

First Description of Adults of *Cincticostella insolta* (Allen, 1971) (Ephemeroptera: Ephemerellidae)

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Abstract

The adults of *Cincticostella insolta* (Allen, 1971) (Ephemeroptera: Ephemerellidae) are described and illustrated for the first time. Adults were successfully reared from mature nymphs collected in spring 2025. Species of the *insolta* complex share characteristic wing coloration in the subimaginal stage, as well as lateral scutellar projections in both subimaginal and imaginal stages. However, male adults of the *insolta* complex exhibit pronounced interspecific differences, particularly in body size, the structure of tergum IX, penis lobes, forceps morphology, and forewing venation.

Keywords

Spiny Crawler Mayflies, Morphology, Taxonomy, Winged Stages, Hengduan Mountains, Himalaya, China

1. Introduction

The nymphs of *Cincticostella insolta* (Allen, 1971) [1] (Ephemeroptera: Ephemerel-

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lidae) first described approximately 50 years ago the species is the type species of the subgenus *Rhionella* Allen, 1980 [2] within the genus *Cincticostella* Allen 1971 [1]. Subsequent studies by Xie *et al.* [3] and Martynov *et al.* [4] provided additional descriptions of the nymphal stage. However, the adult (winged) stages of this species remain unknown.

The winged stages are critical for the classification of the genus *Cincticostella*. Currently, the genus *Cincticostella* includes 25 species (one of which is a *nomen dubium*) grouped into four species complexes, distributed across the eastern Palearctic and Indomalayan regions [5]-[8]. The *nigra* complex includes 13 species, with four have been described based on adult specimens [9]: *C. elongatula* (McLachlan, 1875), *C. nigra* (Uéno, 1928) [10], *C. levanidovae* (Tshernova, 1952) [11] and *C. orientalis* (Tshernova, 1952) [11]. The *insolta* complex includes eight species, with only one species reported from imaginal stage [12]: *C. femorata* (Tshernova, 1972) [13]. The *gosei* complex includes two species, with one of those reported from imaginal stage [14]: *C. gosei* (Allen, 1975) [15]. The *jianchuan* complex includes two species, with both reported from imaginal stage [7] [16]: *C. fusca* (Kang & Yang, 1995) and *C. jianchuan* Sun, Yang, Tan, Li & Jacobus, 2024 [7]. In the *jianchuan* complex, subimagos exhibit similar coloration [7] [16]. In contrast, subimago coloration in the *nigra* complex can be divided into two types, forewings black of *C. orientalis* and *C. nigra*, forewings of *C. levanidovae* and *C. elongatula* brown, with crossveins infuscated [9].

In the spring of 2025, nymphs of *C. insolta* were collected from several headwater streams in the southern Hengduan Mountains, China. Through careful indoor rearing, adults were successfully obtained. This has provided an opportunity to address the lack of information on the adult characteristics of *C. insolta* and to clarify shared traits and interspecific differences within the *insolta* complex.

2. Materials and Methods

Cincticostella insolta nymphs were collected with a D-frame net from riffles of the Mangxing River, Mangshi, western Yunnan; habitat images and photograph of live nymph were taken using a mobile telephone equipped with a Kase 40 - 75 mm macro lens [7] [17]. Specimens were dissected, mounted in Hoyer's, and examined photographed under a Keyence VHX-S550E. Eggs removed from female imagoes were gold-coated for SEM. Plates were assembled in Photoshop CC 2020; imagoes were obtained by rearing final nymphal instars in the laboratory. All material is stored in 95% ethanol are deposited in MBDU, Dali University.

3. Results

Ephemeroptera

Ephemerellidae

Cincticostella insolta (Allen, 1971)

Ephemerella insolta Allen, 1971 [1]: figure 4, figure 8, figure 12, figure 14, figure 18 (nymph). Types: nymph, from Thailand.

Cincticostella insolta: Xie *et al.*, 2009 [3]: 53.

Cincticostella insolta: Martynov *et al.*, 2019 [4]: 170.

Details are shown in **Figures 1-23**.

The distinguishing characteristics of this species were provided by Allen [1], Xie *et al.* [3] and Martynov *et al.* [4], who also included figures of the nymph. Herein is a complementary description including the posterior margin of sternum IX and illustrations useful for species identification (**Figures 1-6, Figure 23**). In addition, characteristics of the winged stage (**Figures 7-19, Figure 21, Figure 22**) and egg (**Figure 20**) are described for the first time.

Material Examined. 2 ♂ adults, 4 ♀ adults, 2 ♂ subimagos, 2 ♀ subimagos, 11 nymphs, Mangxing river, Mangshi county, Dehong city, Yunnan Province, 1296 m a.s.l., 30°22'12"N, 102°22'12"E, 15.V.2025, leg. Xian-Fu Li, Yan-Chang Zi; 3 nymphs, Tuanjie township, Yunlong county, Dali city, Yunnan Province, 2283 m a.s.l., 25°76'29"N, 99°63'49"E, 17. I. 2025, leg. Xian-Fu Li.

Diagnoses. The nymph of this species has the anterolateral angles of the prothorax projecting anteriorly (**Figure 3(A), Figure 3(B)**) and has a pair of large, wide, mesothoracic anterolateral processes (**Figure 3(A), Figure 3(C)**), which are the distinctive of the genus *Cincticostella* [1] [3] [18]. Meanwhile, this species has suboccipital head tubercles (**Figure 2(A)**) and the middle and hind pairs of femora being enlarged with serrated margins and protuberances (**Figure 4(B), Figure 4(C), Figure 4(E), Figure 4(F)**), which are the distinctives of the *insolta* complex [2] [4]. The *insolta* complex includes eight species [4], *C. bifurcata* Xie, Jia, Chen, Jacobus & Zhou, 2009 [3], *C. braaschi* Jacobus & McCaferty, 2008 [19], *C. femorata* (Tshernova, 1972) [13], *C. insolta* (Allen, 1971) [1], *C. ranga* Selvakumar & Subramanian, 2019 [4], *C. richardi* Martynov & Palatov, 2019 [4], *C. sivaramakrishnani* Martynov & Palatov, 2019 [4] and *C. tornata* Auychinda & Gattolliat, 2020 [19]. *Cincticostella insolta* can be distinguished from other *insolta* complex species by the following characters: 1) anterolateral projections of mesothorax notched (**Figure 3(A), Figure 3(C)**); 2) inner margin of forefemur bears 1-3 large chazae (**Figure 4(A), Figure 4(D)**) [4].

Descriptions. Complementary description of *final nymphal instar* (In alcohol). Head width, male 1.4 - 1.6 mm; female 1.6 - 1.7 mm; body length (excluding tails), male 6.0 - 6.3 mm, female 6.9 - 7.7 mm; cerci length, male 4.2 - 4.5 mm, female 4.4 - 5.5 mm, middle caudal filament, male 5.0 - 5.2 mm, female 4.8 - 6.5 mm. Body yellowish brown, whole body densely covered with tiny setae (**Figures 1(A)-(C)**). The characteristics of head, thorax, abdomen and caudal filaments as in **Figures 1-6**. The maxillary palpi of *C. insolta* has 2-segmented (**Figure 2(J)**). Segment length ratio of labial palp from base to apex = 5.3: 3.8: 1. Serration of the mid- and hindfemora (**Figure 4(B), Figure 4(C), Figure 4(E), Figure 4(F)**) is developed. All femora slightly fattened (length/width ratio = fore femur 1.8; middle femur 1.9; hind femur 2.2) (**Figure 4(D), Figure 4(E), Figure 4(F)**). Ratio of femur: tibia: tarsus of foreleg = 1: 1.7: 2.3, ratio of femur: tibia: tarsus of middle-leg = 2.4: 2.4: 1.0, ratio of femur: tibia: tarsus of hindleg = 3: 1.8: 1. Posterior margin of sternum IX of female with a V-shape cleft (**Figure 5(C)**). Posterior margin of

sternum IX of male with a V-shape cleft, but basal and distal margins of the cleft not in a straight line (**Figure 5(B)**).

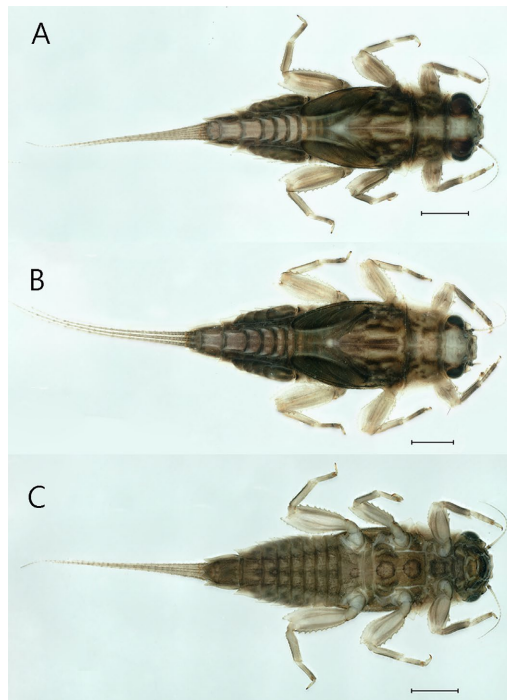


Figure 1. Last nymphal instar of *Cincticostella insolta* (Allen, 1971). (A) dorsal habitus of male (B) dorsal habitus of female. (C) ventral habitus of male. Scale bar: 1000 μm (A)-(C).

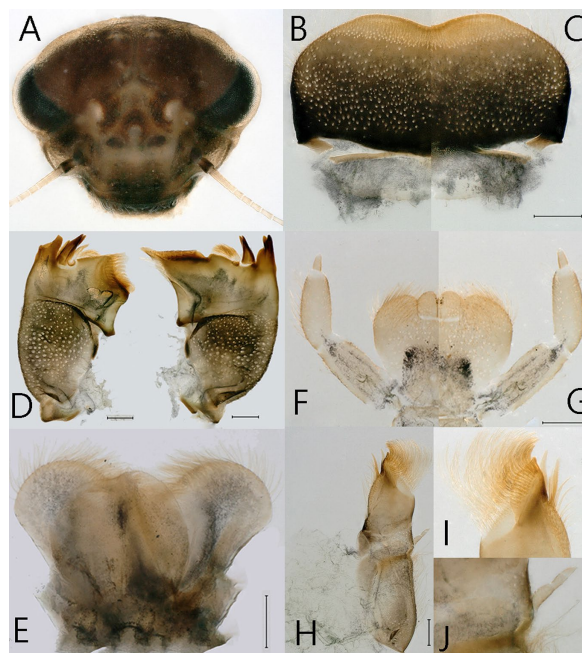


Figure 2. Nymphs of *Cincticostella insolta* (Allen, 1971). (A) head (B) labrum (dorsal view) (C) labrum (ventral view) (D) mandible (E) hypopharynx (ventral view) (F) labium (dorsal view) (G) labium (ventral view) (H) right maxillary (I) apex of right maxillary (ventral view) (J) maxillary palp (dorsal view). Scale bar: 100 μm (B)-(J).



Figure 3. Nymphs of *Cincticostella insolta* (Allen, 1971). (A) thorax of last nymphal instar (dorsal view) (B) anterolateral projections of pronotum (C) projection of mesothorax. Scale bar: 1000 μm (A); 100 μm (B), (C).

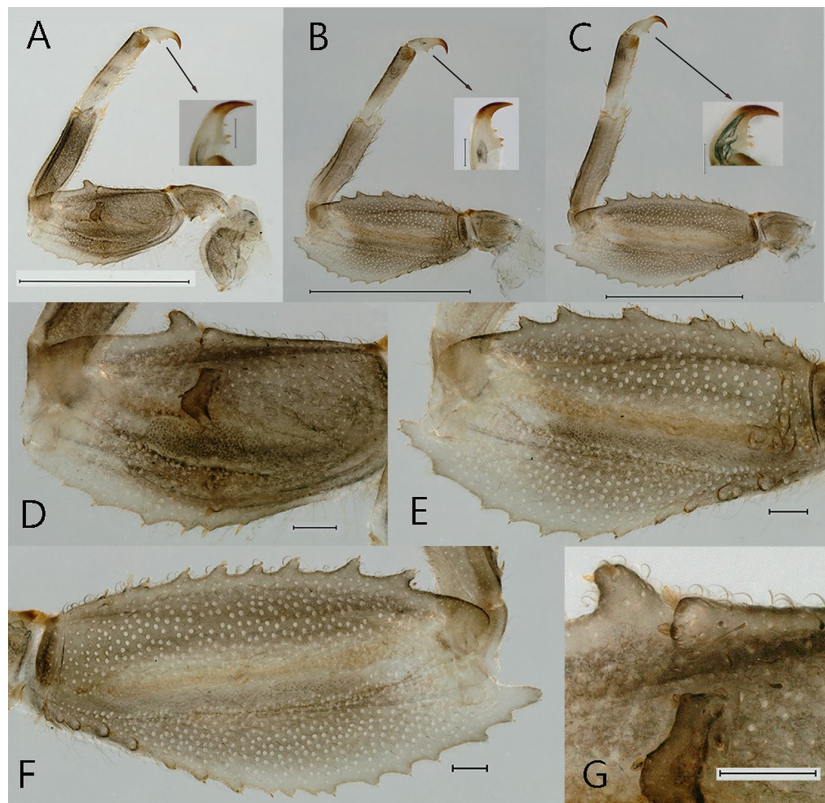


Figure 4. Nymphs of *Cincticostella insolta* (Allen, 1971). (A) foreleg (B) midleg (C) hindleg (D) fore femur (E) middle femur (F) hind femur (G) outer margin of hind femur. Scale bar: 1000 μm (A)-(C); 100 μm (D), (E).

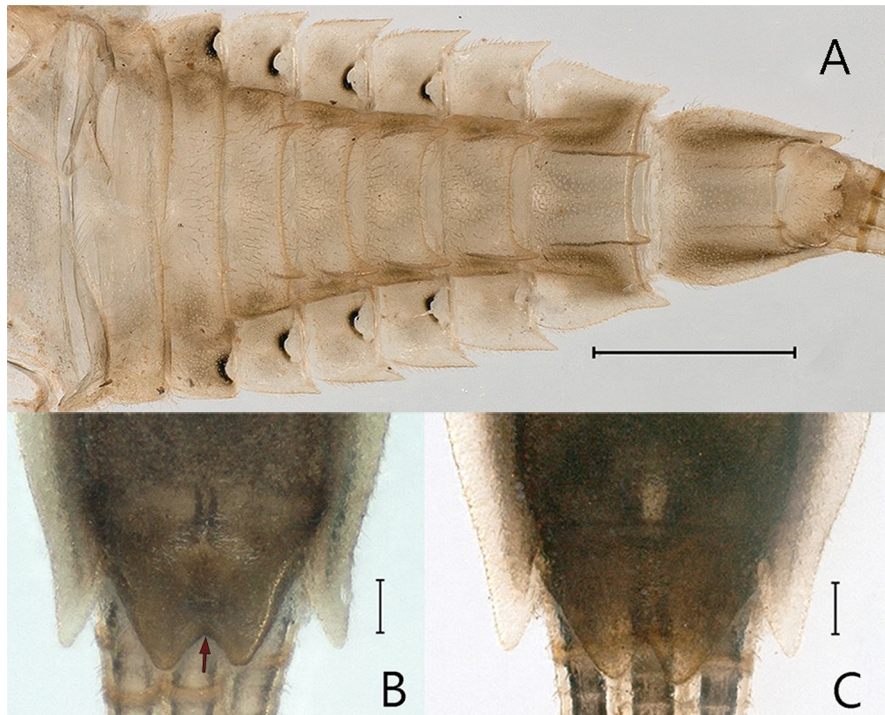


Figure 5. Nymphs of *Cincticostella insolta* (Allen, 1971). (A) abdominal terga (dorsal view) (B) posterior part of abdomen of male (ventral view) (C) posterior part of abdomen of female. Scale bar: 1000 μm (A); 100 μm (B), (C).

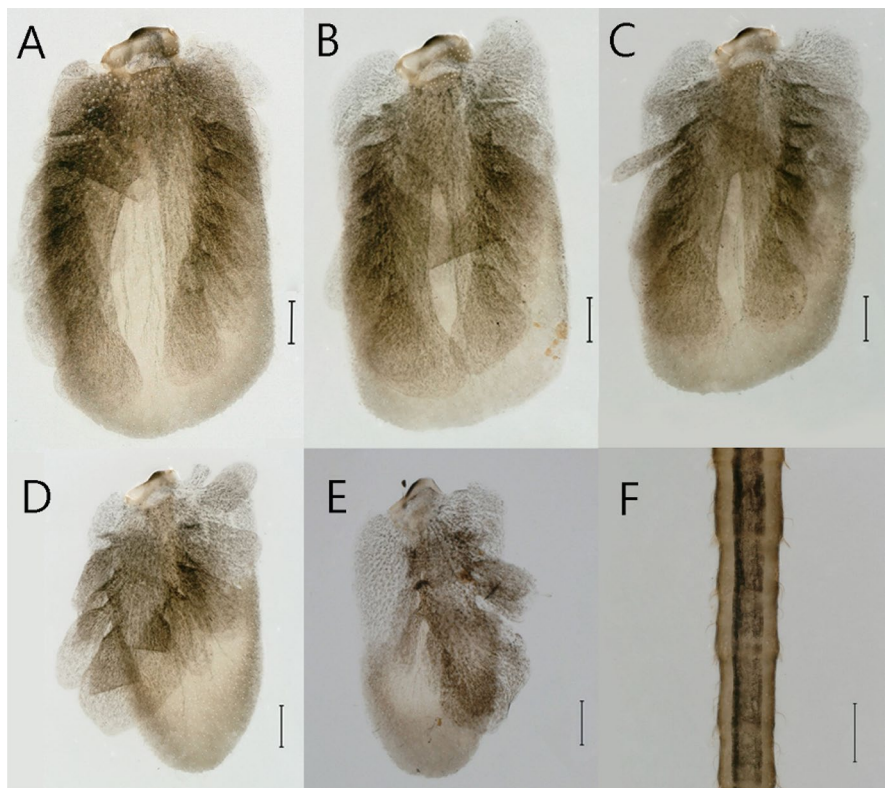


Figure 6. Nymphs of *Cincticostella insolta* (Allen, 1971). (A) gill III (B) gill IV (C) gill V (D) gill VI (E) gill VII (F) caudal filaments. Scale bar: 100 μm (A)-(F).

Male adult. In alcohol. Body length 8.0 - 8.4 mm (excluding tails), head width 1.4 - 1.5 mm, forewing length 8.1 - 8.2 mm, hindwing length 1.8 - 2.0 mm, cerci length 9.0 - 11.0 mm, middle caudal filament 11.1 - 11.5 mm. Body grey to brown (**Figures 7(A)-(C)**).



Figure 7. Male imago of *Cincticostella insolta* (Allen, 1971). (A) dorsal view of body (B) lateral view of body (C) ventral view of body. Scale bar: 1000 μ m (A)-(C).

Head. Compound eyes contiguous, upper portion dark reddish, lower portion black (**Figures 7(A)-(C)**).

Thorax. Pronotum with expanded posterolateral sac-like structure (**Figure 8(A)**). Prosternum dark brown, with slightly anteriorly converging longitudinal carinae, maximum width between carinae 1.5 times minimum width (**Figure 7(C)**). Basisternum of mesosternum dark brown, with parallel furcasternum (**Figure 7(C)**). Mesonotum without projection on posterior margin (**Figure 9(C)**, indicated by red arrow). Forewings hyaline, but costa (C) and subcosta (Sc) regions semihyaline; longitudinal veins brown and cross veins light brown to semihyaline; cross veins in stigma region between C and Sc separated into two parts by vein; radial sector (Rs) leaves medius anterior (MA) at very base, MA forked three-fifths of distance from base to margin; medius posterior (MP) forked slightly more distally than fork of MA + Rs; Intercalary Media Posterior vein (iMP) stay away from the forking point of MP. Cubitus Posterior (CuP) recurved strongly (**Figure 9(A)**). Hindwing totally hyaline (**Figure 9(B)**), costal projection small, located at distance one-third from base to apex; MP forked between forks of R1 (radius) + MA and MA; MA single, MP forked symmetrically. Forelegs dark brown (**Figure 8(B)**), mid- and hindlegs brown (**Figure 8(C)**, **Figure 8(D)**). Femur: tibia: tarsus of foreleg = 1.0: 1.7: 2.3, tarsal segments from basal to apical = 1.0: 6.5: 5.4: 3.6: 1.5; femur: tibia: tarsus of midleg = 1.7: 1.3: 1.0, tarsal segments from basal to

apical = 1.0: 1.4: 1.5: 1.2: 3.4; femur: tibia: tarsus of hindleg = 3: 1.8: 1.0, tarsal segments from basal to apical = 1.0: 1.0: 1.1: 1.1: 1.7. Claws of all legs similar, one blunt and one hooked.



Figure 8. Male imago of *Cincticostella insolta* (Allen, 1971). (A) ventral view of head and pronotum, with air sac-like structure indicated by red arrow (B) foreleg (C) midleg (D) hindleg. Scale bar: 100 μm (A), 1000 μm (B)-(D).



Figure 9. Male imago of *Cincticostella insolta* (Allen, 1971). (A) forewing (B) hindwing (C) lateral scutellar projections indicated by red arrow. Scale bar: 1000 μm (A); 100 μm (B), (C).

Abdomen. Terga II-VII each with pale median line, terga V-IX each with symmetric pale spots on dorsal surface (**Figure 7(A)**). Terga I-IX each with pale stripe on posterior margin (**Figure 7(B)**, **Figure 7(C)**). Terga II-VII each with big dark brown spots, and terga VII-IX each with pale spots on anterior part on ventral surface (**Figure 7(C)**). All terga without posterolateral spines (**Figures 7(A)-(C)**). Caudal filaments dark brown, covered with spines.

Genitalia. Dorsal margin of styliger plate with median convex lobe (**Figure 10(C)**). Forceps gray brown, length about $1.5 \times$ penis length; basal segment shorter than wide, ca. $1/8$ the length of the second segment; forceps segment 2 with medial crease; forceps segment 3 ovoid, length similar basal width (**Figures 10(A)-(C)**). Penis lobes compact with slight subapical swelling, separated by a cleft in apical (**Figures 10(D)-(F)**), and with narrow and shallow linear groove on apical $1/2$ of dorsal face (**Figure 10(D)**), lateral margins slightly convex and somewhat sinuous (**Figure 10(E)**), ventral surfaces flat and smooth, with indistinct median suture (**Figure 10(F)**).

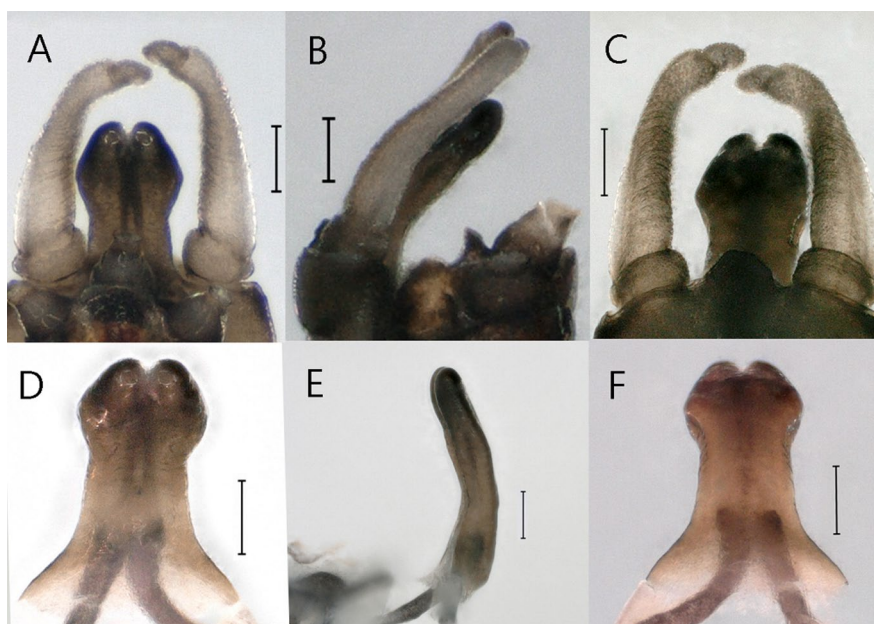


Figure 10. Male imago of *Cincticostella insolta* (Allen, 1971). (A) genitalia (dorsal view) (B) genitalia (lateral view) (C) genitalia (ventral view) (D) penes (dorsal view) (E) penes (lateral view) (F) penes (ventral view). Scale bar: 100 μ m (A)-(F).

Female adult (In alcohol). Colour pattern similar to male (**Figures 11(A)-(C)**, **Figures 12(A)-(E)**, **Figures 13(A)-(C)**); body length 8.0-9.0 mm (excluding tails), head width 1.5-1.6 mm, cerci length 11.9 mm, middle caudal filament 17.3-22.1 mm, forewing 9-9.5 mm, hindwing 2.1-2.2 mm. Lengths of femur: tibia: tarsus of foreleg = 1.1:1.2:1.0, tarsal segments from basal to apical = 1.0:2.0:1.9:1.6:2.3; femur: tibia: tarsus of midleg = 1.9:1.4:1.0, tarsal segments from basal to apical = 1.1:1.3:1.2:1.0:2.5; femur: tibia: tarsus of hindleg = 2.3:1.5:1.0, tarsal segments from basal to apical = 1.2:1.0:1.0:1.0:2.2. Subgenital plate produced to $1/5$ length of ster-

num VIII. Posterior margin of subanal plate with U-shaped median cleft (**Figure 13(C)**). Caudal filaments light brown, with spines (**Figure 12(E)**).

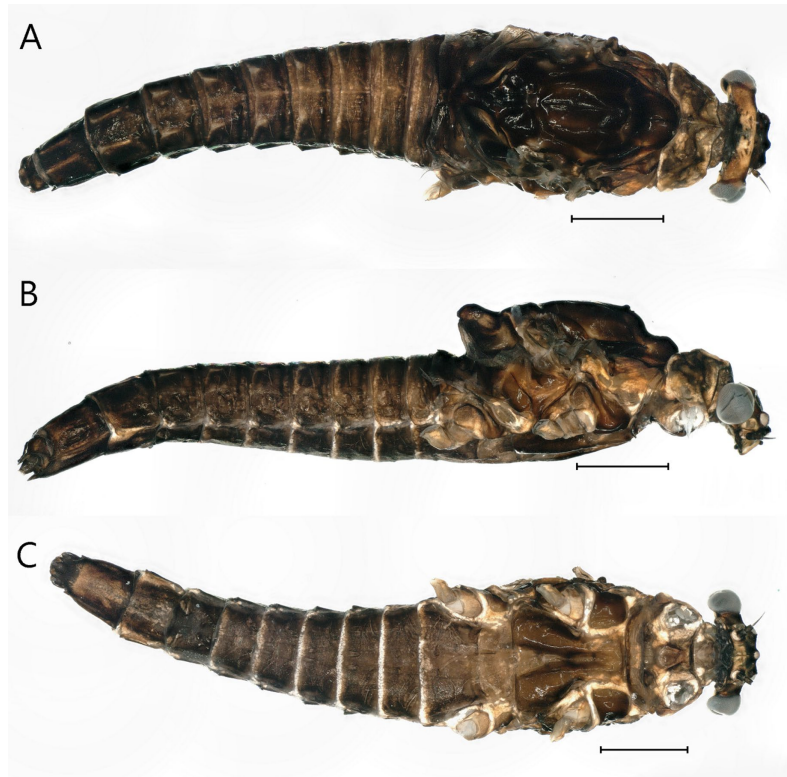


Figure 11. Female imago of *Cincticostella jianchuan* sp. nov. (A) dorsal view (B) lateral view (C) ventral view. Scale bar: 1000 μ m (A)-(C).

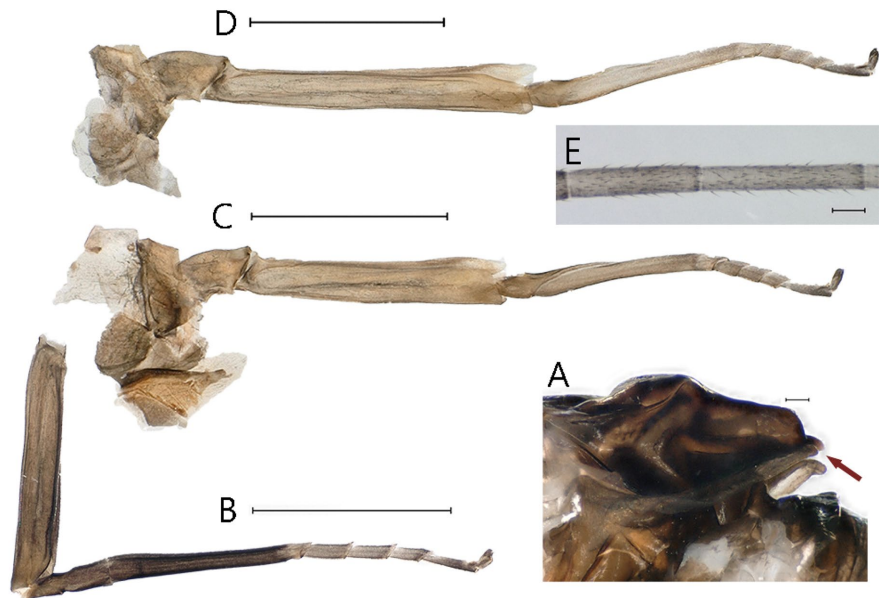


Figure 12. Female imago of *Cincticostella insolta* (Allen, 1971). (A) lateral scutellar projections indicated by red arrow (lateral view) (B) foreleg (C) midleg (D) hindleg (E) caudal filaments. Scale bar: 100 μ m (A), (E); 1000 μ m (B)-(D).

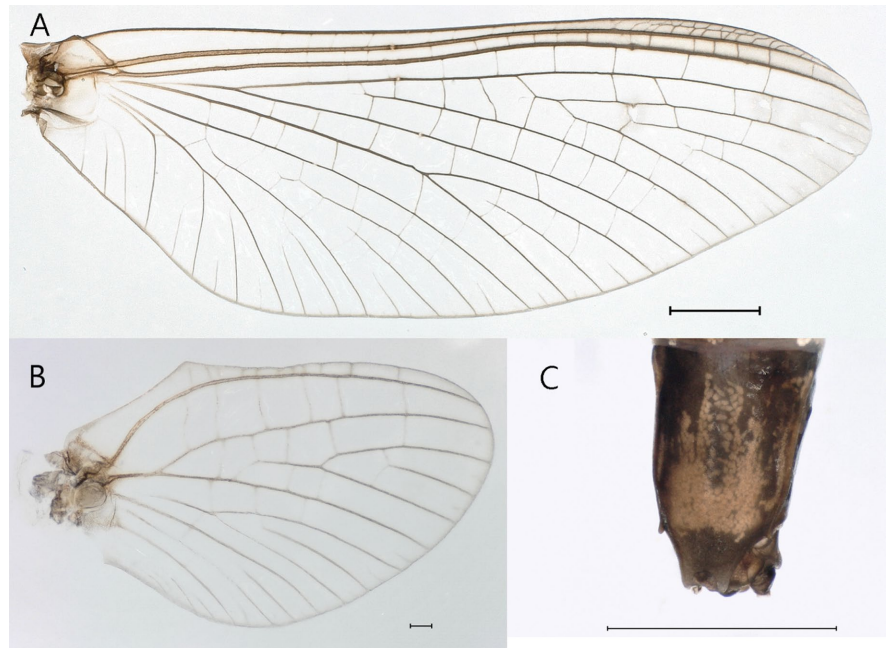


Figure 13. Female imago of *Cincticostella insolta* (Allen, 1971). (A) forewing (B) hindwing (C) posterior part of abdomen of female (ventral view). Scale bar: 100 μm (A), (C); 100 μm (B).

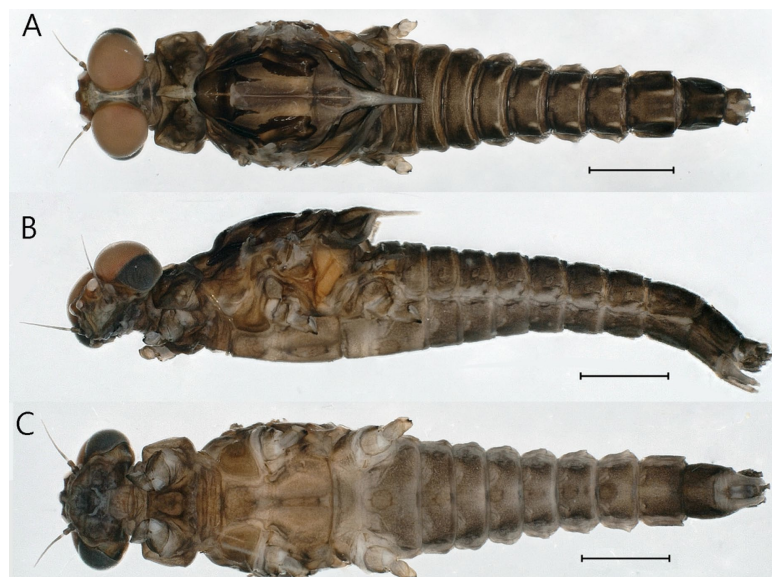


Figure 14. Male subimago of *Cincticostella insolta* (Allen, 1971). (A) dorsal view (B) lateral view (C) ventral view. Scale bar: 1000 μm (A)-(C).

Male subimago (In alcohol). Similar to male imago except for following characters: scutellum with long and pointed posterior prolongation (**Figure 14(A)**, **Figure 14(B)**); forewings and hindwings semi-hyaline, dark brown, with tiny setae on outer and hind margins (**Figure 16(A)**, **Figure 16(B)**); forceps segment 2 straight (**Figure 16(C)**). Body length 8.1 mm (excluding tails), head width 1.6 mm, cerci length 9.0 mm, middle caudal filament 9.0 mm, forewing 8.7 mm, hindwing

2.0 mm (**Figures 12(A)-(C), Figures 13(A)-(C), Figures 14(A)-(E)**). Length of femur: tibia: tarsus of foreleg = 1.0: 1.3: 1.4, tarsal segments from basal to apical = 1.0: 3.8: 3.6: 3.2: 2.5; femur: tibia: tarsus of midleg = 1.8: 1.3: 1.0, tarsal segments from basal to apical = 1.4: 1.4: 1.2: 1.0: 2.5; femur: tibia: tarsus of hindleg = 2.4: 1.6: 1.0, tarsal segments from basal to apical = 1.0: 1.6: 1.6: 1.2: 3.8.

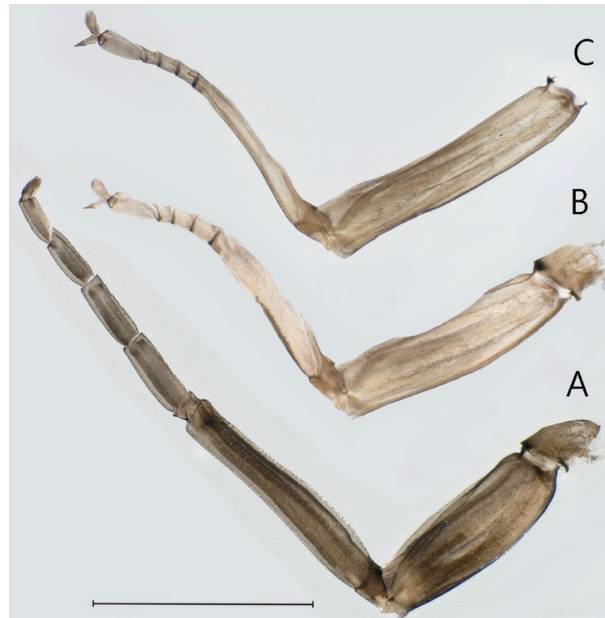


Figure 15. Male subimago of *Cincticostella insolta* (Allen, 1971). (A) foreleg (B) midleg (C) hindleg. Scale bar: 1000 μm (A)-(C).

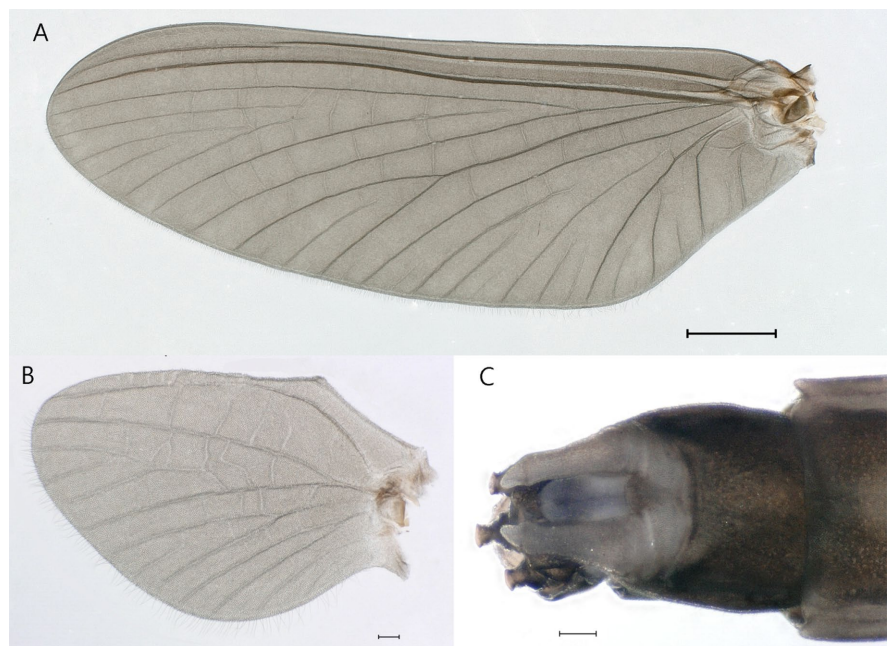


Figure 16. Male subimago of *Cincticostella insolta* (Allen, 1971). (A) forewing (B) hindwing (C) posterior part of abdomen of male (ventral view). Scale bar: 1000 μm (A); 100 μm (B), (C).

Female subimago (In alcohol). Similar to male subimago except for usual sexual differences (**Figures 17(A)-(C)**, **Figures 18(A)-(E)**, **Figures 19(A)-(C)**). Head width 1.5 - 1.6 mm, body length 8.5 - 8.6 mm (excluding tails), forewing length 8.2 - 8.5 mm, hindwing length 1.8 - 2.0 mm, cerci length 8.5 mm, middle caudal filament 8.4 mm. The mesoscutellum has an elongate, pointed posterior process similar to that of the male subimago (**Figure 18(A)**). Caudal filaments light brown, with spines (**Figure 18(E)**). Length of femur: tibia: tarsus of foreleg = 1.4:1.3:1.0, tarsal segments from basal to apical = 1.4:1.6:1.5:1.0:3.0; femur: tibia: tarsus of midleg = 2.3:1.8:1.0, tarsal segments from basal to apical = 1.1:1.7:1.3:1.0:4.6; femur: tibia: tarsus of hindleg = 3.1:2.1:1.0, tarsal segments from basal to apical = 1.4:1.9:1.6:1.0:4.6.

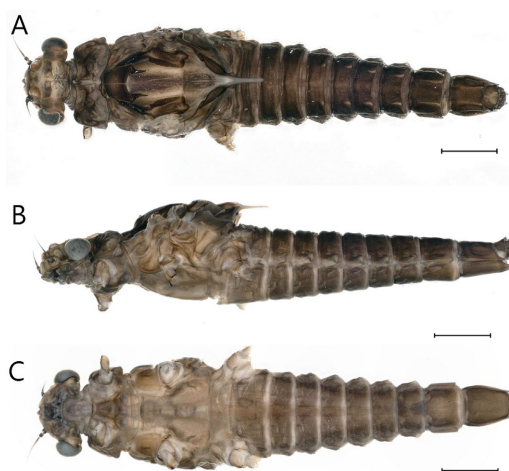


Figure 17. Female subimago of *Cincticostella insolta* (Allen, 1971). (A) dorsal view (B) lateral view (C) ventral view. Scale bar: 1000 μ m (A)-(C).



Figure 18. Female subimago of *Cincticostella insolta* (Allen, 1971). (A) lateral scutellar projections indicated by red arrow (B) foreleg (C) midleg (D) hindleg (E) cerci enlarged. Scale bar: 1000 μ m (B)-(D); 100 μ m (E).

Egg (dissected from female imago). Length 150-190 μm , width 91-95 μm . Ovoid with one big polar cap (**Figure 20(A)**), knobs of attachment structure (**Figure 20(A), Figure 20(B)**) and micropyle (**Figure 20(A), Figure 20(C)**). Chorion with irregular hexagonal ridges except subpolar areas; mesh with one tubercle medially, but with variety of tubercles nearby the polar cap; knobs of attachment structure and micropyle distributed near equator (**Figure 20(A)**).

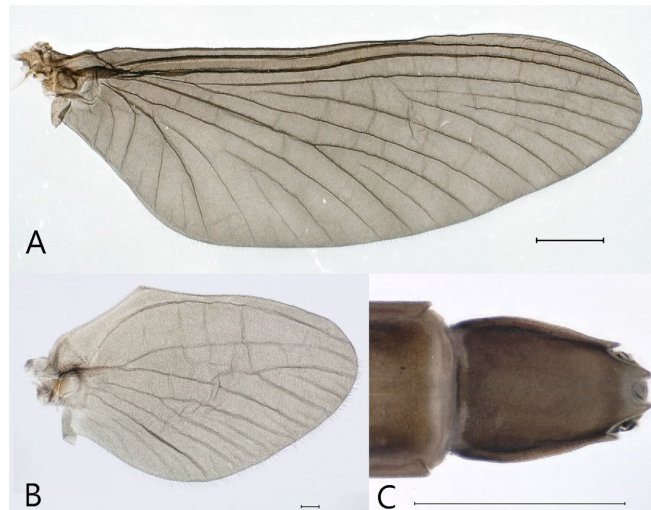


Figure 19. Female subimago of *Cincticostella insolta* (Allen, 1971). (A) forewing (B) hindwing (C) posterior part of abdomen (ventral view). Scale bar: 1000 μm (A), (C); 100 μm (B).

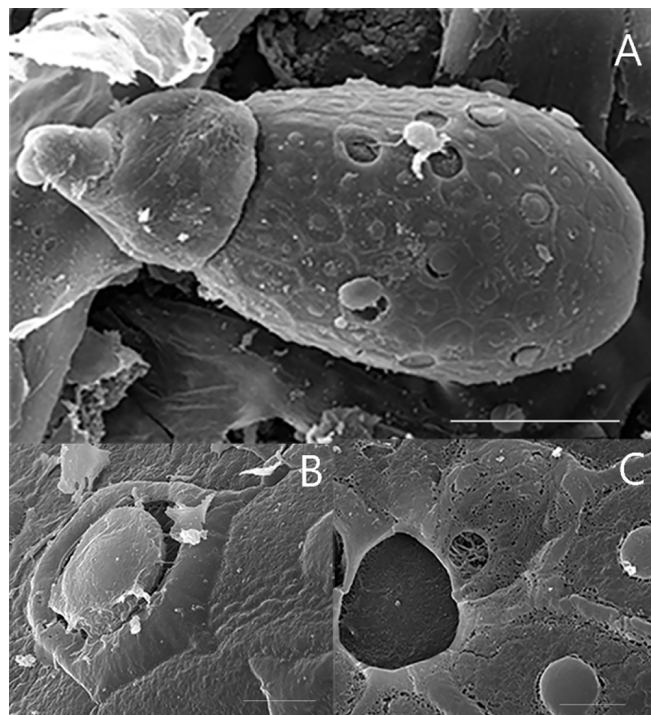


Figure 20. Egg of *Cincticostella insolta* (Allen, 1971). (A) lateral view (B) knob of attachment structure polar cap (C) micropyle enlarged. Scale bar: 5 μm (A); 50 μm (B); 5 μm (C).

Persistent mouthparts of winged stages. The new species presents persistent but vestigial mouthparts in the winged stages; in ventral view of head, the labium is present and clearly visible (**Figures 21(A)-(D)**, indicated by red arrow).

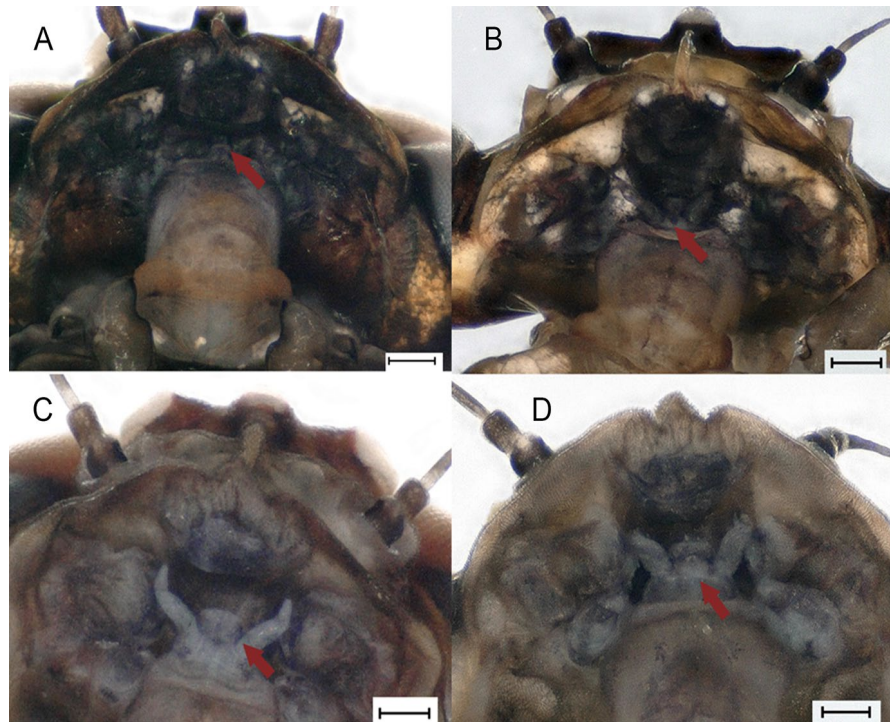


Figure 21. Persistent mouthparts of *Cincticostella insolta* (Allen, 1971) indicated by arrow. (A) male imago (B) female imago (C) male subimago (D) female subimago. Scale bars: 100 μm (A)-(D).

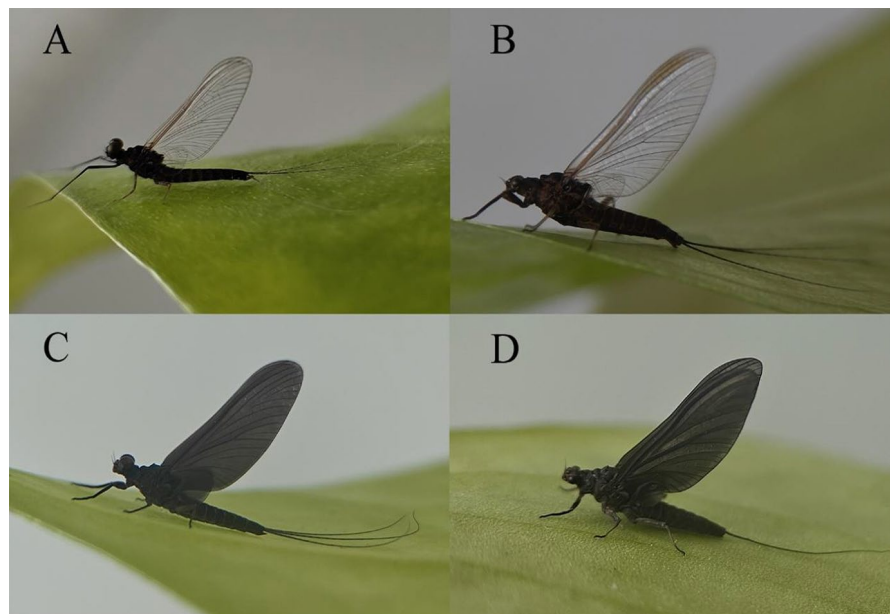


Figure 22. Winged stages of *Cincticostella insolta* (Allen, 1971) (living). (A) male imago (B) female imago (C) male subimago (D) female subimago.

Ecology. The source streams in Mangshi City and Yunlong County where the nymphs of *C. insolta* were collected are 2.5 - 8.0 m wide, with a natural water body depth 15 - 50 cm. They contain stones of various sizes, aquatic plants, and litter (**Figure 23(A), Figure 23(B)**). During collecting, the nymphs were found climbing on aquatic plants and moving slowly. In indoor conditions, the last instar nymphs molted in the afternoon. The subimago stage persisted for noon the next day.

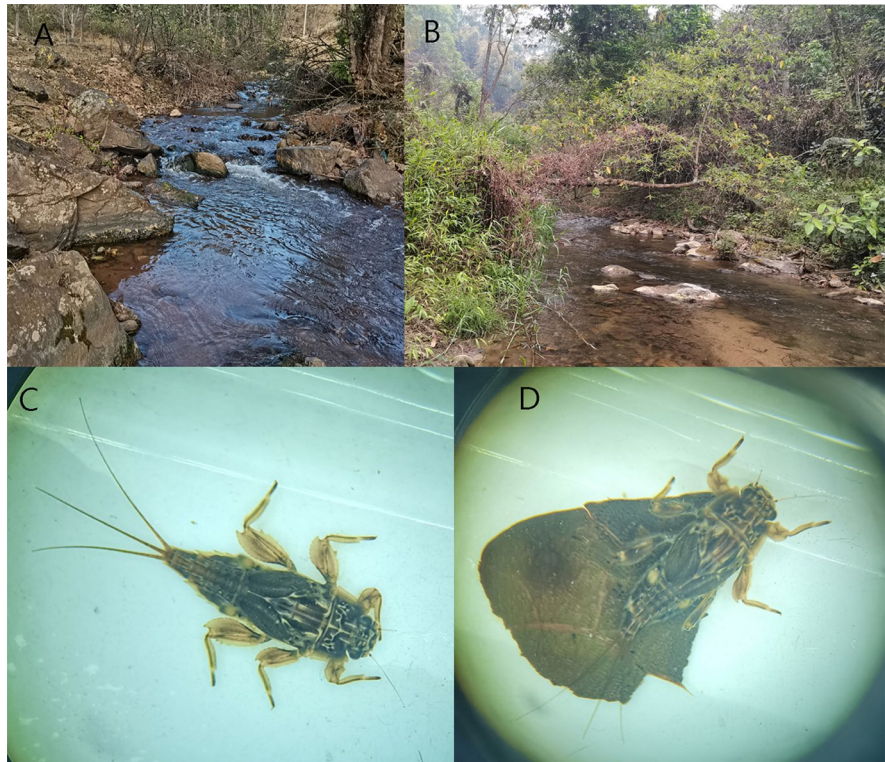


Figure 23. (A), (B) Habitat of *Cincticostella. Insolta* (Allen, 1971) of MangXing River (C), (D) nymph (living) collected in Tuanjie township (January).

Remarks. The serration of femora and the maxillary palpi of *C. insolta* appear to be variable [1] [4]. In our study, the maxillary palpi of *C. insolta* reduced to 2-segmented (**Figure 2(J)**), between a single segment (Allen 1971 [1]: figure 4) and 3-segmented (Martynov *et al.* 2019 [4]: figures 129, 130). Serration of the mid- and hindfemora of our specimens (**Figure 4(B), Figure 4(C), Figure 4(E), Figure 4(F)**) is more developed than in most specimens from Nepal (Martynov *et al.* 2019 [3]: figures 137, 138), similarly to most specimens from Thailand (Martynov *et al.* 2019 [3]: figures 134, 135).

4. Discussion

The winged stages of the species in the *insolta* complex have been described, *C. insolta* is the second one, while *C. femorata* is the first one. *Cincticostella insolta* is closely related to *C. femorata*, whose the winged stages share the color charac-

teristics of the wings in subimago stage (**Figure 16(A)**, **Figure 19(A)**, **Figure 22(C)**, **Figure 22(D)**); Zheng *et al.*, 2021 [9]: figure 4(B)), the characteristics of the lateral scutellar projections in sub- and imago stages (**Figure 7(B)**, **Figure 7(C)**, **Figure 11(B)**, **Figure 12(A)**, **Figure 14(A)**, **Figure 14(B)**, **Figure 17(A)**, **Figure 17(B)**, **Figure 18(A)**), and the linear groove in penis lobes on dorsal face (**Figure 10(A)**, **Figure 10(D)**); Zheng *et al.* 2021 [12]: figure 6(C), figure 6(D), figure 7(C)). *Cincticostella insolta* and *C. femorata* differ from all described species of the *jianchuan* complex in these characters [7] [16], and some described species of the *nigra* complex [9]. But, both the *insolta* complex (**Figures 22(A)-(D)**) and the *gosei* complex [14] can't distinguished by their color characteristics and the lateral scutellar projections. The color characteristics of the subimagoes of *C. nigra* and *C. orientalis* (Ishiwata 2003) [9] and the lateral scutellar projections of *C. levanidovae* (Ishiwata 2003 [9]: figure 18, figure 20) and *C. orientalis* (Ishiwata 2003 [9]: figure 20, figure 24) in the *nigra* complex are similar to the ones of the *insolta* complex. Therefore, we believe that the genus *Cincticostella* exhibits a phenomenon of multiple complexes; however, both the rationality of the *gosei* complex and the grouping of some species in the *nigra* complex remain necessary for the further research. At the same time, the grouping of these species (except *C. nigra*) based on the phylogenetic trees also raise the same question [6] [8].

The larvae between *C. insolta* and *C. femorata* in the *insolta* complex have significant differences [4]. The male adults between them also have significant differences, such as the following characters:

- 1) Body size of *C. femorata* is larger than one of *C. insolta*, for example the body length of male adult of *C. femorata* is 10.0 - 12.0 mm [12], while *C. insolta* is 8.0 - 8.4 mm (in this study).
- 2) Posterolateral spines of tergum IX of *C. femorata* male imagoes are well developed (Zheng and Zhou 2021 [12]: figure 6(C), figure 7(C)). While, the ones of *C. insolta* are poorly developed (**Figures 7(A)-(C)**).
- 3) Penis lobes of *C. insolta* have slight subapical swelling (**Figure 10(A)**, **Figure 10(C)**, **Figure 10(D)**, **Figure 10(F)**), but ones of *C. femorata* do not swell (Zheng and Zhou 2021 [12]: figure 6(C), figure 6(D), figure 7(C)). Moreover, the penis lobes of *C. insolta* have a linear groove on apical half of dorsal face (**Figure 10(D)**), while ones of *C. femorata* almost through the entire dorsal face (Zheng and Zhou 2021 [12]: figure 6(D)).
- 4) Forceps segment 2 of *C. femorata* are straight and with distinct swollen apex, third segment slightly convex. Forceps segment 2 of *C. insolta* have medial crease, forceps segment 3 ovoid.
- 5) The forewing iMP of *C. insolta* stay away from the forking point of MP (**Figure 9(A)**, **Figure 13(A)**). While, the one of *C. femorata* is developed and very close to the forking point of MP (Zheng and Zhou 2021 [12]: figure 6(A), figure 7(A)).

Additionally, Martynov *et al.* [4] had summarized the distinguishing larval characters of *Cincticostella* species complexes. But the distinguishing larval char-

acters of posterior margin of sternum IX among *Cincticostella* species complexes is still unclear. The larval characters of posterior margin of sternum IX between male and female of *C. insolta* in the *insolta* complex are very familiar (**Figure 5(B)**, **Figure 5(C)**). Ones between male and female of *C. jianchuan* in the *jianchuan* complex have significant differences (Sun *et al.* 2024 [7]: Figure 5(C), Figure 5(D)).

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Author Contributions

Conceptualization, X.-F.L.; methodology, R.-P.H. and X.-F.L.; material and resources, R.-P.H. and X.-F.L.; writing of the original draft and visualization (abstract), K.-X.W.; writing of the original draft and visualization (introduction), R.-T.W.; writing of the original draft and visualization (description of nymph), R.-H.Y.; writing of the original draft and visualization (description of adult), Y.-S.L.; writing of the original draft and visualization (description of egg), Y.-H.L.; writing of the original draft and visualization (discussion). review and editing of the draft, R.-P.H. and X.-F.L.

Statement of Informed Consent

This paper is the result of a technology paper writing training activity Institute of Eastern-Himalaya Biodiversity Research conducted for high school students. All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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