



## Two new species of Asian *Serratella* Edmunds (Ephemeroptera: Ephemerellidae)

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### Abstract

Two new species of *Serratella* Edmunds (Ephemeroptera: Ephemerellidae: Ephemerellinae: Hyrtanellini) are described based on larvae from China and Iran. *Serratella brevicauda*, new species, is distinguishable from other Hyrtanellini based on its short caudal filaments and its relatively large body size. *Serratella elissa*, new species, is distinguishable from other Hyrtanellini based on a combination of its having paired tufts of spatulate setae and no paired spines on abdominal terga and having tarsal claws with denticles nearly subequal in size. The state of Asian *Serratella* systematics is reviewed, and some problems of Hyrtanellini systematics are discussed. Modifications to a recent identification key for ephemerellid larvae are suggested.

**Key words:** Ephemerellinae, Hyrtanellini, Palearctic, Iran, China, description, identification

### Introduction

As part of our studies of Ephemerellidae (Ephemeroptera), we discovered two undescribed larvae from stream samples taken in China and Iran. The placement of these species within the phylogenetic framework of Jacobus and McCafferty (2008) was not clear when relationships were explored using MacClade (Maddison & Maddison, 2005). We provisionally consider these two species to be part of the genus *Serratella* Edmunds (Ephemerellinae: Hyrtanellini) because they have cleft ventral lamellae of gills 6 but lack the defining characteristics of all other Hyrtanellini genera. We reiterate that *Serratella* may not be monophyletic and that it requires additional study. The related genus *Quatica* Jacobus & McCafferty contains three species and also may be non-monophyletic (Jacobus & McCafferty, 2008).

*Serratella* recently was revised to include fifteen species from the Oriental, Palearctic and Nearctic regions. Ogden *et al.* (2009) provided alternative hypotheses about the phylogenetic relationships of *Serratella* to other ephemerellid groups, based on analyses of morphological and molecular data from two species collected in the United States and Japan: *Serratella serrata* (Morgan) and *S. tsuno* Jacobus & McCafferty (= *Ephemerella cornutus* Gose of Ogden *et al.*, 2009). The Ogden *et al.* (2009) study was published after the revisions of Jacobus & McCafferty (2008) but was admitted to the publication process before the revisionary work and therefore utilized only names available at the time (ICZN, 1999). The other *Serratella* species included by Ogden *et al.* (2009) was transferred by Jacobus & McCafferty (2008) to the genus *Matriella* Jacobus & McCafferty (Ephemerellinae: Ephemerellini).

As mentioned above, *Serratella* and *Quatica* need further systematic study, especially the association and detailed characterization of male adults and larvae, examination of egg chorionic ultrastructures and analysis of additional molecular data (Jacobus & McCafferty, 2008; Ubero-Pascal & Puig, 2009; Ogden *et al.*, 2009).

Egg structure is unknown for about half of the *Serratella* species, and two Asian species, *S. fusongensis* (Su & You) and *S. longipennis* Zhou, Gui & Su, remain unknown in the larval stage. The also Asian species *S. karia* (Kazanci) and *S. uenoi* (Allen & Edmunds), on the other hand, remain unknown as male adults, but it is very unlikely that any of these four species are conspecific. Jacobus & McCafferty (2008) hypothesized that *S. fusongensis* and *S. longipennis* will be found to have larvae that resemble those of *S. setigera* (Bajkova) and *S. ishiwatai* (Gose), respectively, based on shared characters of the male adults. The eventual discovery and description of these unknown stages and additional new taxa will greatly improve the status of Hyrtanellini taxonomy (Jacobus & McCafferty, 2008).

Our undescribed larvae differ considerably from *S. setigera*, *S. ishiwatai* and the three species included in *Quatica*. Notable differences include the armature of abdominal terga and the morphology of legs, gills and caudal filaments. Therefore, we consider our undescribed larvae to represent new species, which we name and describe below.

Holotypes and paratypes of the new species are deposited in the collections of Nanjing Normal University, Nanjing, China [NNU], the Purdue University Entomological Research Collection, West Lafayette, Indiana, USA [PERC] and the US National Museum of Natural History, Smithsonian Institution, Washington, DC, USA [USNM]. As indicated above, characters have been coded for each species in order to add them to the data matrix of Jacobus & McCafferty (2008).

### ***Serratella brevicauda*, new species**

(Figs. 1–3)

**Type material.** HOLOTYPE: China, Yunnan Prov., Er-yuan Co., Niu-jie Village, 24-V-1996, CF Zhou, larva [PERC]. PARATYPES: same data, 20 larvae [PERC, NNU].

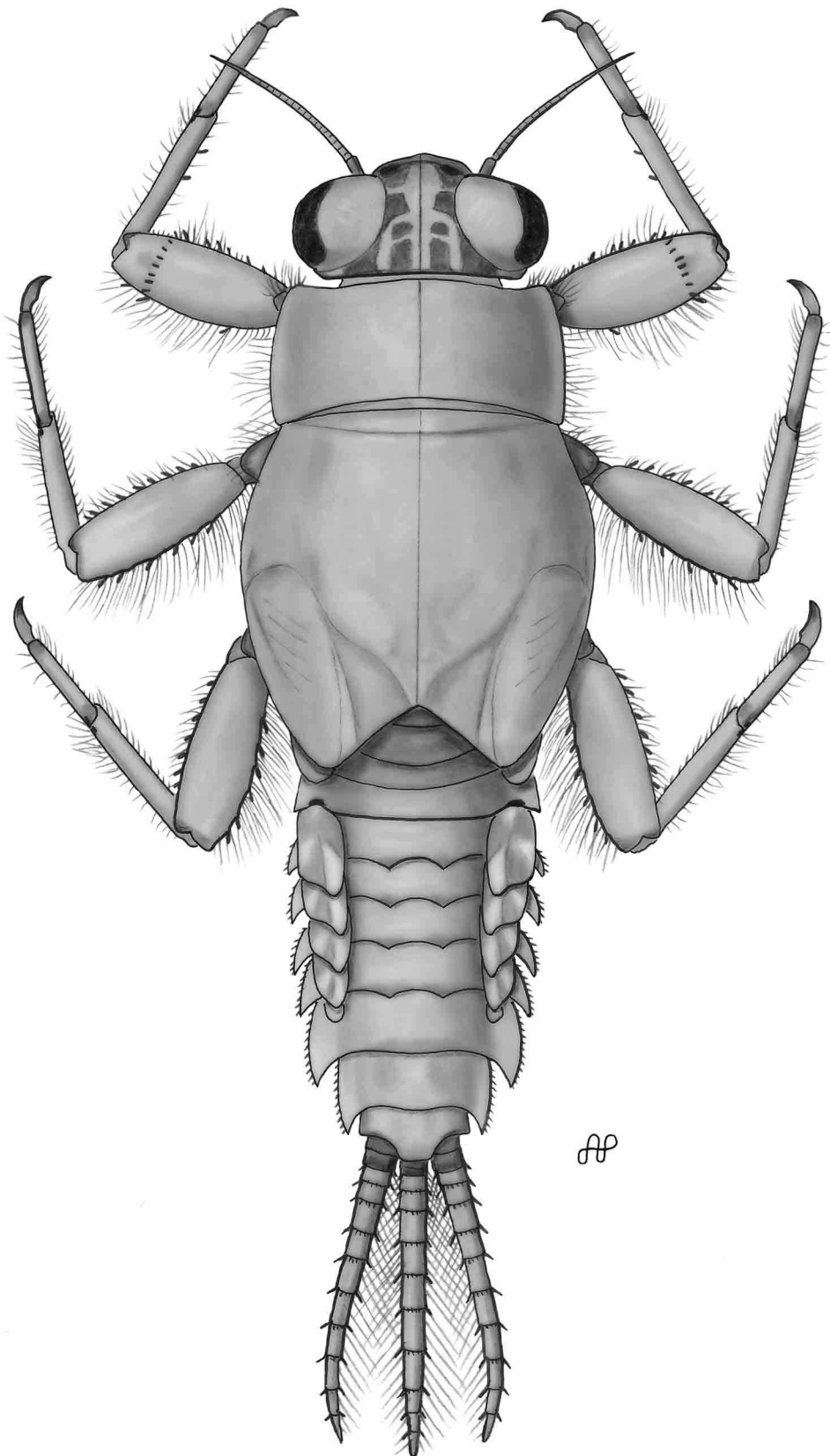
Larva (preserved in ethanol). Length: body 9.9–11.2 mm; antennae 1.6–2.0 mm; caudal filaments 2.1–2.7 mm. Body color yellow to light brown. Head: Color yellow with light brown maculae. Antennal scape and pedicel brown; flagellar segments pale, with whorl of tiny fine, hairlike setae distally on each segment. Vertex relatively smooth. Paired suboccipital bumps variously present or absent. Long setae present along margin of head capsule under compound eye. Clypeus with short setae. Labrum with transverse row of long setae. Mandible not extending beyond margin of head capsule and with sublateral setae. Maxilla (Fig. 2) stout with small subdistal patch of setae, three fimbriate medial setae, and reduced palp with three segments. Labium with palp segment 3 length about one-third that of segment 2. Thorax: Nota with few long, fine, hairlike setae and without dorsal protuberances; pronotum apparently with short anterolateral projections and with row of fine, hairlike setae on anterior and posterior margins. Legs with long, hairlike setae. Forefemur with subdistal band of stout, spatulate setae; all femora with one row of spatulate setae on posterior margin and two rows of spatulate setae on anterior margin. Tibiae with one or two irregular rows of spatulate setae. Claws (Fig. 3) with five to eight denticles and with subdistal setae. Abdomen: Pair of flat, broad, blunt spines present on terga 4–7 and sometimes present on terga 3 and 8. Anterior terga with long, fine, hairlike setae on posterior margins. Dorsal lamellae of gills falcate, with brown trilobed pattern; ventral lamella of gill 6 deeply cleft; gill 7 inserted near posterolateral corner. Sterna yellow to light brown, unmarked. Caudal filaments light brown; segments with long, hairlike setae laterally along inner margins and with distal whorls of stout spatulate setae and fine setae.

Subimagoes and Adults. Unknown.

Egg. Unknown.

Addition to data matrix. brevicauda ?? 1 0 0 0 0 0 0 0 0 0 0 - 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0  
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Larval variability. The suboccipital bumps sometimes appear to be absent, and the anterolateral thoracic projections, if present, vary in their development. Abdominal terga 3 and 8 sometimes lack paired, submedial spines.



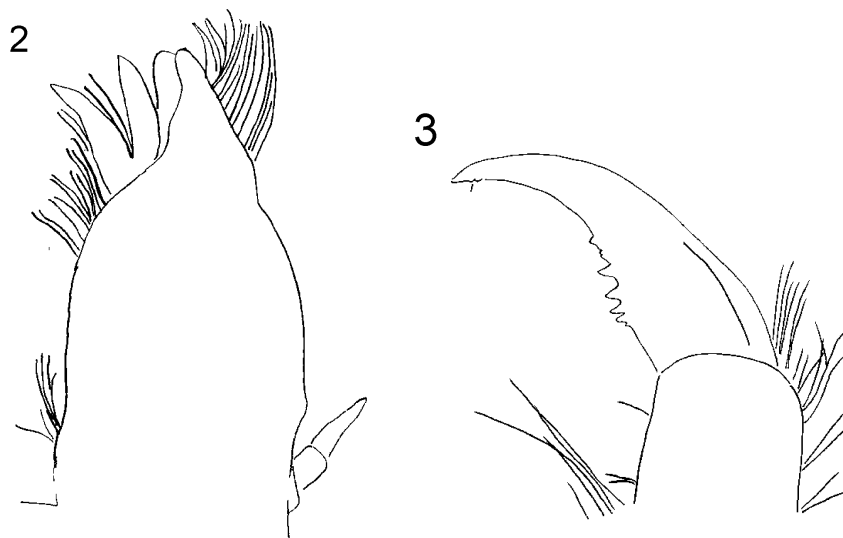
**FIGURES 1.** *Serratella brevicauda*, new species. Dorsal habitus.

**Diagnosis.** The larva of *S. brevicauda* differs from other Hyrtanellini larvae by a combination of its large size and its caudal filaments being very short relative to its body length. Within the subfamily Ephemerellinae,

only two other species, *Torleya lutosa* Kang & Yang and *T. naga* Jacobus & McCafferty, have caudal filaments that are so relatively short. In extreme contrast to *S. brevicauda*, however, these species are much smaller, lack a palp on the maxilla, have a distal pallisade of long denticles on the claw, have semi-operculate gills, and have the caudal filaments curled (Jacobus *et al.*, 2004). Any anterolateral projections on the prothorax of *S. brevicauda* are very much shorter than those of *Quatica ikonovski* (Puthz) and *Q. euphratica* (Kazanci).

This species will come out at couplet 23 of Jacobus and McCafferty's (2008: 247) key to ephemereleid larvae. In parts 23 and 23', "anterolateral projections" should be changed to *prominent* anterolateral projections, so that *S. brevicauda* will key to the genus *Serratella*.

**Etymology.** The specific epithet refers to the short cerci and median filament of the larva.



**FIGURES 2, 3.** *Serratella brevicauda*, new species. **Fig. 2.** Maxilla. **Fig. 3.** Claw.

### *Serratella elissa*, new species

(Figs. 4–6)

**Type material.** HOLOTYPE: Iran, Guilan River at Lanak Waterfall, 37°00'N, 49°52'E, no collection date, larva [PERC]. PARATYPES: same data, four larvae [PERC]. Iran, Havigh River, 20 km south of Astara, 30-IV-1973, SF&KD Kimball, seven larvae [USNM].

Larva (preserved in ethanol). Length: body 6.5–7.3 mm; antennae 1.4–1.7 mm; caudal filaments 3.7–4.0 mm. Body color yellow to light brown, sometimes with dark brown shading. Head: Color light brown with variable, dark brown maculae. Antennal scape and pedicel brown; flagellar segments light brown, darker distally, with whorl of fine, hairlike setae distally on each segment; hairlike setae one-half length of respective segment. Vertex rough. One to two pairs of spiculate, suboccipital bumps present. Clypeus with short setae. Labrum with irregular, transverse row of long, fine setae. Mandible not extending beyond margin of head capsule, with few fine, sublateral setae. Maxilla (Fig. 4) with few subdistal setae, three fimbriate medial setae, and palp with three segments. Labium with palp segment 3 length about one-half that of segment 2. Thorax: Notum without prominent protuberances and with few fine setae, sometimes with brown maculation; pronotum with no anterolateral projections. Coxae and trochanters dark brown. Femora with subproximal and subdistal dark brown bands; forefemur with broad subdistal band of few long, sharp setae; mid- and hindfemora each with scattered hairlike setae and with sparse row of few, spatulate setae recumbent on posterior margin. Tibiae dark brown basally, grading to pale distally and with scattered hairlike setae. Tarsi brown with dark brown basal band and with scattered hairlike setae. Claws (Fig. 5) with seven to nine denticles and with subdistal

setae; denticles nearly subequal in size; subdistal setae sometimes difficult to discern. Abdomen: Terga without paired, submedian spines; paired tufts of fewer than four spatulate setae present on at least some posterior margins. Terga 6, 7, 9, and 10 usually dark brown to black. Dorsal lamellae of gills falcate, with brown trilobed pattern; ventral lamella of gill 6 deeply cleft; gill 7 inserted near posterolateral corner. Sterna with dark brown to black sublateral maculation; sterna 9 and 10 dark brown to black. Caudal filaments uniformly yellow to light brown, few basal segments dark brown; segments with distal whorls of stout setae and fine setae, sometimes with few long, hairlike setae laterally.

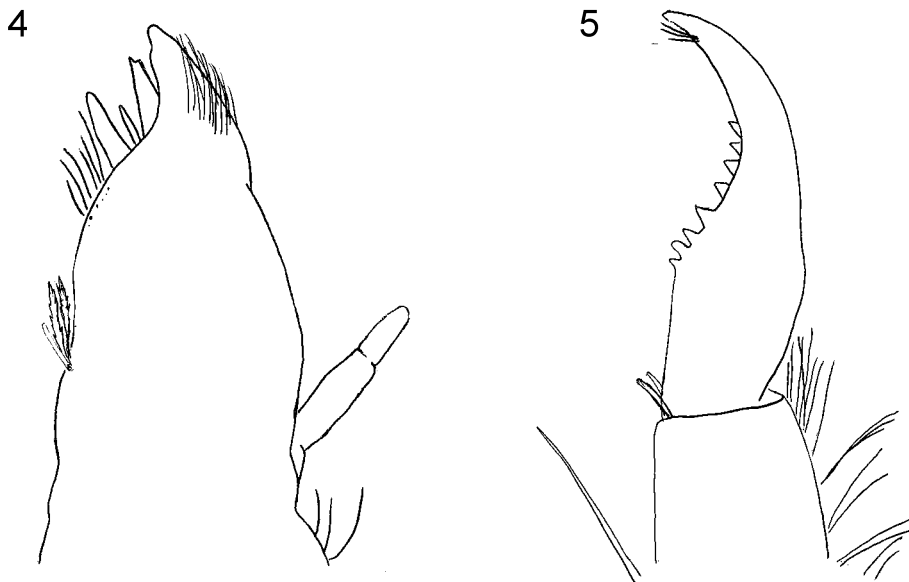
Subimagos and Adults. Unknown.

Egg. Unknown.

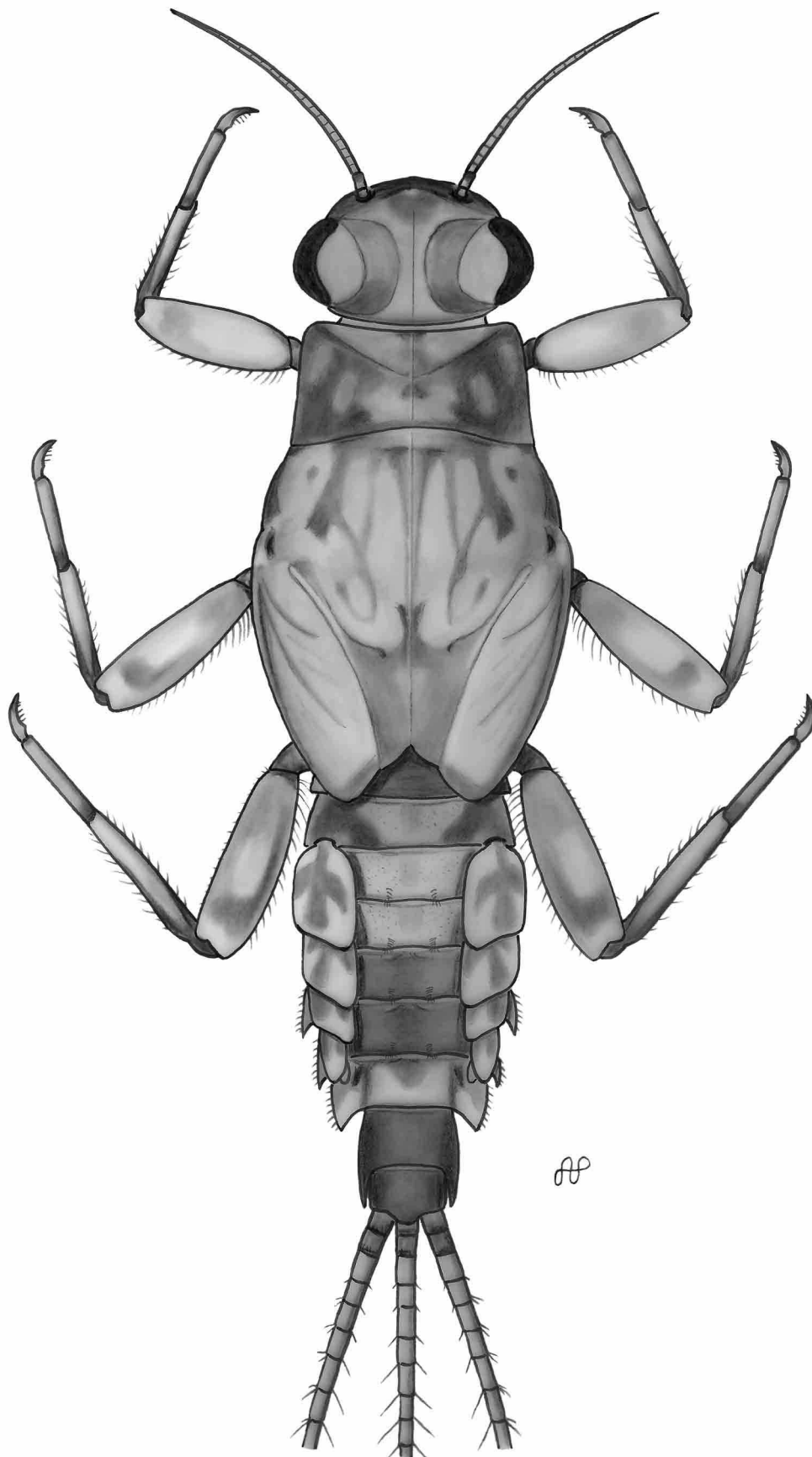
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Larval Variability. Body color of the new species varies from nearly uniform yellow with few or no markings to brown with distinct dark and pale markings. The caudal filaments are variable with respect to the presence or absence of lateral hairlike setae. Larvae tend to differ in body shape, depending on the instar examined; earlier instars tend to be more compact and dorsoventrally flattened than later instars.

**Diagnosis.** *Serratella elissa* is distinguished from other Hyrtanellini by the combination of having at least some abdominal terga with distinctive paired tufts of spatulate setae on the posterior margins (Fig. 6), gills 3 that are not operculate and claws with denticles nearly subequal in size (Fig. 5). This new species is somewhat similar in general appearance to *Quatica euphratica* (Kazanci) and *Serratella karia* (Kazanci), from Turkey. These species are distinguished easily from *S. elissa* by the dorsal armature of thorax and abdomen (Kazanci, 1990). *Serratella elissa* also resembles species of the *Teloganopsis mesoleuca* (Brauer) species group, which includes also *T. bauernfeindi* (Thomas, Marie & Dia), *T. maculocaudata* (Ikonomov) and *T. subsolana* (Allen) (Jacobus & McCafferty, 2008; Jacobus, 2009; Ubero-Pascal & Sartori, 2009). *Serratella elissa* is distinguishable from these by its abdominal armature and lack of elongate apical denticles on the tarsal claws. *Serratella elissa* superficially resembles *Ephemerella mucronata* (Bengtsson), of the tribe Ephemerellini, but *S. elissa* is distinguishable by its having deeply cleft ventral lamellae of gills 6, a character shared by all Hyrtanellini (Jacobus & McCafferty, 2008).



**FIGURES 4, 5.** *Serratella elissa*, new species. **Fig. 4.** Maxilla. **Fig. 5.** Claw.



**FIGURES 6.** *Serratella elissa*, new species. Dorsal habitus.

Couplet 20 of the recent key to ephemereleid larvae (Jacobus & McCafferty, 2008: 247) should be modified so that *S. elissa* will pass through and not be misidentified as *Torleya major* (Klapálek). Part 20 should include the following: *and gills 3 semi-operculate*. Part 20' should include the following: *and gills 3 not semi-operculate*.

**Etymology.** The specific epithet is a noun in apposition, referring to one of three fictitious stepsisters in Edmund Spenser's *The Faerie Queene*.

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