncate. Maxillae with well developed palp. Thoracic nota without tubercles or ridges. Abdominal terga 5–8 with well developed tubercles. Caudal filaments with stout setae on every segment.

*Measurement* (mm). BL: 9.6, HL: 1.5, HW: 1.7, AL: 2.25, EL: 1, EW: 0.8, DE: 1.1, CL: 6.5.

*Materials examined*. Heilongjiang Heihe Xingfuxiang (5L, 26 VII 1997, YTQ), Sijiazhi (10L, 26 VII 1997, YTQ), Hailinshi Pinghe (4L, 28 VII 1997, YTQ), Hailinshi Sanbuluo (7L, 28 VII 1997, YTQ), Hailinshi Shunqiao (26L, 28 VII 1997, YTQ), Yanshouxian Yanhe (5L, 6 VI 1999, YTQ), Mudanjiangshi Liuchun (11L, 29 VII 1997, YTQ), Ninganxian Dongjingchengzhen (15L, 15 VII 2000, YTQ). Jilin Yanjishi Xiaowudao (14L, 30 VI 2000, YTQ), Yanjishi Xidong (41L, 3 VIII 2000, YTQ), Antu Toudaobaihe (12L, 3 VI 1997, YJB), Antu Sandao (10L, 1 VI 1997, YJB), Antu Sidaobaihe (1L, 1 VI 1997, YJB), Wolong (1L, 6 VI 1997, YJB).

*Distribution*. China (Heilongjiang, Jilin), Japan, Korea, Russia.

#### 14. *Cincticostella tshernovae* Bajkova (Figs. 12, 59, 65, 66, 117, 143, 164, 185, 192, 193)

*Cincticostella tshernovae* Bajkova, 1962: 203.

*Diagnosis.* Body reddish brown to dark brown with purple to blackish purple markings. Abdominal terga 5–9 with large paired submedian tubercles, with short heavy setae. Caudal filaments less than one-half body length.

*Measurement* (mm). BL: 10.3, HL: 2.0, HW: 2.4, AL: 2.7, EL: 0.65, EW: 0.5, DE: 1.5, CL: 5.0.

*Materials examined.* **Jilin** Yanjishi Xiaowudao (3L, 30 VI 2000, YTQ), Hailinshi Pinghe (2L, 28 VII 1997, YTQ).

*Distribution.* China (Jilin), Japan, Korea, Russia.

### 15. *Drunella aculea* (Allen)

*Ephemerella basalis* Na: Imanishi, 1940: 196.

*Materials examined.* Not available.

*Locality.* **Jilin** Antu Eradaobaihe (Bae and Liu, 1999), Antu baihe (Bae and Liu, 1999), Antu Sandao (Bae and Liu, 1999), Helong, Wolong (Bae and Liu, 1999), Helong Songxiaping (Bae and Liu, 1999).

*Distribution.* China (Jilin), Korea, Russia.

### 16. *Drunella cryptomeria* (Imanishi) (Figs. 13, 119, 194)

*Ephemerella cryptomeria* Imanishi, 1937a: 328.

*Diagnosis.* Body brown. Head with three long clypeal tubercles. Frontal clypeal edge notched. Forefemora dorsally with distinct ridges. Tarsal claw with three denticles. Abdominal terga 2–7 with paired pale projection. Caudal filaments with whorls of setae at end of each segment.

*Measurement* (mm). ♂: BL: 8.5, HL: 1.3, HW: 0.9, AL: 1.2, EL: 0.7, EW: 0.6, DE: 1.7, CL: 2.5, TF: 2.7. ♀: BL: 10.8, HL 1.5, HW: 2.1, EL: 0.7, EW: 0.5, DE: 1.0, CL: 5.5, TF: 5.8.

*Materials examined.* **Heilongjiang** Hailinshi Sanbuluo (11L, 28 VII 1997, YTQ), Hailinshi Shunqiao (4L, 28 VII 1997, YTQ). **Jilin** Yanjishi Xiaowudao (7L, 30 VII 2000, YTQ), Antu Baihe (7L, 2 VI 1997, YJB), Antu Sandao (12L, 1 VI 1997, YJB), Helong (2L, 6 VI 1997, YJB), Wolong (1L, 6 VI 1997, YJB), Helong Songxiaping (32L, 1 VI 1997, YJB), Helong Songxiaping (8L, 1 VI 1997, YJB).

*Distribution.* China (Heilongjiang, Jilin), Japan, Korea, Russia.

### 17. *Drunella fusongensis* Su and Gui

*Drunella fusongensis* Su and Gui, 1995: 451.

*Materials examined.* Not available.

*Locality.* **Jilin** Fusongxian (Su and Gui, 1995).

*Distribution.* China (Jilin).

*Remarks.* Su and Gui (1995) described adult of this species from Jilin province.

### 18. *Drunella lepnevae* (Tshernova) (Figs. 14, 67, 121, 122, 144)

*Ephemerella lepnevae* Tshernova, 1949: 152.

*Diagnosis.* Body brown or light brown. Head without clypeal tubercles, with paired occipital tubercles. Anterior margin of forefemora with small denticles. Abdominal terga 2–9 with paired pale tubercle. Caudal filaments with row of dense dorsal setae and whorls of setae at each segment.

*Measurement* (mm). BL: 9.0, HL: 2.1, HW: 2.2, AL: 1.5, EL: 1.1, EW: 0.8, DE: 0.85, CL: 8.0, TF: 9.0.

*Materials examined.* **Heilongjiang** Hailinshi Sanbuluo (3L, 28 VII 1997, YTQ). **Jilin** Antu Toudaobaihe (3L, 3 VI 1997, YJB), Antu Eradaobaihe (18L, 3 VI 1997, YJB), Antu Baihe (261L, 2 VI 1997, YJB), Antu Sandao (2L, 1 VI 1997, YJB), Helong Songxiaping (1L, 1 VI 1997, YJB).

*Distribution.* China (Heilongjiang, Jilin), Korea, Mongolia, Russia.

**19. *Drunella solida* (Bajkova)** (Figs. 15, 45, 68, 100, 118, 145, 165, 195, 196)

*Ephemerella solida* Bajkova, 1980: 74.

*Diagnosis.* Body brown, with distinct light markings. Head with three frontal tubercles; clypeal margin round. Forefemora with frontal spines, without dorsal ridges; tibiae and tarsi with one broad transverse stripe.

*Measurement* (mm). BL: 12.4, HL: 1.6, HW: 2.6, EL: 0.8, EW: 0.7, DE: 1.1, CL: 8.0.

*Materials examined.* **Jilin** Yanjishi Xiaowudao (1L, 27 VI 1999, YTQ), Antu Sandao (1L, 1 VI 1997, YJB).

*Distribution.* China (Jilin), Korea, Russia.

**20. *Drunella triacantha* (Tshernova)**

*Ephemerella trispina* na: Imanishi, 1940: 193.

*Ephemerella triacantha* Tshernova, 1949: 151.

*Materials examined.* Not available.

*Locality.* **Jilin** Antu Baihe (Bae and Liu, 1999).

*Distribution.* China (Jilin), Japan, Korea, Mongolia, Russia.

**21. *Ephacera longicaudata* (Uéno)**

*Ephemerella longicaudata* Uéno, 1928: 42.

*Ephacera longicaudata* (Uéno): Paclt, 1994: 283.

*Materials examined.* Not available.

*Locality.* **Heilongjiang** (You and Gui, 1995).

*Distribution.* China (Heilongjiang, Jilin, Liaoning), Japan, Korea, Russia.

**22. *Ephemerella antuensis* Su and You**

*Ephemerella* (*Ephemerella*) *antuensis* Su and You, 1989: 181.

*Materials examined.* Not available.

*Locality.* **Jilin** Antuxian (You and Gui, 1995).

*Distribution.* China (Heilongjiang, Jilin).

*Remarks.* Su and You (1989) described adult of this species from Jilin province.

**23. *Ephemerella aurivillii* (Bengtsson)** (Fig. 16)

*Chitonophora aurivillii* Bengtsson, 1909: 8.

*Diagnosis.* Body color brown or dark brown. Head without frontal tubercles. Abdominal terga without tubercle, with light longitudinal stripes. Caudal filaments with whorls of setae and lateral setae.

*Measurement* (mm). BL: 12.0, HL: 1.8, HW: 2.0, AL: 3, EL: 0.5, EW: 0.4, DE: 1.2, CL: 7.5.

*Materials examined.* Jilin Antu Eradaobaihe (5L, 3 VI 1997, YJB), Antu Baihe (10L, 2 VI 1997, YJB), Antu Sandao (5L, 1 VI 1997, YJB), Helong (18L, 6 VI 1997, YJB), Wolong Xianfeng (1L, 6 VI 1997, YJB), Helong Qingshanli (20L, 1 VI 1997, YJB), Helong Songxiaping (2L, 1 VI 1997, YJB).

*Distribution.* China (Jilin), Japan, Korea, Mongolia, Russia.

#### 24. *Ephemerella changbaishanensis* Su and You

*Ephemerella changbaishanensis* Su and You, 1988: 63.

*Materials examined.* Not available.

*Locality.* Jilin Antuxian, Fushongxian (You and Gui, 1995).

*Distribution.* China (Jilin)

*Remarks.* Su and You (1988) described adult of this species from Jilin province.

#### 25. *Ephemerella dentata* Bajkova (Figs. 17, 53, 69, 87, 101, 197)

*Ephemerella dentata* Bajkova, 1967: 331.

*Diagnosis.* Body light brown. Head without frontal tubercles. Forefemora with subapical row of stout setae. Abdominal terga with moderately developed submedian tubercles. Caudal filaments with whorls of setae and lateral setae.

*Measurement* (mm). ♂: BL: 6.0, HL: 0.8, HW: 1.4, AL: 3.5, EL: 0.5, EW: 0.7, DE: 0.2, CL: 4.5, TF: 4.8. ♀: BL: 6.7, HL: 1.2, HW: 1.6, AL: 2.1, EL: 0.5, EW: 0.3, DE: 0.8, CL: 4.7.

*Materials examined.* Heilongjiang Hulan (13L, 23 VII 1999, YTQ), Yabuli Shishun (8L, 28 VII 1997, YTQ), Hailinshi Pinghe (61L, 28 VII 1997, YTQ), Shangzhishi Maorshanzhen (60L, 4 VI 1999, YTQ), Mudanjiangshi Liuchun (25L, 29 VII 1997, YTQ). Jilin Yanjishi Xiaowudao (32L, 27 VI 1999, YTQ), Yanjishi Yanxiqiao (4L, 2 VIII 2000, YTQ), Antu Toudaobaihe (2L, 3 VI 1997, YJB), Antu Baihe (11L, 2 VI 1997, YJB), Antu Sandao (234L, 1 VI 1997, YJB), Antu Sidaobaihe (7L, 1 VI 1997, YJB), Helong (1L, 6 VI 1997, YJB), Wolong (25L, 6 VI 1997, YJB), Helong Songxiaping (138L, 1 VI 1997, YJB), Yanji (1L, 6 VI 1997, YJB).

*Distribution.* China (Heilongjiang, Jilin), Russia.

#### 26. *Ephemerella fusongensis* Su and You

*Ephemerella fusongensis* Su and You, 1988: 64.

*Materials examined.* Not available.

*Locality.* Jilin Fushongxian (You and Gui, 1995).

*Distribution.* China (Jilin).

*Remarks.* Su and You (1988) described adult of this species from Jilin province.

#### 27. *Ephemerella kozhovi* Bajkova (Figs. 18, 120, 146, 166, 198, 199, 200)

*Ephemerella kozhovi* Bajkova, 1967: 327.

*Diagnosis.* Body brown with broad traverse bands across basal part of wingpads and on abdominal terga 5–6. Head and thorax without distinct humps. Abdominal tergum 2–9 with rudimentary tubercles. Caudal filaments with whorls of setae and lateral setae.

*Measurement* (mm). ♂: BL: 7.5, HL: 1.3, HW: 1.6, AL: 1.7, EL: 0.75, EW: 0.7, DE: 0.65.



CL: 3.8. ♀: BL: 7.6, HL: 1.4, HW: 1.5, AL: 1.8, EL: 0.55, EW: 0.35, DE: 0.8, CL: 4.0.

*Materials examined.* Heilongjiang Yabuli Shishun (4L, 28 VII 1997, YTQ). Jilin Antu Eradaobaihe (2L, 3 VI 1997, YJB), Antu Baihe (8L, 2 VI 1997, YJB).

*Distribution.* China (Heilongjiang), Korea, Russia.

**28. *Serratella setigera* (Bajkova) (Fig. 19)**

*Ephemerella setigera* Bajkova, 1967: 333.

*Diagnosis.* Body brown with dark markings. Head and thorax without distinct tubercles. Abdominal terga 3-9 with paired tubercles. Caudal filaments with whorls of setae, without lateral setae, with dark bands on alternate segments.

*Measurement* (mm). BL: 6.0, HL: 0.9, HW: 1.25, AL: 1.5, EL: 0.5, EW: 0.4, DE: 0.5, CL: 3.1.

*Materials examined.* Heilongjiang Hailinshi Pinghe (9L, 28 VII 1997, YTQ), Mudanjiangshi Liuchun (6L, 29 VII 1997, YTQ). Jilin Yanjishi Xiaowudao (3L, 30 VI 2000).

*Distribution.* China (Heilongjiang, Jilin), Russia.

**29. *Serratella zapekinae* (Bajkova) (Figs 20, 70, 88, 123, 186, 201)**

*Ephemerella zapekinae* Bajkova, 1967: 329.

*Diagnosis.* Body brown. Head and thorax with dark tiny marking. Abdominal terga 3-8 with paired tubercles. Caudal filaments with whorls of setae, without lateral setae, without dark bands.

*Measurement* (mm). ♂: BL: 6.2, HL: 1.3, HW: 1.6, AL: 2.0, EL: 0.7, EW: 0.65, DE: 0.6, CL: 5.2. ♀: BL: 5.75, HL: 1.2, HW: 1.25, AL: 1.9, EL: 0.4, EW: 0.25, DE: 0.8, CL: 5.0.

*Materials examined.* Heilongjiang Sijiazhi (2L, 26 VII 1997, YTQ).

*Distribution.* China (Heilongjiang), Russia.

**30. *Uracanthella rufa* (Imanishi) (Figs 21, 71, 102, 124, 125, 147, 167, 187)**

*Ephemerella rufa* Imanishi, 1937a: 327.

*Diagnosis.* Body brown with light paired longitudinal stripes along dorsal body. Mandibles large. Abdominal terga without tubercles. Caudal filaments with whorls of setae and lateral setae.

*Measurement* (mm). ♂: BL: 5.9, HL: 1.45, HW: 1.4, CL: 3.2. ♀: BL: 6.0, CL: 3.0, HW: 1.35, HL: 1.4, AL: 1.5, EW: 0.2, EL: 0.4, DE: 0.9.

*Materials examined.* Heilongjiang Heihe Xingfuxiang (37L, 26 VII 1997, YTQ), Hailinshi Pinghe (3L, 28 VII 1997, YTQ), Shangzhishi Maorshanzhen (21L, 4 VI 1999, YTQ), Ning-anxian Dongjingchengzhen (31L, 15 VII 2000, YTQ).

*Distribution.* China (Heilongjiang), Korea, Mongolia, Russia.

**Family Ephemeridae**

**31. *Ephemerella kirinensis* Hsu**

*Ephemerella kirinensis* Hsu, 1931: 40.

*Materials examined.* Not available.

*Locality.* Jilin (You and Gui, 1995).

*Distribution.* China (Jilin).

*Remarks.* Hsu (1931) described adult of this species from Jilin province.

**32. *Ephemera orientalis* McLachlan (Fig. 22)**

*Ephemera orientalis* McLachlan, 1875: 167.

*Diagnosis.* Body color light yellow to light brown. Abdominal tergum 7-9 with paired three-lined stripes.

*Measurement* (mm). ♀: BL: 18.0, HL: 1.8, HW: 1.7, AL: 5.5, EL: 0.75, EW: 0.7, DE: 0.95, PL: 3.2, PW: 4.3, CL: 5.4 TF: 5.7.

*Materials examined.* **Heilongjiang** Hulan (1L, 23 VII 1999, YTQ), Ninganxian Dongjingchengzhen (5L, 15 VII 2000, YTQ). **Jilin** Yanjishi Yanxiqiao (1L, 2 VIII 2000, YTQ).

*Distribution.* China (Heilongjiang, Jilin, Liaoning), Japan, Korea, Mongolia, Russia.

**33. *Ephemera sachalinensis* Matsumura**

*Ephemera sachalinensis* Matsumura, 1911: 9.

*Materials examined.* Not available.

*Locality.* **Heilongjiang** Xiaoxinganling (You and Gui, 1995).

*Distribution.* China (Heilongjiang, Jilin, Liaoning), Korea, Russia.

*Remarks.* You and Gui (1995) reported adult of this species from Heilongjiang province.

**34. *Ephemera separigata* Bae (Fig. 23)**

*Ephemera separigata* Bae, 1995: 160.

*Diagnosis.* Body color light yellow to light brown. Abdominal tergum 7-9 with relatively narrow lateral stripes.

*Measurement* (mm). BL: 21.0, HL: 2.6, HW: 2.6, AL: 6.7, EL: 0.8, EW: 0.9, DE: 1.6, CL: 10

*Materials examined.* **Jilin** Antu Baihe (10L, VI 1997, YJB), Antu Sandao (10L, VI 1997, YJB).

*Distribution.* China (Jilin), Korea.

**35. *Ephemera strigata* Eaton (Figs. 24, 72, 148, 168, 209)**

*Ephemera strigata* Eaton, 1892: 302.

*Diagnosis.* Body light yellow or light brown. Abdominal tergum 7-9 with relatively broad sublateral stripes.

*Measurement* (mm). ♂: BL: 6.5, HL: 0.6, HW: 0.65, AL: 3.7, EL: 0.4, EW: 0.5, DE: 0.7, CL: 2.2. ♀: BL: 9.7, HL: 1.0, HW: 1.1, EL: 0.6, EW: 0.7, DE: 0.85, CL: 3.5, TF: 4.5.

*Materials examined.* **Heilongjiang** Sijiazhi (1L, 26 VII 1997, YTQ), Hailinshi Pinghe (1L, 28 VII 1997, YTQ). **Jilin** Antu Baihe (3L, VI 1997 YJB).

*Distribution.* China (Heilongjiang, Jilin), Japan, Korea, Mongolia, Russia.

**Family Heptageniidae**

**36. *Cinygmula brunnea* Tiunova (Fig. 25)**

*Cinygmula brunnea* Tiunova, 1990: 814.

*Diagnosis.* Body brown. Head dark brown. Legs yellowish brown, with dark markings.

Abdominal terga 2-5 with light paired markings. Caudal filaments brown, basally somewhat lighter.

*Measurement* (mm). BL: 13.0, HL: 2.2, HW: 3.2, AL: 3. EL: 1.2, EW: 0.8, DE: 1.1, CL: 11.0.

*Materials examined.* **Jilin** Helong Qingshanli (25L, VI 1997, YJB), Wolong Xianfeng (10L, 6 VI 1997, YJB), Antu Eradaobaihe (4L, 3 VI 1997, YJB), Antu Sandao (95L, VI 1997, YJB) Antu Baihe (3L, VI 1997, YJB), Antu Sandao (10L, VI 1997, YJB), Wolong Xianfeng (16L, 6 VI 1997, YJB), Helong Qingshanli (25L, VI 1997, YJB).

*Distribution.* China (Jilin), Russia.

**37. *Cinygmula hirasana* (Imanishi)** (Figs. 26, 46, 54, 73)

*Cinygmula hirasana* Imanishi, 1935: 214.

*Diagnosis.* Body brown. Thorax with distinct median light line and two light small spots on each side of the scutellum. Femora apically with light longitudinal markings. Abdominal terga 2-9 with light triangular markings.

*Measurement* (mm). BL: 9.2, HL: 2.0, HW: 2.6, AL: 2.5, EL: 0.8, EW: 0.6, DE: 0.8, CL: 9.0.

*Materials examined.* **Heilongjiang** Heihe Xingfuxiang (5L, 26 VII 1997, YTQ), Heihe Jinhongchang (3L, 26 VII 1997, YTQ), Sijiazhi (2L, 26 VII 1997, YTQ), Shangzhishi Maorshanzhen (8L, 4 VI 1999, YTQ). **Jilin** Yanjishi Xiaowudao (12L, 27 VII 2000, YTQ), Yanjishi Xiaowudao (20L, 27 VII 2000, YTQ), Yanjishi Xiaowudao (42L, 30 VI 2000, YTQ). Antu Toudaobaihe (3L, 3 VI 1997, YJB), Antu Eradaobaihe (35L, 3 VI 1997, YJB), Antu Baihe (29L, VI 1997, YJB), Antu Sandao (108L, VI 1997, YJB), Wolong Xianfeng (35L, 6 VI 1997, YJB), Wolong (11L, 6 VI 1997, YJB), Helong Qingshanli (25L, VI 1997, YJB), Helong Songxiaping (7L, VI 1997, YJB).

*Distribution.* China (Heilongjiang, Jilin), Japan, Korea, Russia.

**38. *Cinygmula kurenzovi* (Bajkova)** (Fig. 27)

*Cinygmula kurenzovi* Bajkova, 1965: 301.

*Diagnosis.* Body color light yellowish brown, with brown markings. Labrum semicircular, reddish brown. Pronotum lateral margin hyaline, with Z-shape light stripes. Abdominal terga 2-9 with pair light spots. Gills white, with dark brown marking.

*Measurement* (mm). BL: 9.5, HL: 1.4, HW: 2.2, AL: 1.5, EL: 0.7, EW: 0.5, DE: 0.7, CL: 7.0, TF: 8.0.

*Materials examined.* **Jilin** Antu Toudaobaihe (2L, 3 VI 1997, YJB), Antu Eradaobaihe (18L, 3 VI 1997, YJB), Antu Baihe (15L, VI 1997, YJB), Antu Sandao (50L, VI 1997, YJB), Wolong Xianfeng (18L, 6 VI 1997, YJB), Wolong (6L, 6 VI 1997, YJB), Helong Qingshanli (13L, VI 1997, YJB), Helong Songxiaping (4L, VI 1997, YJB).

*Distribution.* China (Heilongjiang), Korea, Russia.

**39. *Cinygmula levanidovi* Tshernova and Belov** (Fig. 28)

*Cinygmula levanidovi* Tshernova and Belov, 1982: 193.

*Diagnosis.* Body color light brown with light or brown markings. Head yellowish brown; middle of anterior margin with a pit. Pronotum light yellowish brown, with median longitudinal stripes. Forelegs with light yellowish brown markings; posterior margin with hairlike setae. Gills white.

*Measurement* (mm). BL: 7.5, HL: 1.8, HW: 2.0, AL: 1.5, EL: 0.7, EW: 0.4, DE: 0.7, CL: 7.0, TF: 7.5.

*Materials examined.* **Jilin** Antu Toudaobaihe (1L, 3 VI 1997, YJB), Antu Eradaobaihe (9L, 3 VI 1997, YJB), Antu Baihe (8L, VI 1997, YJB), Antu Sandao (28L, VI 1997, YJB), Wolong Xianfeng (9L, 6 VI 1997, YJB), Wolong (3L, 6 VI 1997, YJB), Helong Qingshanli (7L, VI 1997, YJB), Helong Songxiapiang (2L, VI 1997, YJB).

*Distribution.* China (Jilin), Russia.

**40. *Ecdyonurus dracon* Kluge** (Figs. 29, 74, 89, 103, 130, 131, 150, 169, 179)

*Ecdyonurus dracon* Kluge, 1983b: 27.

*Diagnosis.* Body brown to dark brown. Frontal area of head without marking. Abdominal terga 4–5, 8–9 with U-shaped marking. Caudal filaments with whorls of spines at apex of each segment.

*Measurement* (mm). BL: 12.9, HL: 2.3, HW: 3.6, AL: 2.5, EL: 1.15, EW: 1.1, DE: 1.2.

*Materials examined.* **Heilongjiang** Ningnanxian Dongjingchengzhen (2L, 15 VII 2000, YTQ).

*Distribution.* China (Heilongjiang), Korea, Russia.

**41. *Ecdyonurus kibunensis* Imanishi** (Figs. 30, 47, 75, 151, 170)

*Ecdyonurus kibunensis* Imanishi, 1936: 540.

*Diagnosis.* Body brown. Head with two obscure light spots on middle portion of frontal margin. Legs yellow; femora with brownish spot. Abdominal terga 4–5 with U-shaped marking.

*Measurement* (mm). BL: 5.4, HL: 1.4, HW: 2.0, EL: 0.7, EW: 0.6, DE: 0.6, CL: 7.5.

*Materials examined.* **Jilin** Yanjishi Xiaowudao (6L, 27 VII 2000, YTQ), Yanjishi Xiaowudao (2L, 30 VI 2000, YTQ), Yanjishi Yanxiqiao (12L, 2 VIII 2000, YTQ), Antu Toudaobaihe (1L, 3 VI 1997, YJB), Antu Baihe (3L, VI 1997, YJB).

*Distribution.* China (Jilin), Korea, Russia, Japan, Mongolia.

**42. *Ecdyonurus levis* (Navás)** (Figs. 31, 132, 152, 171, 180)

*Epeorus levis* Navás, 1912: 415.

*Diagnosis.* Body brown with light markings. Frontal margin of head with two paired round markings. Abdominal terga with distinct light markings. Caudal filaments with whorls of setae at apex of each segment.

*Measurement* (mm). ♂: BL: 9.2, HL: 1.9, HW: 2.95, EL: 1.1, EW: 1.4, DE: 0.1, CL: 12. ♀: BL: 11.6, HL: 2.3, HW: 3.4, EL: 1.2, EW: 1.2, DE: 0.8, TF: 15.0.

*Materials examined.* **Heilongjiang** Hailinshi Shunqiao (12L, 28 VII 1997, YTQ), Ningnanxian Dongjingchengzhen (9L, 15 VII 2000, YTQ). **Jilin** Yanjishi Xiaowudao (4L, 27 VII 2000, YTQ), Yanjishi Yanxiqiao (13L, 2 VIII 2000, YTQ).

*Distribution.* China (Heilongjiang, Jilin), Korea, Russia.

**43. *Ecdyonurus yoshidae* Takahashi**

*Ecdyonurus yoshidae* Takahashi, 1924: 380.

*Materials examined.* Not available.

*Locality.* **Heilongjiang** Mudanjiangjingspohu (Imanishi, 1940). Liaoning Dalian (Imanishi,

1940), Shenyangtaizihe (Imanishi, 1940).

*Distribution.* China (Heilongjiang, Liaoning, Neimenggu), Korea, Russia, Japan.

**44. *Epeorus curvatulus* Matsumura** (Figs. 32, 76, 92, 104, 153)

*Epeorus curvatulus* Matsumura, 1931: 1477.

*Diagnosis.* Body brown. Frontal margin of head with paired C-shaped markings. Each tibia with brownish spot. Abdominal terga 2–10 with brownish median line. Abdominal segment 2–7 with two lateral projections. Tails two.

*Measurement* (mm). ♂: BL: 9.8, HL: 2.0, HW: 2.7, AL: 2.5, EL: 1.0, EW: 0.7, DE: 0.4, CL: 15.6. ♀: BL: 9.5, HL: 2.1, HW: 2.8, AL: 2.7, EL: 0.9, EW: 0.6, DE: 0.8, CL: 13.5.

*Materials examined.* **Jilin** Yanjishi Xiaowudao (1L, 27 VII 2000, YTQ), Antu Baihe (1L, VI 1997, YJB).

*Distribution.* China (Heilongjiang, Jilin, Liaoning), Korea, Russia, Japan.

**45. *Epeorus latifolium* Uéno**

*Epeorus latifolium* Uéno, 1928: 34.

*Materials examined.* Not available.

*Locality.* **Liaoning** Wangyemiao (Imanishi, 1940).

*Distribution.* China (Jilin), Korea, Japan.

*Remarks.* Larvae of *Epeorus latifolium* cannot be distinguished from those of *E. pellucidus*. Imanishi (1940) reported *E. latifolium* from Liaoning province, but it may belong to *E. pellucidus* judging from the distributional data.

**46. *Epeorus pellucidus* (Brodsky)** (Fig. 33)

*Cinygma pellucida* Brodsky, 1930: 35.

*Diagnosis.* Body light brown to brown. Frontal margin of head with light spots, with row of hairlike setae. Abdominal terga with paired dark markings. Outer margin of femora with row of long hairlike setae. Tails two.

*Measurement* (mm). ♂: BL: 13.2, HL: 2.2, HW: 3.2, AL: 2.1, EW: 1.1, DE: 0.6, CL: 10.2. ♀: BL: 15.2, HL: 2.6, HW: 3.7, AL: 2.0, EW: 1.1, DE: 0.6, CL: 14.0.

*Materials examined.* **Heilongjiang** Heihe Xingfuxiang (4L, 26 VII 1997, YTQ), Sijiazhi (7L, 26 VII 1997, YTQ), Hailinshi Pinghe (2L, 28 VII 1997, YTQ), Hailinshi Sanbuluo (20L, 28 VII 1997, YTQ), I: Hailinshi Shunqiao (30L, 28 VII 1997, YTQ), Shangzhishi Maorshanzhen (61L, 4 VI 1999, YTQ), Yanshouxian Yanhe (21L, 6 VI 1999, YTQ), Mudanjiangshi Xinfeng (24L, 29 VII 1997, YTQ), Mudanjiangshi Liuchun (86L, 29 VII 1997, YTQ), Ninganxian Dongjingchengzhen (33L, 15 VII 2000, YTQ). **Jilin** Hailin Huanggang (5L, 18 VII 2000, YTQ), Yanjishi Xiaowudao (21L, 27 VII 2000, YTQ), Yanjishi Xiaowudao (2L, 30 VI 2000, YTQ), Yanjishi Yanxiqiao (4L, 2 VIII 2000, YTQ), Antu Toudaobaihe (103L, 3 VI 1997, YJB), Antu Baihe (10L, VI 1997, YJB), Antu Sandao (23L, VI 1997, YJB), Antu Sidaobaihe (25L, VI 1997, YJB), Wolong (3L, 6 VI 1997, YJB).

*Distribution.* China (Jilin), Korea, Japan.

**47. *Heptagenia flava* Rostock**

*Heptagenia* na: Imanishi, 1940: 256.

*Heptagenia flava* Rostock, 1878: 76.

*Materials examined.* Not available.

*Locality.* **Heilongjiang** Mudanjiangjingspohu (Imanishi, 1940).

*Distribution.* China (Heilongjiang, Neimenggu), Mongolia, Russia, Japan.

*Remarks.* Imanishi (1940) reported larvae of *Heptagenia* na from Heilongjiang province which was subsequently associated with *H. flava* (see Bae *et al.*, 2000).

**48. *Heptagenia kihada* Matsumura** (Figs. 34, 90, 154, 172, 181, 202)

*Heptagenia kihada* Matsumura, 1931: 1478.

*Diagnosis.* Body brown. Lacinial region of left mandible with a single hair. Thorax brown with irregular light markings. Tibiae slightly shorter than femora. Gills on abdominal segments 1–7, apically pointed.

*Measurement* (mm). BL: 8.8, HL: 1.35, HW: 2.2, AL: 2.2, EL: 1.1, EW: 0.7, DE: 0.75, CL: 12.0, TF: 10.5.

*Materials examined.* **Heilongjiang** Ninganxian Dongjingchengzhen (1L, 15 VII 2000, YTQ).

*Distribution.* China (Heilongjiang), Japan, Mongolia, Russia.

**49. *Heptagenia kyotoensis* Gose** (Figs. 35, 48, 77, 91, 105, 133, 155, 173, 182)

*Heptagenia kyotoensis* Gose, 1963: 143.

*Diagnosis.* Body brown with light markings. Frontal margin of head without marking. Lateral pronotum and mesonotum with paired light stripes. Abdominal tergum with paired light longitudinal stripes, with paired markings. Abdominal segments 1–7 with tufts of filamentous gills. Caudal filaments very long.

*Measurement* (mm). BL: 11.1, AL: 1.9, CL: 17.5.

*Materials examined.* **Heilongjiang** Ninganxian Dongjingchengzhen (1L, 15 VII 2000, YTQ).

*Distribution.* China (Heilongjiang), Korea, Japan.

**50. *Heptagenia sulphurea albicauda* Kluge** (Fig. 36)

*Heptagenia sulphurea albicauda* Kluge, 1987: 318.

*Diagnosis.* Body reddish brown. Abdominal terga 3–10 with light paired markings; posterior margin of abdominal segment 1–10 with acute processes. Caudal filament with whorls of setae at end of each segment.

*Measurement* (mm). BL: 10, HL: 2.4, HW: 3.3, AL: 4, EL: 1.3, EW: 0.8, DE: 0.4, TF: 14.

*Materials examined.* **Jilin** Yanji (1L, 6 VI 1997, YJB).

*Distribution.* China (Jilin), Russia.

**51. *Iron aesculus* (Imanishi)** (Figs. 37, 49, 78, 93)

*Epeorus aesculus* Imanishi, 1934: 384.

*Diagnosis.* Body light brown to brown. Frontal margin of head lighter, with dark median stripe. Abdominal segments 2–7 with two lateral spines. Gill lamellae on abdominal segment 1 and 7 meeting beneath body. Tails two, without setae.

*Measurement* (mm). BL: 10.4, HL: 1.9, HW: 2.7, AL: 2.3, EL: 0.8, EW: 0.4, DE: 0.9, CL: 12.0.

*Materials examined.* **Jilin** Antu Toudaobaihe (1L, 3 VI 1997, YJB), Antu Eradaobaihe (19L,

3. VI 1997, YJB), Antu Baihe (14L, VI 1997, YJB), Antu Sandao (32L, VI 1997, YJB), Wolong Xianfeng (78L, 6 VI 1997, YJB), Helong Songxiaping (3L, VI 1997, YJB).  
*Distribution.* China (Jilin), Korea, Russia.

#### Family Isonychiidae

52. *Isonychia japonica* (Ulmer) (Figs. 38, 79, 94, 106, 156, 174)  
*Chironetes japonocus* Ulmer, 1919: 59.

*Diagnosis.* Body brown with light median longitudinal stripe. Forefemora and foretibiae with rows of hairlike setae. Abdominal segments 1-7 with both lamellate and filamentous gills.

*Measurement* (mm). BL: 15.8, AL: 5.0, EW: 1.4, DE: 0.3, CL: 8.1.

*Materials examined.* Jilin Yanjishi Xiaowudao (2L, 30 VI 2000, YTQ).

*Distribution.* China (Jilin), Korea, Mongolia, Russia, Japan.

53. *Isonychia na*  
*Isonychia na*: Imanishi, 1940: 214.

*Materials examined.* Not available.

*Locality.* Heilongjiang Hailaer (Imanishi, 1940).

*Distribution.* China (Heilongjiang).

*Remarks.* Imanishi (1940) reported larva of this informal species from Heilongjiang province.

#### Family Leptophlebiidae

54. *Choroterpes altiocolus* Kluge  
*Choroterpes trifurcata* Uéno: Imanishi, 1940: 189.  
*Choroterpes (Euthraulus) altiocolus* Kluge, 1984: 722.

*Materials examined.* Not available.

*Locality.* Liaoning Dalian (Imanishi, 1940).

*Distribution.* China (Liaoning), Korea, Russia Japan.

*Remarks.* Bae *et al.* (1994) corrected Imanishi's (1940) report of the larvae of *Choroterpes trifurcata* Uéno from Japan and Korea as *C. altiocolus* Kluge. Imanishi's Manchurian materials also may belong to *C. altiocolus*.

55. *Paraleptophlebia chocolata* Imanishi (Figs. 39, 81, 107, 134, 135, 157, 188, 203)  
*Paraleptophlebia chocolata* Imanishi, 1937b: 330.

*Diagnosis.* Body chocolate brown. Head with three light round spots. Gills 1-7 bi-forked; tracheae of the gills with small lateral branches.

*Measurement* (mm). ♂: BL: 8.0, HW: 1.5, HL: 1.3, EW: 0.4, EL: 0.72, DE: 0.35, CL: 5.0.  
♀: BL: 9.4, HW: 1.3, HL: 1.35, EW: 0.3, EL: 0.4, DE: 0.85.

*Materials examined.* Heilongjiang Hailinshi Sanbuluo (2L, 28 VII 1997, YTQ), Shangzhishi Maorshanzhen (3L, 4 VI 1999, YTQ).

*Distribution.* China (Heilongjiang), Korea, Mongolia, Russia.

**56. *Thraulus na***

*Thraulus na*: Imanishi, 1940: 189.

*Materials examined.* Not available.

*Locality.* **Liaoning** Erdaohezi (Imanishi, 1940).

*Distribution.* China (Liaoning).

*Remarks.* Imanishi (1940) reported larva of this undetermined species from Liaoning province.

**57. *Thraulus YUa*** (Figs. 40, 50, 80, 95, 108, 158, 175, 204, 205)

*Diagnosis.* Body grayish brown. Anterior margin of pronotum with hairlike setae. Mesonotum with irregular markings. Abdominal segment 7-9 with distinct posterolateral processes. Gills 1 single; gills 2-7 multi-forked.

*Measurement* (mm). BL: 6.2, HL: 1.4, HW: 1.35, EL: 0.65, EW: 0.4, DE: 0.25, CL: 9.0.

*Materials examined.* **Heilongjiang** Mudanjiangshi Dongjingcheng (1L, 15 VII 2000, YTQ).

*Distribution.* China (Heilongjiang).

*Remark.* This species is distinguished from *Thraulus na* by possessing relatively larger abdominal gills and well developed posterolateral projections on abdominal segment 7.

**Family Neoephemeridae****58. *Potamanthellus chinensis* Hsu**

*Potamanthellus chinensis* Hsu, 1935: 321.

*Materials examined.* Not available.

*Locality.* **Jilin** Beishan (You and Gui, 1995).

*Distribution.* China (Jilin), Korea.

*Remarks.* Hsu (1935) described adult of this species from Jilin province.

**Family Polymitarciidae****59. *Ephoron shigae* (Takahashi)** (Figs. 41, 51, 98, 99, 136, 206)

*Polymitarcis shigae* Takahashi, 1924: 379.

*Diagnosis:* Body light yellow to light brown. Head with round clypeal process. Mandibles developed into long tusks with small tubercles.

*Measurement* (mm). BL: 5.2, HL: 0.2, HW: 0.3, EL: 0.2, EW: 0.3, DE: 1.25, CL: 1.5, TF: 1.9.

*Materials examined.* **Heilongjiang** Shangzhishi Maorshanzhen (2L, 4 VI 1999, YTQ), Hailinshi Pinghe (4L, 28 VII 1997, YTQ).

*Distribution.* China (Heilongjiang), Japan, Korea, Russia.

**60. *Ephoron virgo* (Oliver)**

*Ephoron virgo* Olivier, 1791: 404.

*Materials examined.* Not available.

*Locality.* **Jilin** (You and Gui, 1995).

*Distribution.* China (Jilin), Russia.



*Remarks.* You and Gui (1995) reported adult of this species from Jilin province.

### Family Potamanthidae

**61. *Potamanthus luteus oriens* Bae and McCafferty** (Figs. 42, 61, 207)

*Potamanthus (Potamanthus) luteus oriens* Bae and McCafferty, 1991: 54.

*Diagnosis.* Body brown with light markings, dorso-ventrally flattened. Mature male compound eyes relatively large. Mandibles 0.3 x length of head. Forefemora with dorsal transverse row of 10-15 simple-shout setae. Gills 2-7 each with 20-30 marginal fibrillae arranged in single row in each lamella.

*Measurement* (mm). BL: 11.5, HL: 1.7, HW: 2.6, AL: 2.4, EL: 1.7, EW: 0.8, DE: 1.0, CL: 6.8.

*Materials examined.* Heilongjiang Ninganxian Dongjingchengzhen (2L, 15 VII 2000, YTQ).

*Distribution.* China (Heilongjiang), Korea, Japan.

**62. *Rhoenanthus youi* (Wu)**

*Neopotamanthus youi* Wu, 1986: 401.

*Materials examined.* Not available.

*Locality.* Jilin Antuxian, Fusongxian (You and Gui, 1995).

*Distribution.* China (Jilin).

*Remarks.* Based on distributional data of the species of Potamanthidae (Bae and McCafferty, 1991), this species probably belongs to *Rhoenanthus coreanus* (Yoon and Bae) which is distributed in the Korean peninsula and Russian Far East. *R. youi* occurs in southern China.

### Family Siphonuridae

**63. *Siphonurus binotatus* (Eaton)**

*Siphonurus binotatus* Eaton, 1892: 302.

*Materials examined.* Not available.

*Locality.* Heilongjiang Heihenankuanhe (Imanishi, 1940).

*Distribution.* China (Heilongjiang), Japan.

**64. *Siphonurus chankae* Tshernona** (Fig. 43)

*Siphonurus chankae* Tshernona, 1952: 263.

*Diagnosis.* Body yellowish brown. Wingpads without dark spots. Legs with single dark transverse band on femora and tibiae of all legs. Posterolateral spines of abdomen poorly developed. Gills 1 posterior margin of dorsal and ventral lamellae slightly notched.

*Measurement* (mm). BL: 15.4, HL: 2.5, HW: 2.0, EL: 1.2, EW: 0.8, DE: 0.5, CL: 6.0, TF: 5.7.

*Materials examined.* Heilongjiang Heihe Xingfuxiang (76L, 26 VII 1997, YTQ), Sijiazhi (129L, 26 VII 1997, YTQ), Hailinshi Pinghe (6L, 28 VII 1997, YTQ), Hulan (3L, 23 VII 1999, YTQ), Yanjishi Xiaowudao (6L, 30 VI 2000, YTQ).

*Distribution.* China (Heilongjiang), Korea.

**65. *Siphonurus immanis* Kluge** (Figs 44, 55, 96, 137, 149, 176)*Siphonurus immanis* Kluge 1985: 18.

**Diagnosis.** Body color grayish brown. Wingpads without dark spots. Legs with single dark transverse band on femora and tibiae of all legs. Posterolateral spines of abdomen well developed. Gills 1 posterior margin of dorsal and ventral lamellae deeply notched.

**Measurement (mm).** ♂: BL: 15.5, HL: 3.0, HW: 2.4, AL: 2.1, EL: 1.4, EW: 1.0, DE: 1.0, CL: 8.0, TF: 7.0, ♀: BL: 13.5, AL: 1.3, CL: 6.8, TF: 6.2.

**Materials examined.** Jilin Yanjishi Xiaowudao (2L, 27 VII 2000, YTQ).

**Distribution.** China (Jilin).

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## EXPLANATIONS OF FIGURES

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