A systematic review of the genus *Constempellina* Kieffer (Diptera: Chironomidae) from the Russian Far East, with description of a new species

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Abstract

A new species of the genus *Constempellina* Brundin, 1947, *C. tokunagai* sp. *n.*, from the Russian Far East is described and figured as male, pupa and larva. The male and pupa of *C. brevicosta* (Edwards 1937) are redescribed and figured. Consequently, the generic diagnosis is emended. Keys to the males, pupae and larvae of Russian *Constempellina* are also given.

Key words: Chironomidae, Tanytarsini, *Constempellina*, new species, key, Russian Far East

Introduction

The genus was erected by Brundin in 1947 for *Tanytarsus* (*Phaenopelma*) *brevicosta* Edwards, 1937, and later placed in the subtribe Stempellinina (Shilova 1976; Spies 2005) of the tribe Tanytarsini, subfamily Chironominae (Sæther 1977). Brundin (1948) presented the first thorough morphological analysis of the all life stages and combined the genera *Stempellina* Thienemann *et* Bause, 1913 with *Constempellina* into the *Stempellina*-group, morphologically different from the *Zavrelia*-group. Species of the genus *Constempellina* Brundin, 1947, are small non-biting midges with immature stages living in standing and flowing waters. The larvae construct small transportable cases of sand grain.

The genus *Constempellina* includes one Holarctic species, *C. brevicosta* (Edwards, 1937). Up to present time two species, *C. brevicosta* and *C. bita* Konstantinov, 1948 (nomina dubia) (Ashe & Cranston 1990) have been recorded from Russia (Pankratova 1983). However, during studies of the chironomid fauna in the Russian Far East, a new species was found, and herein is presented. Additionally, *C. brevicosta* is redescribed, and the keys to males, pupae and larvae of Russian *Constempellina* are given.

Material and methods

The material was preserved in 70% ethanol and 4% formalin and slide-mounted in Fora-Berlese solution. Morphological terminology and abbreviations follow Sæther (1980). The measurements are given as ranges. The following additional abbreviations are used: PL-male = associated larva, pupa, and adult male; PL-female = associated larva, pupa, and adult female; P-male = associated pupa and male; P-female = associated pupa and female; L = larva. Larvae are associated with pupae on the larval head capsules skins remaining on the pupae. Pupae are associated with adult males on the prepared from mature pupae genitals.

The holotype and paratypes of the new species are deposited in the Institute of Biology and Soil Sciences, Far East Branch of the Russian Academy of Sciences, Vladivostok, Russia (IBSS FEBRAS).
Systematics

**Constempellina Brundin**

*Constempellina* Brundin, 1947: 82.

**Type species:** *Tanytarsus (Phaenopelma) brevicosta* Edwards, 1937: 146.

**Other included valid species:** *Constempellina tokunagai* new species.

**Emended diagnosis.** Male: as in Cranston *et al.* (1989: 369) with the following emendations: wing length 1.5–2.7 mm, AR 0.57–1.26, acrostichals 0–4, apical part of anal point conical or parallel-side, base of superior volsella with or without microtrichia.

Pupa: as in Pinder and Reiss (1986: 313) with the following emendations: thoracic horn onion- or fusiform, antepronotals 2–3, pedes spurii B weakly developed or absent, sternite IV, rarely V, with two longitudinal rows of pale spines, anal lobe with 8–19 taeniate setae.

Fourth instar larva: as in Pinder and Reiss (1983: 206) with the following emendations: pedestal of antenna with 1–7 apical projections.

**Constempellina tokunagai** sp. n.

(Figs 1–30)


**Etymology.** Named in honour of the Japanese entomologist Professor Masaaki Tokunaga from Kyoto Imperial University.

**Diagnostic characters.** WL 1.10–1.35; AR 0.57–0.73; anal point with long and narrow apical part; basal part of superior volsella oval form without tubercle. Pupa with narrow and long thoracic horn (width 15–21 µm); tergite IV without posterolateral patches of spines; segment VIII with anal spurs (2–5) of different length. Larva with setae SIII usually simple sometimes bifurcate; AR 1.12–1.41; pedestal with 2–7 apical tubercles; blade of antenna usually not extend far beyond apex of 5th segment.

**Male (n=15).** Total length 2.2–2.7 mm; wing length 1.10–1.35 mm. Total length / wing length 1.61–1.88.

**Colouration.** Adult males characterize by following pattern of body coloration:

- Antenna: thorax, abdomen and legs brown.
- Mesonotal stripes and postnotum brown or dark brown, ground colour and scutellum yellowish-brown; abdomen yellowish-brown or brown; legs yellowish with brown distal third of femora, proximal third and distal end of tibiae, tarsalia gradually darkened toward ends, tibiae sometimes brown.
Mesonotal stripes and postnotum brown or dark brown, ground colour of thorax and scutellum yellowish-brown or brown; abdomen yellowish with brown longitudinal band; legs yellowish, ta₁–₅ gradually darkened toward ends.

Mesonotal stripes and postnotum dark brown, ground colour and scutellum yellowish; abdomen brown; legs yellowish with brown spots on proximal and distal ends of femora and tibiae and proximal end of ta₁.


**Thorax chaetotaxy.** Acrostichals 0–4, dorsocentrals 5–8, prealars 1. Scutellum with 2 setae.

**Wing.** 0.36–0.44 mm wide (Fig. 1). Veins R+R₁ with 13–20 setae, R₄+₅ with 2–6, M₁+₂ with 12–24, M₃+₄ with 13–22, Cu₁ with 0–5, Cu₂ with 0–10 and An with 0–5 setae. Cell r₄+₅ with about 50 setae, m₁+₅ with 14–25, m₃+₄ with 4–15 setae. VR 1.3–1.6.

**Legs.** Lengths and proportions of legs as in Table 1.

### TABLE 1. Lengths (in µm) and proportions of legs of *Constempellina tokunagai* sp. n., male (n=14).

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<td>p₂</td>
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<td>160–220</td>
<td>120–160</td>
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<tr>
<th>p₁</th>
<th>0.89–1.00</th>
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<tr>
<td>p₂</td>
<td>0.40–0.48</td>
<td>4.36–5.63</td>
<td>2.55–2.80</td>
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<td>p₃</td>
<td>0.50–0.59</td>
<td>3.63–4.25</td>
<td>2.42–2.79</td>
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**Hypopygium** (Figs 2–5). Laterosternite IX with 1–4 strong setae. Anal point with parallel-sided apical part (length 15–21 µm, width 3 µm) and with broad triangular base (21–36 µm long) bearing 7–15 lateral setae. Gonocoxite 90–120 µm long, with 2–4 setae on inner margin. Superior volsella 24–42 µm long with digitiform apical part (12–15 µm long) bearing 2–4 setae, and with broad basal part bearing 2–5 setae and usually densely covered with microtrichia, sometimes number of microtrichia lower, reduced to 0-5. Median volsella 36–45 µm long with dense clump of subulate setae. Inferior volsella 54–75 µm long, with 15–20 setae. Gonostylus 75–105 µm long, 18–24 µm wide at about middle, apically pointed or rounded. HR 1.03–1.40.

**Pupa** (n=9, males). Total length 2.60 mm.

**Cephalothorax** (Figs 6–8). Cephalic tubercle conical, 24–39 µm long. Spine-like frontal setae 78–90 µm long. Thoracic horn narrow, 168–240 µm long, 15–21 µm wide, covered with sparse small spines. Precornes 3 (1ˢᵗ 120–165 µm long, 2ⁿᵈ 105–204 µm long, 3ʳᵈ 96–210 µm long), anterornentials 2–3 (1 median 165–225 µm long and 1–2 lateral 105 µm long), dorsocentrals 4 (Dc₁ 120–195 µm long, Dc₂ 180–320 µm long, Dc₃ 60–165 µm long, Dc₄ 48–81 µm long); distance between Dc₂ and Dc₃ 54–90 µm. Wing sheath usually with a well-developed “nose”, rarely “nose” absent.

**Abdomen** (Figs 9–20). 1.7–2.6 mm long. Tergites II–VI with a pair of longitudinal bands of shagreen, broadened posterolaterally. Tergite VII without shagreen. Tergite VIII medially with paired patches of very fine shagreen. Hook row 180–225 µm long with 96–115 spines. Pleura of segments IV–V, sometimes VI, with longitudinal areas of shagreen (Figs 11–12). Pedes spurii B weakly developed or absent (Fig. 10). Sternites IV with a pair of longitudinal bands of pale spines laterally (Fig. 14), rarely sternite V with a pair of lateral bands. Lateral margin of segment VIII with 2–5 strong anal spurs different in length (Figs 15–20). Segments II–IV with weak L seta, V with 3 LS, VI–VII with 4 LS, VIII with 2 LS setae. Anal lobe with 8–19 taeniate setae.
Fourth instar larva (n=8). **Colouration.** Green (in formaldehyde).

**Head.** Setae SIII usually simple sometimes bifurcate (Figs 21–22). Antenna 96–123 µm long (Fig. 23), length of segments (in µm): 51–72, 15–18, 9, 12–15, 9. AR 1.12–1.41. Pedestal with 2–7 apical projections (Fig. 24). Basal segment with ring organ at base and single 27–30 µm long seta. Blade 45–54 µm long, usually not extend far beyond apex of antenna, accessory seta 9–12 µm long. Lauterborn organ 30 µm long, not extend beyond antennal apex. Style 9 µm long. Seta SI comb-like 21–24 µm long (Fig. 25), SII 30–36 µm long. Premandible 45–63 µm long, with 5 teeth (Fig. 26). Mandible 66–102 µm long, 45–57 µm wide; seta subdentalis 45–57 µm long; mola with 1 spine; dorsal teeth, apical and 2 inner teeth brownish (Fig. 27). Maxillary palp 12–24 µm long. Mentum 60–75 µm long, median tooth yellowish, 6th pair of lateral teeth brownish (Figs 28–29). Ventromental plate 48–60 µm wide, 27–33 µm high; distance between ventromental plates 24 µm.
FIGURES 6–20. Pupa of Constempellina tokunagai sp.n. 6—frontal apotome, dorsal view; 7—thorax, lateral view; 8—thoracic horn; 9—tergites II–IX; 10—pedes spurii B on segment II; 11—tergite IV; 12, 13—tergites VI; 14—sternite IV; 15, 16, 17, 18, 19, 20—anal spurs on segment VIII. Scale bar 100 µm.
Body. Posterior parapod with 16 yellow simple claws. Anal tubules conical, upper pair 48–63 µm long, bottom pair 23–27 µm long. Procercus 45 µm long, with 8 simple or branched anal setae, and 1–2 dark brown spines (Fig. 30).

Remarks. The male of a new species is very similar to *C. brevicosta* (Edwards) in the shape of the hypopygium, but can be separated by a smaller size of the wing (WL 1.0–1.35) and a lower value of the index of the antenna (AR 0.57–0.73), a long and parallel-sided apical part of the anal point. The male of *C. brevicosta* has wing length 1.5–2.0 mm, AR 1.0–1.26, short and conical apical part of the anal point. The male of *C. tokunagai* sp. n. closely resembles that described by Lindeberg (unpublished data) as *C. arcticola*, but *C. tokunagai* has gonostylus widest at mid length, while *C. arcticola* has gonostylus widest in the apical third. The new species is also similar to *C. brevicosta* in the pupal stage and can be separated by the presence of a slender and long thoracic horn and by the absence of posterolateral patches of spines on tergite IV. The larva also is close to *C. brevicosta*, but can be easily separated by the presence of 2–7 apical tubercles on pedestal of antenna, and the blade of antenna usually does not extend far beyond apex of 5th segment.
**Distribution and ecology.** *Constempellina tokunagai* sp. n. was collected in the Primorye, Khabarovsk, Amur, Magadan and Zabaykalsk Territories, Sakhalin Island and Kamchatka Peninsula in the Russian Far East. Probably this species is widely spread in China and Japan. *Constempellina tokunagai* sp. n. has been recorded from many springs, streams and rivers. Larvae construct cases from sand.

***Constempellina brevicosta*** (Edwards, 1937)  
(Figs 31–43)

*Tanytarsus (Phaenopelma) brevicosta* Edwards, 1937: 146, fig. 2.  
*Lauterbornia (Phaenopelma) brevicosta* Edwards; Goetghueber (1940: 57).  
*Phaenopelma brevicosta* Edwards; Thienemann (1941: 236, figs 45–47); Goetghueber (1954: 137).  
*Constempellina brevicosta* Edwards; Brundin (1947: 82, fig. 122); Brundin (1948: 19, figs 2, 7, 10, 15, 17); Shilova (1976: 18);  
Grimås & Wiederholm (1979: 119); Pankratova (1983: 306, fig. 10.9 A–E); Pinder & Reiss (1986: 313, fig. 10.10 A, B, D); Cranston *et al.* (1989: 369, fig. 10.11); Langton (1991: 314, figs 129 h–j); Gilka (2011: 33, figs 86–88).


**Diagnostic characters.** Wing length 1.5–2.0 mm; AR 1.0–1.26; anal point with short and conical apical part; basal part of superior volsella oval or triangular form, sometimes with a small tubercle. Pupa with bulb-shaped thoracic horn; tergite IV with posterolateral patches of spines; segment VIII with 4 strong anal spurs approximately equal length. Larva with setae SIII simple; pedestal with one apical tubercle; blade of antenna extending far beyond apex of 5th segment; AR 1.3 (according to Brundin 1948 and Pankratova 1983).

**Male** (n=12). Total length 2.3–3.1 mm; wing length 1.5–2.0 mm. Total length / wing length 1.31–1.63.  
**Colouration.** Dark brown midges. Legs dark brown except for yellowish brown proximal half of the femur.  
**Thorax chaetotaxy.** Acrostichals 0–3, dorsocentrals 6–12, prealars 1. Scutellum with 2 setae.  
**Wing** 0.4–0.5 mm wide (Fig. 31). Veins R+R 1 with 24–57 setae, R 4+5 with 4–34, M 1+2 with 17–85, M 3+4 with 24–65, Cu 1 with 7–18, Cu with 0–4 and An with 0–64 setae. Cells r 5+6, m 1+2, m 3+4 with setae. VR 1.31–1.38.  
**Legs.** Lengths and proportions of legs as in Table 2.  
**Hypopygium** (Figs 32–37). Laterosternite IX with 1–5 strong setae. Apical part of anal point triangular (length 42–72 µm, width 12–15 µm at base), and with broad triangular base bearing 20–32 lateral setae (Figs 33–34). Gonocoxite 120–144 µm long, with 4–5 setae on inner margin. Superior volsella 30–39 µm long, apical part 9–18 µm long and with 3–4 setae, basal part oval (Fig. 37) or triangular form (Fig. 35), sometimes with a small tubercle (Fig. 36), bearing 1–7 setae and densely covered with microtrichia (rarely microtrichia absent Fig. 37). Median volsella 48–60 µm long with a dense clump of subulate setae. Inferior volsella 72–90 µm long, with 17–25 setae. Gonostylus 105–129 µm long, 30–39 µm wide at about middle, apically rounded. HR 1.05–1.14.
TABLE 2. Lengths (in µm) and proportions of legs of *Constempellina brevicosta* (Edwards), male (n=11).

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TABLE 2. (Continued)

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<tr>
<td>p₁</td>
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<td>2.16–2.48</td>
<td>2.10–2.29</td>
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<tr>
<td>p₂</td>
<td>0.43–0.45</td>
<td>4.60–5.00</td>
<td>2.52–2.80</td>
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<tr>
<td>p₃</td>
<td>0.55–0.61</td>
<td>3.55–3.88</td>
<td>2.56–2.77</td>
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FIGURES 38–43. Pupa of *Constempellina brevicosta* (Edwards). 38—frontal apotome, dorsal view; 39—thorax, lateral view; 40—thoracic horn; 41—tergites II–VII; 42—stermite IV; 43—anal spurs. Scale bar 100 µm.

Pupa (n=1, female). Cephalothorax (Figs 38–40). Cephalic tubercle conical, 36 µm long. Spine-like frontal setae 84 µm long. Thoracic horn 216 µm long, bulb-shaped, broadest basally (maximum width 69 µm), tapering to pointed apex, covered with small spines. Precorneals 3 (1st 126–144 µm long, 2nd 150–165 µm long, 3rd 144–156 µm long), antepronotals 2 (1 median 168 µm long and 1 lateral 105–120 µm long), dorsocentrals 4 (Dc1 84 µm long, Dc2 60 µm long, Dc3 144–150 µm long, Dc4 180–204 µm long); distance between Dc2 and Dc3 66 µm. Wing sheath with a well-developed “nose”.

**Fourth instar larva** is absent in our materials. The brief description and illustrations of larva are given in articles of Brundin (1948), Pinder & Reiss (1983) and Pankratova (1983). Unfortunately, there are still no detailed morphometric descriptions of larvae of this species.

**Remarks.** The males of *C. brevicosta* are characterized by variability of morphological features such as chaetotaxy of the wing, AR, LR and structure of some parts of the hypopygium. Some variations are related to features of ecology of the species (Grimås & Wiederholm 1979), the other—with the incorrect identification of the species. Gilka (2011) gives a figure of the hypopygium of *C. brevicosta* which possibly most similar to *C. arcticola* sp. n. (Lindeberg unpublished data) in the form of anal point and gonostyly. Chaetotaxy of the wing was the most variable feature among the examined far eastern specimens of *C. brevicosta* (see redescription).

The male of *C. brevicosta* is similar to *C. tokunagai* sp. n., but can be separated by having an AR>0.9, anal point with short and conical apical part, basal part of superior volsella oval or triangular, sometimes with a small tubercle. The male of *C. brevicosta* is also similar to *C. monticola* (Lindeberg unpublished data), but it differs in the form of anal point and gonostylus. The pupa of *C. brevicosta* also closely resembles that of *C. tokunagai* sp. n., but may be separated by a bulb-shaped thoracic horn and by the presence of posterolateral patches of spines on tergite IV.

Morphological characteristics of the examined adult males and larvae of *C. brevicosta* agree with previous descriptions (Edwards 1937; Brundin 1947; Brundin 1948; Grimås & Wiederholm 1979; Pankratova 1983; Pinder & Riess 1983; Cranston et al. 1989; Lindeberg unpublished data). The far eastern pupae of *C. brevicosta* have two median patches of shagreen on tergite VIII, while pupae described by Thienemann (1941) and Webb (1969) are characterized by the presence of one median patch of shagreen.

**Distribution and ecology.** *Constempellina brevicosta* (Edwards) is distributed across the Holarctic Region (Saether & Spies 2004). This species was so far reported from various localities of the Northern part of European Russia (Zvereva 1969; Kuzmina 2001), Karelia (Zabolotsky 1965; Kulikova et al. 2009), Western Siberia (Stepanova 2007; Pozdeev 2010; Palatov & Chertoprud 2012), Eastern Siberia—Zabaikalye and Yakutia Region (Linevich 1981; Kravtsova 2000, 2010; our data), Kazakhstan (Minsarina & Kiseleva 2007). All the above records are based on larval captures. Adults captures were recorded by Zelentsov (2013) and by Zelentsov & Shilova (1996) from northern Karelia, by Shilova & Zelentsov (2000) from the North of Eastern Siberia. This species is widely distributed in Russian Far East: Primorye and Khabarovsk Territory, Magadan and Sakhalin Region, Kamchatka Peninsula (makarchenko et al. 2005). It occurs also in China (Wang 2000) and Mongolia (Hayford 2005). The larvae live in the littoral zone of lakes, as well as in streams and rivers, building sand conical houses.

**Key to the Russian Far East species of the genus Constempellina Brundin**

**Males**

1. Wing length 1.10–1.35 mm. AR < 0.9. Anal point with long and parallel-sided apex. Basal part of superior volsella oval, without tubercle (Figs 1–5) ................................................................. 1. *C. tokunagai* sp. n.  
   - Wing length 1.5–2.0 mm. AR > 0.9. Anal point with short conical apex. Basal part of superior volsella oval or triangular, sometimes with small tubercle (Figs 31–37). ......................................................... 1. *C. brevicosta* (Edwards)

**Pupae**

1. Thoracic horn slender and long. Tergite IV usually without posterolateral groups of spines (sometimes 1–3 spines present). Segment VIII with spurs of different length (Figs 6–20) ................................. 1. *C. tokunagai* sp. n.  
   - Thoracic horn robust, bulb-shaped, broadest at base and tapering to pointed apex. Tergite IV with posterolateral groups of spines. Segment VIII with approximately equal spurs (Figs 38–43). ........................................... 1. *C. brevicosta* (Edwards)

**Fourth instar larvae**

1. Pedestal of antenna with 2–7 apical tubercles. Blade usually not extend beyond apex of antenna (Figs 21–30) ................................................................. 1. *C. tokunagai* sp. n.  
   - Pedestal of antenna with 1 apical tubercle. Blade extend far beyond apex of antenna (Brundin 1948, Figs 2, 7, 10, 15, 17; Pinder & Reiss 1983, Fig. 10.9 A–E) ................................................................. 1. *C. brevicosta* (Edwards)
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