Two new Caenis species from north-eastern China (Insecta: Ephemeroptera)

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Two new *Caenis* species from north-eastern China (Insecta: Ephemeroptera)

Peter Malzacher

Abstract

The new mayflies *Caenis wui* **n. sp.** and *C. pekinensis* **n. sp.** from China (Beijing) are described and compared with West and Central Palaearctic species (*C. robusta* and species of the *C. beskidensis* group).

Keywords: Caenidae, *Caenis*, Palaearctic, Beijing, Ulmer collection.

Zusammenfassung

Zwei neue Eintagsfliegenarten aus China (Peking), *Caenis wui* **n. sp.** und *C. pekinensis* **n. sp.**, werden beschrieben und mit west- und zentralpaläarktischen Arten verglichen (*C. robusta* und Arten der *C. beskidensis*-Gruppe).

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1 Introduction

Within the bounds of an investigation of the Caenidae in the collection Georg Ulmer (1877–1963) deposited in the Museum of the University of Hamburg, I examined also samples with *Caenis* specimens from the surroundings of Beijing, collected by C. F. Wu. In two cases visible subimaginal genitalia allow the description of new species. From China, six species of *Caenis* are so far described (Zhou & Zheng 2004, Jia et al. 2010), but they can be well distinguished from the herein described species. Unfortunately no dates are given on the labels, but it seems very likely that the material described below was part of the material which is mentioned by Ulmer (1936). Ulmer states that mayflies in alcohol were sent to him by Wu "in den letzten Jahren" [during the last years], that the collector donated the majority of the material to him, and that part of it remained unidentified. Most of Wu's material is cited without exact calendar dates also in Ulmer's article, but at least in two cases the years 1929 and 1930 are given. Wu has worked in Beijing since 1926.

Acknowledgements

My special thanks go to the colleagues from the Zoologisches Museum Hamburg, in particular to Kai Schütte for leaving me the material for investigation. Thanks also to Susanne Leidenroth for making the SEMs and to Arnold H. Staniczek (both Staatliches Museum für Naturkunde, Stuttgart) for useful comments on the manuscript.

2 Material and methods

The examined material is preserved in 75% ethanol. The types of the herein described species are deposited in the Zoologisches Museum, Hamburg.

Specimens used for SEM were dehydrated through a stepwise immersion in ethanol and then dried by critical point drying. The mounted material was coated with a 20 nm Au layer, examined and photographed with a Zeiss EVO LS 15 scanning electron microscope. Digital photographs were enhanced by using Photofiltre 6.5.2 (http://www.photofiltre-studio.com).

3 Systematic account

3.1 *Caenis wui* **n. sp.** (Figs. 1, 3–6)

Holotype, ♂ larva (on microslide): M22, China, Peking [= Beijing env.], May [exact date missing], leg. C. F. Wu.

Paratypes: same data as holotype, 1♀ larva (differential diagnostic characters are the same in male and female larvae).

Etymology

The new species is dedicated to the collector, Chenfu F. Wu [= Hu Jingfu] (1896–1972).

Male imago

The holotype is a male last instar larva. The following subimaginal features are therefore visible and can be

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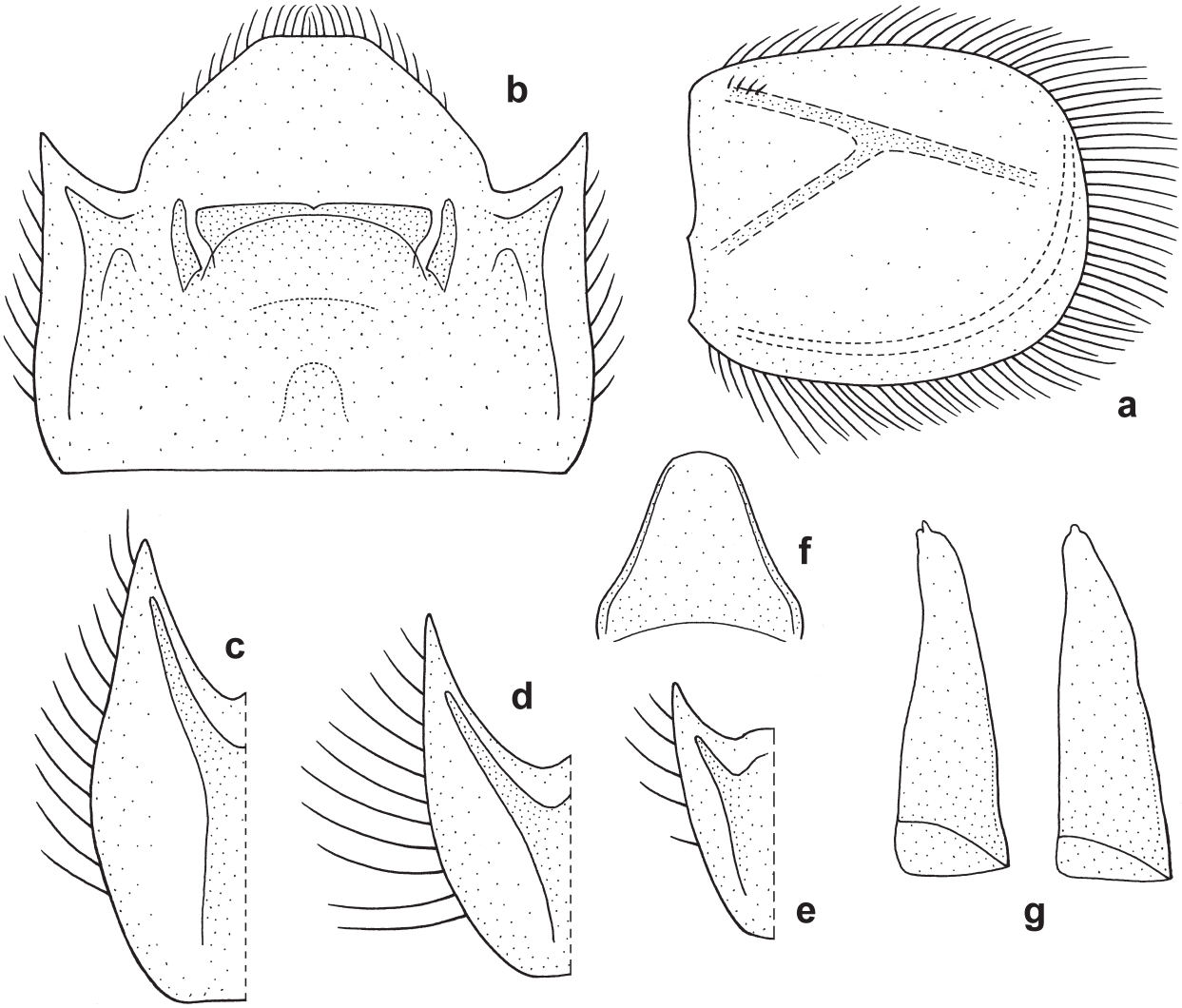

Fig. 1. *Caenis wui* n. sp., larva (a–e) [genitalia of ♂ subimago (b) and lateral processes of subimago (b–e) visible], male subimago (f–g). – **a**. Operculate gill, general view. **b**. Sternum IX. **c**. Abdominal segment VII, lateral part. **d**. Abdominal segment V, lateral part. **e**. Abdominal segment III, lateral part. **f**. Prosternal triangle. **g**. Forcipes.

described: genitalia, arrangement of prosternal ridges, shape of antenna, and posterolateral processes on abdomen:

Base of antennal flagellum not dilated; pedicel more than three times as long as scape. Prosternal ridges forming a triangle with straight or slightly concave lateral sides and broadly rounded tip (Fig. 1f). Abdominal segments V–VIII with long or very long lateral processes (Fig. 1c, d), segments III, IV and IX with shorter ones (Fig. 1b, e). Sternite IX and subimaginal genitalia as in Fig. 1b. Penis anvil-shaped. Forcipes moderately short with converging sides and a sclerotized apical knob or rounded tip (Fig. 1g).

Egg
[extracted from female last instar larva]

Egg oval, relatively short and broad (Fig. 3). Chorion granulated, with two coiled rope-like epithemata of *robusta* subtype. 15–30 threads emerge from the poles (Fig. 4). There are eggs with about 15 threads present on the one and about 30 on the other pole. As all epithemata are already unrolled in the larva, the number of terminal knobs per epithema cannot exactly be determined (12–25). The knobs show apical cap-like structures; from each knob 2–4 threads are leading off (Fig. 5 right) (for

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detailed description of coiled rope-like epithema types see MALZACHER 2011: 73, fig. 13). Micropyle with a large oval sperm guide; mouth broadly rounded; visible part of micropyle channel very short (Fig. 5 left).

Larva

Measurements and colouration

Male larva of last instar, body length 5.7 mm, length of cerci 4.5 mm; female larva of last instar, body length 8.0 mm, length of cerci 6.0 mm.

Colouration and pigmentation of the ULMER material is not preserved.

Morphology

Cuticle with small granules (pro and mesonotum) or denticles (operculate gills), two types of bristles: (1) very long and thin, (2) very short, broadly spatulate, more or less frayed. The latter form one or two dense rows laterally and sublaterally on wing buds.

Head: Genae not bulging out. Dorsolateral field of moderate or long bristles on mandibles. Second segment of labial palp 1.2–1.4 times as long as the third (along the centre-line); outer margin with about 6 very long, strong bristles. Sides of postmentum posteriorly slightly diverging, with strong and pointed bristles.

Thorax: Sides of pronotum straight and more or less parallel, anterior corners rounded. Sides of mesonotum with an anterolateral, inconspicuous, flat bulge. Coxal processes narrow, sickle-shaped, not bulging out. Fore femur with a longitudinal row of long thin bristles on dorsal side. Fore tarsus ventrally with a row of strong, dagger-shaped bristles. Mid tarsus with a similar row, additionally with a few apical pinnate bristles. Hind tarsus ventrally with two rows of dagger-shaped bristles, apical part of the inner row with pinnate bristles. Claws with 7–10 strong denticles. All claws relatively small.

Abdomen: Abdominal segments with long posterolateral processes, strongly protruding laterally, particularly in female larvae; margins with long bent bristles, shorter on posterior segments (Fig. 1b–e). Posteriomedian process of tergum II equilateral triangular, with pointed tip; tergum I also with a short and rounded process. Hind margin of tergum VII with long bristles, tergum VIII with only a few bristles (male) or bristles lacking (female), hind margin of terga IX and X with denticles, tergum IX only with a few lateral ones. Hind part of sternum IX triangular, posteriorly broadly rounded or cut, with bristles of moderate length more or less bent medially (Fig. 1b); dorsal side without shagreen. Margins of operculate gills densely provided with long thin bristles (Fig. 1a). Y-shaped ridges well developed, with a few short basal bristles. A ventral band of microtrichia consisting of short transverse rows of about 4 microtrichia (Fig. 6); the band nearly reaching the posteromedian corner of the gill (Fig. 1a). Microtrichia slightly elongated in the posterolateral part of the row (Fig. 6 left). A couple of spatulate, shortly frayed bristles basally on ventral side. Gill II 2.5 times length of gill I. Gills III–V(VI) with long marginal filaments; a great part of them with 5 or 6 branches.

Differential diagnosis

Caenis wui n. sp. can be distinguished from all other *Caenis* species by the following combination of characters:

Male imago: Lateral processes on abdomen long or very long. Penis anvil-shaped. Forcipes moderately short with converging sides and a sclerotized apical knob.

Eggs: with two coiled rope epithemata of *robusta* subtype. About 15–30 threads are anchored on the egg pole. Chorion granulated, without network of ridges. Micropyle channel very short.

Larva: Second segment of labial palp about 1.25 times as long as the third one. Sides of pronotum straight and parallel. Abdominal segments with long posterolateral processes, laterally protruding. Hind part of sternum IX triangular, dorsal side without shagreen. Operculate gill with a ventral band of microtrichia consisting of short transverse rows each with about 4 microtrichia. Most filaments of gills III–V with 5 or 6 branches.

Tab. 1. Differential diagnostic characters of *Caenis wui* n. sp. and *C. robusta*.

Character	*Caenis wui* n. sp.	*Caenis robusta*
Shape of forceps	sides irregular, tip stepped, blunt	triangular with pointed tip
Chorion of egg	with fine granules	with a network of ridges
Labial palp, segment II	1.2–1.4 times length of segment III	0.8–1.0 times length of segment III
Sides of pronotum	straight, parallel, posterior corner rounded	anterior fourth abruptly bent laterally, anterior corner pointed
Operculate gill, band of microtrichia	short transverse rows with about 4 microtrichia	longer transverse rows with 6–8 microtrichia
Hind margin of tergum VIII	without denticles, with a few bristles or without bristles	with denticles and a few bristles
Shagreen on sternum IX	without shagreen	evenly covered with small denticles

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Caenis wui is closely related to the Palaearctic species *Caenis robusta* Eaton, 1884 (compare description and figures in MALZACHER 1984 and 1986). Both species share the following characters: Imago: Abdomen with very long lateral filaments. Penis anvil-shaped. Forcipes short, with sides converging to the apex. Eggs with coiled rope-like epithemata of *robusta* subtype (MALZACHER 1982, 2011). – Larva: Third segment of labial palp very long. Fore femur with a longitudinal row of bristles (nearly all other species with a transverse row). Ventral side of operculate gill with a band of microtrichia consisting of short transverse rows; except for *Caenis horaria* (Linnaeus, 1758) all other known larvae of *Caenis* with a single row of microtrichia. The species of the Brachycercinae tribe Caenoculini however possess bands of short transverse rows (MALZACHER, in preparation). For characters distinguishing *Caenis wui* and *C. robusta* see Tab. 1.

ZHOU et al. (2000) described a species with similar genitalia, *Brachycercus parviforcipes*, that was subsequently transferred to the genus *Caenis* (ZHOU & ZHENG 2004). This species also seems to be similar to *Caenis wui*, but the forcipes of the former are short, triangular and pointed, roughly like in *Caenis robusta*. Unfortunately larvae, and hence arrangement of microtrichia on operculate gill and other larval diagnostic features, are unknown.

3.2. *Caenis pekinensis* **n. sp.**
(Figs. 2, 7)

H o l o t y p e , ♂ larva (on microslide): M11, China, Peking [= Beijing env.], [date missing], leg. C. F. WU.

P a r a t y p e s : same data as holotype, 2 ♀♀ larvae (differential diagnostic characters are the same in male and female larvae).

Etymology

The species epithet refers to the locus typicus Peking [= Bejing].

M a l e i m a g o

The holotype is a last instar male larva. Therefore a few subimaginal characters can be described:

Base of antennal flagellum not dilated. Abdomen with short posterolateral processes (Fig. 2c). Sternite IX and

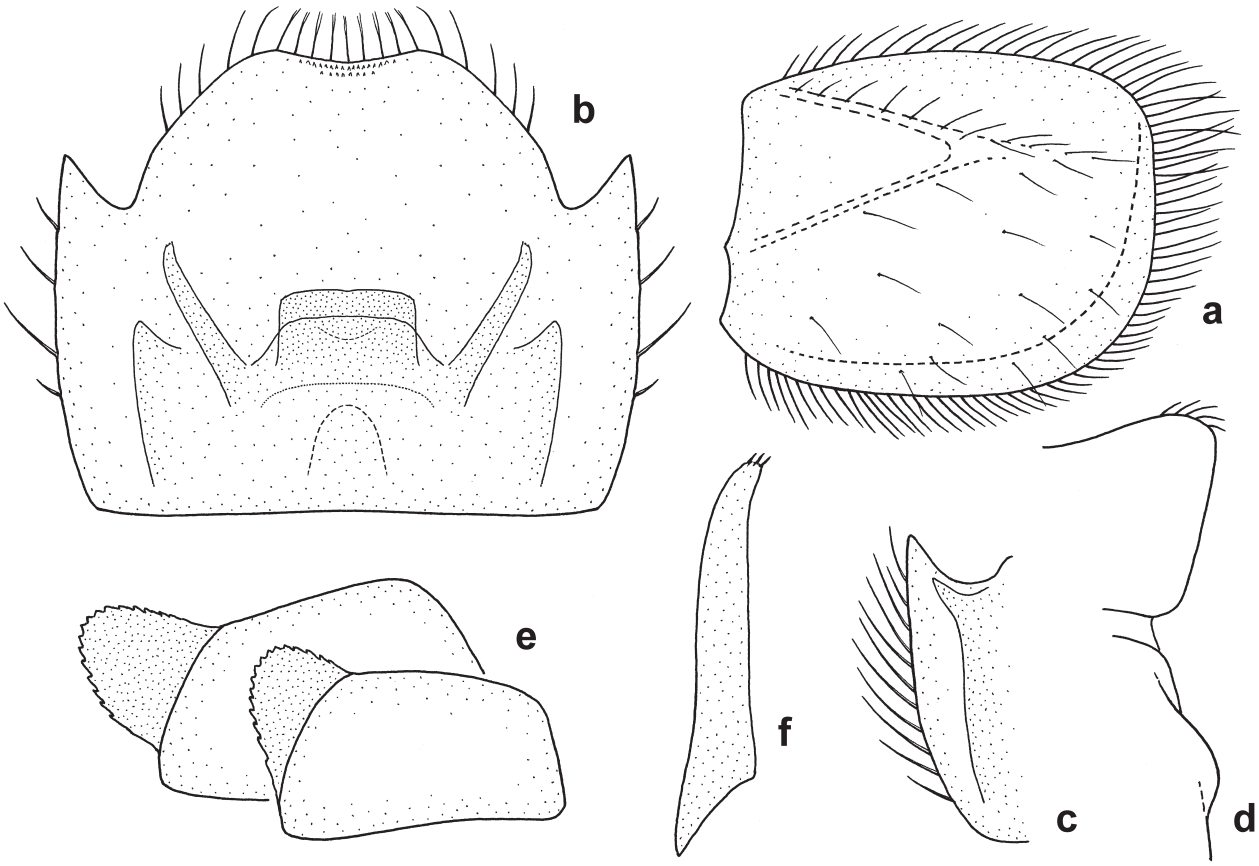

Fig. 2. *Caenis pekinensis* n. sp., larva (a–e) [genitalia of ♂ subimago (b) and lateral processes of subimago (c) visible], male subimago (f). – **a**. Operculate gill, general view. **b**. Sternum IX. **c**. Abdominal segment VII, lateral part. **d**. Lateral outline of pronotum and anterior part of mesonotum. **e**. Coxal processes of mid (right) and hind leg (left). **f**. Forceps.

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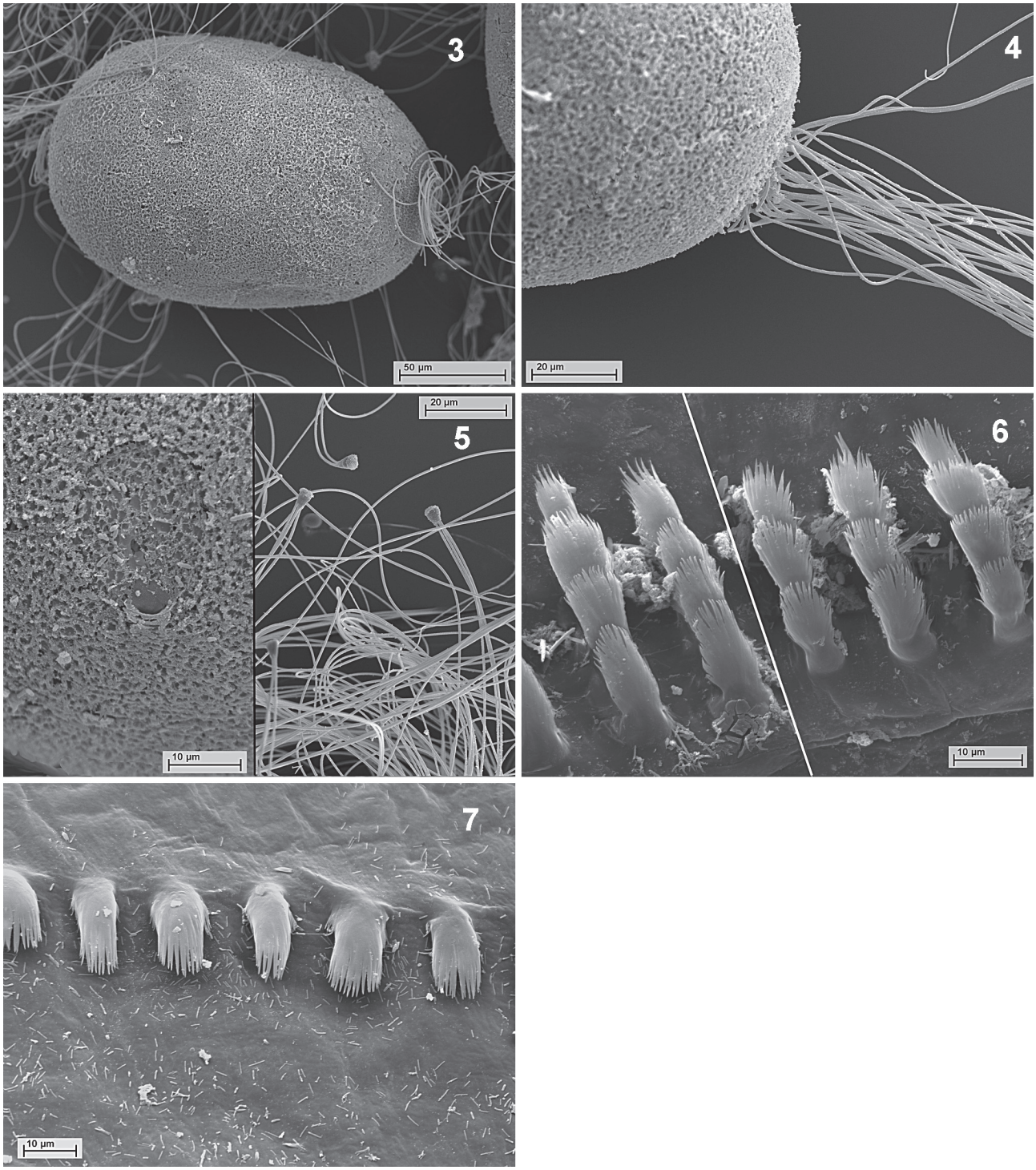

Figs. 3–7. *Caenis wui* n. sp. (3–6) [eggs dissected from ♀ last instar larva], C. *pekinensis* n. sp. (7). – **3**. Egg. **4**. Egg, polar region, with tuft of threads. **5**. Egg, threads with terminal knobs (right), micropyle (left). **6**. Larva, operculate gill, microtrichia from the band on ventral side, from anterolateral (right) and posterolateral (left) regions. **7**. Larva, operculate gill, microtrichia from the band on ventral side.

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subimaginal genitalia as in Fig. 2b. Penis square, no lateral lobes. Forcipes long and straight, median part with nearly parallel sides; apex with a few short spines (Fig. 2f).

Larva

Measurements and colouration

Male larva of last instar, body length 3.5 mm, length of cerci 2.5 mm; female larva of last instar, body length 6.0 mm, length of cerci 3.5 mm.

Colouration and pigmentation of the Ulmer material is not preserved.

Morphology

Cuticle smooth or with very small, inconspicuous denticles.

Head: Genae bulging out. Dorsolateral field of long bristles on mandibles. Second segment of labial palp 2.2–2.5 times as long as the third (along the centre-line); outer margin with about 9 long, strong bristles.

Thorax: Sides of pronotum straight, more or less diverging anteriorly, anterior corners rounded; sides of mesonotum anterolaterally with a flat, broadly rounded process (Fig. 2d). Coxal processes well developed, semicircular or tongue-shaped, margin denticulated (Fig. 2e). Fore femur dorsally with a transverse row of thin bristles of different length and a posteriorly adjoining group of bristles. Mid and hind femora with long bristles on margins and dorsal surface. Tibiae with a submarginal row of long bristles and spines on anterior margin; posterior margin with bristles shorter than those on femora. Fore tarsus ventrally with a row of short pointed bristles, apical ones more or less pinnate. Mid tarsus with a similar row, additionally with a few apical pinnate bristles. Hind tarsus ventrally with one long and one short row (short one half the length of long one) or an irregular band of short, pointed bristles with apical ones pinnate. Claws slightly bowed, with minute denticles, often hardly visible.

Abdomen: Abdominal segments with moderate posterolateral processes, more or less protruding laterally; margins with long bent bristles, shorter on posterior segments (Fig. 2b, c). Posteriomedian process of tergum II flat and broadly rounded, semicircular. Hind margin of terga VII and VIII with long bristles, of terga IX and X with denticles. Hind margin of sternum IX with a flat indentation or cut, with bristles of moderate length more or less bent medially, the median ones apically bifurcated; dorsal side with one or two rows of microdenticles close to the hind margin (in the female larva immediately on hind margin and hardly visible) (Fig. 2b). Margins of operculate gills densely provided with thin bristles of moderate length; surface with scattered thin bristles; posterior part of median ridge reduced, only indicated by a row of thin bristles (Fig. 2a). Outer ridge consisting of strong, rounded denticles. Ventral row of short microtrichia (Fig. 7) running to the posteriomedian corner of the gill (Fig. 2a). Basal part with more or less frayed, spatulate bristles of different length and shape. Gill II 2.5 times length of gill I.

Differential diagnosis

Caenis pekinensis n. sp. can be distinguished from all other *Caenis* species by the following combination of characters:

Male imago: Penis square. Forcipes long and straight, nearly parallel-sided, with a few short apical spines.

Larva: Second segment of labial palp 2.2–2.5 times length of third segment. Sides of pronotum diverging anteriorly. Coxal processes well developed. Posteromedian process on abdominal tergum II broad, semicircular. Hind margin of sternum IX with a flat indentation or cut. Y-shaped ridge on operculate gill posteriorly reduced, outer ridge consisting of strong rounded denticles.

As a Palaearctic species, *Caenis pekinensis* seems to belong to the *Caenis beskidensis*-group. The larva of *Caenis pycnacantha* from eastern China, described by Jia et al. 2010, is similar to that of *C. pekinensis*, but *C. pycnacantha* differs by sides of pronotum clearly convex, claws with 6–10 well developed denticles, and posterior part of Y-shaped ridge well developed. Males of *C. pycnacantha* show a dilated base of antennal flagellum, penis with broadly rounded lobes, bowed forceps with converging sides and strong apical spines.

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