Two new species of Stenochironomus Kieffer (Diptera, Chironomidae) from Zhejiang, China

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Abstract
Two new species of Stenochironomus Kieffer (Diptera: Chironomidae: Chironominae), S. brevissimus sp. n. and S. linanensis sp. n., are described from China and the male imagines are illustrated. S. brevissimus sp. n. can be separated from the so far known species by having very short and small, spatulate superior volsella with two long setae, whereas S. linanensis sp. n. is easily separated from the other species of Stenochironomus by the following characters: wings transparent, body yellow, superior volsella finger-like, with nine long setae, elongated inferior volsella with four long setae and one well developed terminal spine; tergite IX with 10–15 long setae medially. A key to the males of Stenochironomus occurring in China is given.

Keywords
Stenochironomus, new species, key, China

Introduction
Stenochironomus Kieffer, 1919 is a species-rich genus with worldwide distribution, occurring in all biogeographical regions except in Antarctica (Cranston et al. 1989). The genus was erected by Townes in 1945 based on Chironomus pulchripennis (Coquillett, 1902) (Spies and Sæther 2004). The larvae are easily found mining decayed leaves or
wood in freshwater habitats ranging from small ponds and swamps to fast-flowing streams and rivers (Cranston et al. 1989). Based on the different hosts of larvae and pupae, Borkent (1984) erected two subgenera: *Stenochironomus s. str.* Kieffer (larvae and pupae mine dead submerged wood) and *Petalopholeus* Borkent (larvae and pupae mine dead submerged leaves). This subdivision has not been adopted by subsequent authors, because immature stages are known only for a few species, which makes difficult to ascribe them to any subgenus (Pinho et al. 2005, Andersen et al. 2008, Qi et al. 2008, Dantas et al. 2010, Zorina 2010). To date, there are 97 species recorded around the world: 24 species from the Palaearctic Region, 17 from the Nearctic Region, 30 from the Neotropical Region, 16 from the Oriental Region, 16 from the Afrotropical Region and 4 from the Australasian Region (Qi et al. 2011, Reis et al. 2013).

Zhejiang Province is located in the Chinese central subtropical region, which has a humid monsoon climate. In Zhejiang, three species of *Stenochironomus* [S. *koreanus* Borkent, 1984, S. *nubilipennis* Yamamoto, 1981 and S. *satorui* (Tokunaga & Kuroda, 1936)] have been recorded (Wang 2000, Qi et al. 2011). In this paper, two new species of *Stenochironomus* from Zhejiang, Oriental China, are described and illustrated. A key to the males of *Stenochironomus* from China is presented.

**Materials and methods**

The morphological nomenclature follows Sæther (1980). Measurement methods follow Qi et al. (2012). The material examined was slide-mounted, following the procedure outlined by Sæther (1969). Specimens have been deposited in the College of Life Science, Taizhou University, China.

Abbreviations of parts measured are as follows:

- **AR** Antennal ration, length of 13th / length of flagellomeres 1–12
- **Palpomere ratio (5th/3rd)** Length of the 5th Palpomere / length of the 3rd Palpomere
- **VR** Venarum ration, length of Cubitus (Cu) / length of Media (M)
- **BV** Length of (femur + tibia + ta₁) / length of (ta₂ + ta₃ + ta₄ + ta₅)
- **LR** Leg ration, length of ta₁ / length of tibia
- **SV** Length of (femur + tibia) / length of ta₁
- **HR** Hypopygium ration, length of gonocoxite / length of gonostylus
- **HV** Hypopygium value, total length / length of gonostylus times ten
- **p₁** Fore leg
- **p₂** Mid leg
- **p₃** Hind leg
- **fe** femur
- **ti** tibia
- **ta₁…taₙ** tarsus₁…tarsusₙ
- **R** Radius
- **R₁** Radius 1 vein
- **R₄⁺₅** Radius 4+5 vein
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Taxonomy

*Stenochironomus brevissimus* sp. n.
http://zoobank.org/ADC155AF-0069-4052-8907-191E35A59854
Figs 1–10

**Diagnosis.** The adult male of *S. brevissimus* sp. n. can be distinguished from all other species of *Stenochironomus* by the following combination of characters: superior volsella very short and small, spatulate, with 2 long setae, elongated inferior volsella with 6 long setae, posterior margin of tergite IX with 20–22 setae and 8 spines.

**Description.** Male imago (n = 3). Total length 4.3–4.6 mm. Wing length 2.2–2.5 mm. Total length / wing length 1.8–1.9. Wing length / length of profemur 1.7–1.8.

Coloration. Head yellow, antenna brown. Thorax light yellow, postnotum and scutum with brown spots. Wings transparent, without any pigmentation. Abdomen and hypopygium yellow, anal point brown. Fore legs yellow with femur apically brown. Mid legs with apex and posterior basal region of femur with dark brown stripes, tibia brown, tarsomers 1–5 yellow. Hind legs brown with femur yellow with dark brown stripes at apex.

Head (Fig. 1). AR 1.80–1.92. Temporal with 10–12 setae. Clypeus with 20–22 setae. Tentorium 173–176 mm long, 43–46 mm wide. Stipes 140–145 µm long, 10–13 µm wide. Palpomere lengths (in mm): 60–63, 60–65, 210–230, 140–150, 260–300. Palpomere ratio (5th/3rd) 1.2–1.3.

Wings (Fig. 2). VR 1.08–1.15. Brachiolum with 3–4 setae; R with 25–32 setae, R₁ with 27–30 setae, R₄₅ with 41–42 setae. Squama with 8–10 setae.

Thorax (Fig. 3). Dorsocentrals 12–14, acrostichals 14–16, prealars 4–5. Scutellum with 6–7 setae.

Legs (Fig. 4). Fore leg: width at apex of tibia 60–65 mm, tibia with scale 53–56 µm long, with 2–4 strong setae (Fig. 5). Mid leg: width at apex of tibia 80–83 mm, tibia with two apical spurs 40–50, 43–53 µm long. Hind leg: width at apex of tibia 70–80 mm, tibia with two apical spurs 40–50, 40–55 µm long. Mid and hind tibiae with fused combs (Figs 6–7), each comb 36–50 µm long. Lengths (in mm) and proportions of legs in Table 1.

Hypopygium (Fig. 8). Anal point 113–120 mm long, 15–20 µm wide at base, 13–15 µm wide at apex, parallel-sided, slender, apically rounded. Tergite IX with 16–17 long setae medially, posterior margin of tergite IX with 20–22 setae and 8 spines (Fig. 9). Phallapodeme 120–123 mm long; transverse sternapodeme 30–50 mm long. Gonocoxite 200–230 mm long. Superior volsella short, small and spatulate, 16–18 mm long, 20–22 mm wide, with 2 long setae (Fig. 10). Inferior volsella elongated, 190–200 mm long, with 6 long setae. Gonostylus 210–230 mm long, with 4 long setae along inner margin in distal 1/3. HR 0.95–1.00, HV 1.89–2.04.

**Female, pupa and larva.** Unknown.

**Type material.** Holotype: Male, CHINA, Zhejiang, Zhejiang, Quzhou City, Hunan County, 19.iv.2012, leg. XL Lin, sweep net. 2 Paratypes: 2 males, same data as holotype.
**Etymology.** The specific epithet is a Latin adjective “*brevissimus*”, meaning the shortest, and refers to the superior volsella, which is the shortest in the genus.

**Remarks.** *S. brevissimus* sp. n. is similar to *S. hainanus* Qi, Shi & Wang, 2008 and *S. okialbus* Sasa, 1990 in having short and small superior volsella, but can be separated from these species by the differences given in Table 2.

**Distribution.** The species is currently known only from Zhejiang Province of Oriental China.

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**Table 1.** Lengths (in µm) and proportions of leg segments in *Stenochironomus brevissimus* sp. n. (n = 3).

|        | $P_1$       | $P_2$       | $P_3$       |
|--------|-------------|-------------|-------------|
| Fe     | 1300−1400   | 1125−1200   | 1325−1525   |
| Ti     | 1300−1500   | 1000−1125   | 1275−1400   |
| $ta_1$ | 1500−1600   | 725−800     | 950−1100    |
| $ta_2$ | 775−875     | 375−450     | 525−625     |
| $ta_3$ | 675−750     | 340−410     | 440−500     |
| $ta_4$ | 525−600     | 200−290     | 260−360     |
| $ta_5$ | 250−300     | 90−110      | 110−130     |
| LR     | 1.07−1.15   | 0.71−0.73   | 0.74−0.79   |
| BV     | 1.78−1.84   | 2.48−2.83   | 2.49−2.66   |
| SV     | 1.73−1.81   | 2.91−2.95   | 2.66−2.74   |

**Table 2.** Main differences between *S. brevissimus* sp. n., *S. hainanus* and *S. okialbus*.

|        | *S. brevissimus* | *S. hainanus* | *S. okialbus* |
|--------|------------------|---------------|---------------|
| Wing   | transparent, without any pigmentation | transparent, without any pigmentation | with dark bands across the middle and posterior area |
| Coloration | thorax light yellow, postnotum and scutum with brown spots; fore legs yellow with femur apically brown; mid legs with apex and posterior basal region of femur with dark brown stripes, tibia brown, tarsomeres 1–5 yellow; hind legs brown with femur yellow with dark brown stripes at apex | whole body yellow, without dark pigmentation | thorax yellow; fore legs yellow with femur apically brown, apex and basal region of tibia with dark brown stripes; mid legs yellow with femur apically brown; hind legs yellow with femur apically brown |
| Superior volsella | with 2 setae | with 3 setae | with 4 setae |
| Inferior volsella | with 6 setae | with 3 setae | with 4 setae and a strong terminal spine |
| Posterior margin of tergite IX | with 20–22 setae and 8 spines | with 16 setae | with 8 setae and 8 spines |
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Figures 1–10. *Stenochironomus brevissimus* sp. n., male. 1 head 2 wing 3 thorax, lateral view 4 legs coloration (a. fore leg; b. mid leg; c. hind leg) 5 fore tibial apex, ventral view 6 mid tibial apex, lateral view 7 hind tibial apex, lateral view 8 hypopygium 9 spines on posterior margin of tergite IX, ventral view 10 superior volsella.
**Stenochironomus linanensis sp. n.**

http://zoobank.org/F01888A4-0CA1-4041-9290-12B68CFA5BA0

Figs 11–18

**Diagnosis.** The adult male of *S. linanensis* sp. n. can be distinguished from all other species of *Stenochironomus* by the following combination of characters: wings transparent, body yellow, superior volsella finger-like, with 9 long setae, elongated inferior volsella with 4 long setae and one well-developed terminal spine, tergite IX with 10–15 long setae medially.

**Description.** Male imago (*n* = 5). Total length 2.9–3.8 mm. Wing length 1.4–1.5 mm. Total length / wing length 1.98–2.41. Wing length / length of profemur 1.30–1.57.

Coloration. Head yellow. Thorax greenish yellow. Wings transparent, without any pigmentation. Abdomen yellow, hypopygium brown. Legs pale yellow.

Head (Fig. 11). AR 1.20–1.32. Temporal with 8–14 setae. Clypeus with 9–10 setae. Tentorium 153–156 mm long, 37–42 mm wide. Stipes 72–95 µm long, 5–6 µm wide. Palpomere lengths (in mm): 45–47, 28–33, 53–60, 75–90, 110–120. Palpomere ratio (5th/3rd) 2.00–2.07.

Wings (Fig. 12). VR 1.07–1.20. Brachiolum with 2 setae; R with 16–23 setae, R1 with 17–18 setae, R4,5 with 22–28 setae. Squama with 5–7 setae.

Thorax (Fig. 13). Dorsocentrals 9–13, acrostichals 9–14, prealars 4–5. Scutellum with 5–6 setae.

Legs. Fore leg: width at apex of tibia 33–47 mm, tibia with scale 33–46 µm long, with 2–3 strong setae (Fig. 14). Mid leg: width at apex of tibia 50–65 mm, tibia with two apical spurs 25–28, 30–40 µm long. Hind leg: width at apex of tibia 50–60 mm, tibia with two apical spurs 32–39, 35–40 µm long. Mid and hind tibiae with fused combs (Fig. 15–16), each comb 18–22 mm long. Lengths (in mm) and proportions of legs in Table 3.

Hypopygium (Fig. 17). Anal point 65–73 mm long, 14–20 µm wide at base, 6–8 µm wide at apex, apex of anal point slightly swollen and rounded. Tergite IX

|       | P₁   | P₂   | P₃   |
|-------|------|------|------|
| fe    | 925–1075 | 625–700 | 650–725 |
| ti    | 700–875  | 650–725 | 750–900  |
| ta₁   | 925–1100 | 475–550 | 780–950  |
| ta₂   | 500–725  | 200–260 | 400–600  |
| ta₃   | 400–500  | 210–300 | 300–350  |
| ta₄   | 320–400  | 130–200 | 240–300  |
| ta₅   | 140–200  | 70–80   | 100–120  |
| LR    | 1.25–1.32 | 0.73–0.75 | 1.04–1.06 |
| BV    | 1.67–1.88 | 2.35–2.87 | 1.88–2.10 |
| SV    | 1.76–1.83 | 2.60–2.68 | 1.71–1.79 |
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Figures 11–18. *Stenochironomus linanensis* sp. n., male. 11 head 12 wing 13 thorax, lateral view 14 fore tibial apex, ventral view 15 mid tibial apex, lateral view 16 hind tibial apex, lateral view 17 hypopygium 18 superior volsella.
with 10–15 long setae medially, posterior margin of tergite IX with 12–14 setae and 4 spines. Phallapodeme 70–80 mm long; transverse sternapodeme 35–38 mm long. Gonocoxite 160–180 mm long. Superior volsella finger-like, 53–63 mm long, with 9 long setae (Fig. 18). Inferior volsella elongated, 160–170 mm long, with 4 long setae and one well-developed terminal spine. Gonostylus 123–170 mm long, with 9 long setae along inner margin in distal 1/2. HR 0.94–1.47, HV 1.98–2.35.

Female, pupa and larva. Unknown.

**Type material.** Holotype: Male, CHINA, Zhejiang, Linan City, Qingliangfeng Mountain, 16.v.2012, leg. XL Lin, sweep net. 4 Paratypes: 4 males, same data as holotype.

**Etymology.** The specific epithet is an adjective referring to the type locality, Linan City.

**Remarks.** *S. linanensis* sp. n. is similar to *S. macateei* (Malloch, 1905), *S. maculatus* Borkent, 1984 and *S. recticaudatus* Borkent, 1984 in the structure of the hypopygium and the inferior volsella with a strong terminal spine, but can be separated from these species by the differences given in Table 4.

**Distribution.** The species is known from Zhejiang Province of Oriental China.

### Table 4. Main differences between *S. linanense* sp. n., *S. macateei*, *S. maculatus* and *S. recticaudatus*.  

|                | *S. linanense* | *S. macateei* | *S. maculatus* | *S. recticaudatus* |
|----------------|---------------|---------------|---------------|-------------------|
| Wing           | transparent   | transparent   | entire wing with pigmentation | transparent |
| Median setae of tergite IX | 10–15         | 35–37         | 25–28         | 35–37         |
| posterior margin of tergite IX | with 12–14 setae and 4 spines | with 8 setae and 6 spines | with 8 setae and 4 spines | with 14 setae and 8 spines |
| Anal point     | apex of anal point slightly swollen and rounded | parallel-sided | apex of anal point slightly swollen and rounded | apex of anal point slightly swollen and rounded |
| Superior volsella | with 9 setae | with 4–5 setae | with 4–6 setae | with 6 setae |
| Coloration     | whole body yellow, without dark pigmentation | whole body yellow, without dark pigmentation | postnotum, scutum and scutellum with dark pigmentation; other parts of body yellow | dark pigmentation entirely absent except on tarsomeres 3–5 of all legs |

**Key to males of the genus Stenochironomus in China**

1. Inferior volsella with a well-developed terminal spine ........................................2
2. Inferior volsella without a well-developed terminal spine ................................7
2. Wing membranes with dark pigmentation ..................................................3
3. Wing membranes without any pigmentation .............................................4
3. Legs almost entire brown, posterior area smoky area between veins C and M pale................................................................. *S. gibbus* (Fabricius, 1805)
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Legs yellow; entire wing smoky gray ............ **S. maculatus** Borkent, 1984

- Apex of anal point swollen and rounded..........................5
- Apex of anal point not swollen and rounded...............................6

5 Superior volsella with 9 setae; posterior margin of tergite IX with 12–14 setae and 4 spines.................................................................**S. linanensis** sp. n.

- Superior volsella with 4 setae; posterior margin of tergite IX with 14–16 setae.......................................................... **S. koreanus** Borkent, 1984

6 Posterior edge of tergite IX with 8 long setae and 6 spines; anal point parallel-sided ............................................................ **S. macateei** (Malloch, 1915)

- Posterior edge of tergite IX with 14 long setae, without any spine; anal point roughly triangular, apically pointed... **S. mucronatus** Qi, Shi & Wang, 2008

7 Wing membranes with dark pigmentation.................................8

- Wings without any pigmentation or with narrow pigment areas around RM and along veins M₃,₄ and Cu₁ ..................................................10

8 Abdomen and hypopygium light yellow .................. **S. inalemeus** Sasa, 2001

- Abdominal tergites I–IV light yellow, tergites V–VIII light brown, hypopygium dark brown...............................................................9

9 Preepisternum with brown spots; anal point slender and parallel-sided, apically rounded........................................... **S. nubilipennis** Yamamoto, 1981

- Preepisternum without any pigmentation; anal point slender and parallel-sided, apically pointed ... **S. satorui** (Tokunaga & Kuroda, 1936)

10 Posterior margin of tergite IX with spines.............................. **S. brevissimus** sp. n.

- Posterior margin of tergite IX without spines...............................11

11 Entire body yellow, without dark pigmentation; wings transparent, without any pigmentation; inferior volsella with 3 long setae ................................................................. **S. hainanus** Qi, Shi & Wang, 2008

- Body yellow, with brown spots on thorax, abdomen, hypopygium and legs; wings with narrow pigment areas around RM and along veins M₃,₄ and Cu₁; inferior volsella with 6 long setae .................. **S. totifuscus** Sublette, 1960

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