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## Discovery in Japan of the second species of the genus *Dolichocentrus* Martynov (Trichoptera: Brachycentridae)

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### Abstract

A new species *Dolichocentrus sakura* is described from western Honshu, Japan. This is the second species of the genus *Dolichocentrus* Martynov. Descriptions of female and immature stages of this genus are provided for the first time.

**Key words:** new species, description, adult, larva, pupa, generic diagnosis, habitat

### Introduction

The family Brachycentridae is a small family, consisting of seven extant genera with 114 species (Morse 2016). Most of the species belong to the genera *Brachycentrus* Curtis and *Micrasema* McLachlan, both of which are distributed in the Palearctic, Nearctic, and Oriental biogeographic regions. The genus *Eobrachycentrus* Wiggins includes three species known from North America and Japan, and the other four genera (*Adicrophleps* Flint, *Amiocentrus* Ross, *Dolichocentrus* Martynov, and *Tsudaea* Nozaki) are monobasic. The genera *Adicrophleps* and *Amiocentrus* are distributed in North America, the genus *Dolichocentrus* in the Russian Far East, and the genus *Tsudaea* in Japan.

Among these seven genera, knowledge about the genus *Dolichocentrus* is quite poor. Martynov (1935) described this genus with *Dolichocentrus tenuis* based on three male specimens collected from the South Ussuri region. Illustrations of male characteristics redrawn from the original description were provided by Arefina and Levanidova (1997). Although a few additional specimens of *D. tenuis*, including one female, were recently collected from near Lake Khanka (Vshivkova 2016), immature stages of this genus have not yet been discovered.

In 2015, Mr. K. Nojima provided me with an interesting brachycentrid male collected from the bank of a large river, Asahi-gawa, in Okayama City, western Japan in early April of 2013. Most characters of this male suggested that this species belongs to the genus *Dolichocentrus*. However, the shape of each labial palpus and genitalic characteristics of the male were different from those of the original description of *D. tenuis* by Martynov (1935) and from pencil sketches of a syntype specimen of *D. tenuis* kindly provided by Dr. V.D. Ivanov. From February to April in 2016, I was able to obtain additional specimens including females, larvae, and pupae with the cooperation of Mr. Nojima and his colleagues.

In this paper, I describe this species as the second member of the genus *Dolichocentrus*. Diagnostic characteristics of adult and larval stages of this genus are also provided.

### Material and methods

Male and female genitalia were figured after being cleared in a 10% solution of KOH. Larval characters described are based on final instar larvae. The map of localities was drawn using the software Kashmir 3D. Morphological terms mainly follow Schmid (1998) for the adults and Wiggins (1996, 2004) for the larva and pupa. Depositories of the specimens are abbreviated as follows: Natural History Museum and Institute, Chiba (CBM); M. Sakata, Okayama-shi, Okayama (MS); T. Nozaki, Ninomiya-machi, Kanagawa (TN); National Museum of Natural History, Smithsonian Institution, Washington, DC (USNM).

## Description

### *Dolichocentrus sakura* sp. nov.

Figures 1–6

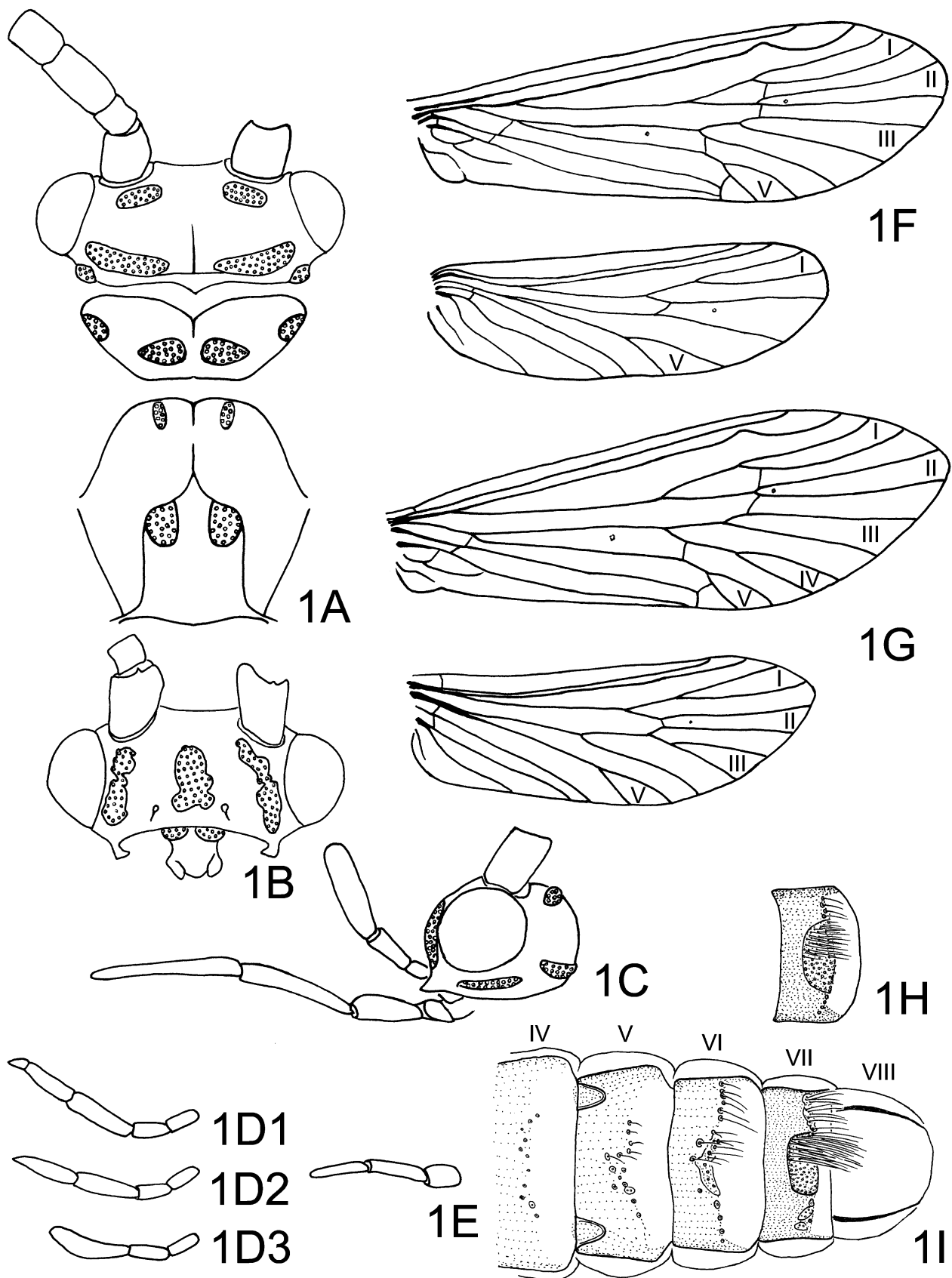
**Diagnosis.** The male of this species is easily distinguishable from *D. tenuis* by the following characters: 2nd and 3rd segments of each labial palp more slender than those in *D. tenuis*; each intermediate appendage is short, versus very long in *D. tenuis*; in the inferior appendages, the dorsal process of each basal segment has a blunt apex, compared with an acute apex in *D. tenuis*.

**Adult** (Figs. 1, 5). Forewings each 5.4–6.0 mm long ( $n = 10$ ) in male, 7.0–7.3 mm long ( $n = 8$ ) in female; antennae slightly shorter than forewings in male, about 3/5th length of forewings in female. Head, thoraces, and coxae blackish brown in both sexes; antennae dark gray in male, light gray in female, with dark band on each segment of basal half in both sexes, forewings yellowish brown with distinct dark band on each longitudinal vein; femora blackish brown in male, light brown in female; tibiae and tarsi dark brown in male, light brown in female; abdominal tergites and sternites dark brown in male, light brown in female. Head shorter than width; ocelli absent; with anterior setal warts oval, posterior and posterolateral setal warts slender; frons with large setal wart on center, pair of long setal warts present laterally with irregular margin. Male maxillary palpi each 3-segmented, about 0.5 mm long; ratio of three segments approximately 1: 1.3: 3. Female maxillary palpi 5-segmented but often reduced to 3 or 4 segments, 0.4–0.5 mm long; 5th segment shortest if present. Labial palpi 3-segmented in both sexes; in male total length about 0.9 mm, ratio of three segments approximately 1: 1.7: 2; in female total length 0.36–0.5 mm long, length of each segment variable but usually 2nd segment longest. Pronotum with pair of oval setal warts dorsally and pair of long oval setal warts laterally. Both mesoscutal and mesoscutellar setal warts oval, former smaller and more slender than latter. Tibial spur formula 2, 2, 2 in both sexes. Forewings with apical forks I, II, III, and V in male, I, II, III, IV, and V in female; with discoidal cell closed in both sexes; R1 with distinct kink near apex in both sexes. Hind wings with apical forks I and V in male, but rarely also III; with apical forks I, II, III, and V in female; R5 fused to M in male. Abdominal sternite V with pair of sclerotized lobes associated with scent gland near anterolateral margins in female, absent in male. In both sexes, large central setal area of abdominal sternite VII shaped as rounded rectangle with long setae.

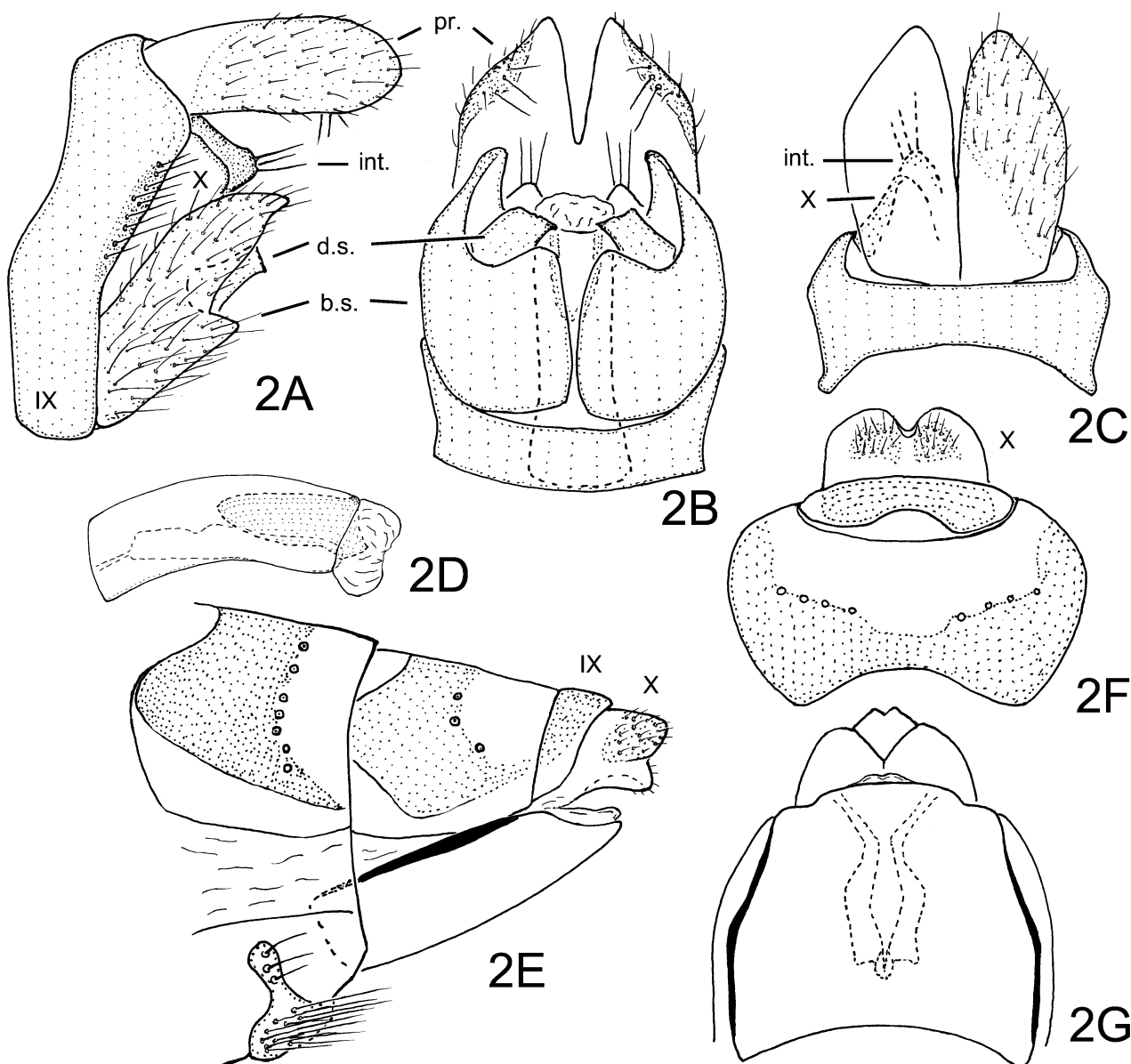
**Male genitalia** (Figs. 2A–2D). Segment IX (IX) in lateral view longitudinally short, gently curved anteriorly, posterior margin slightly protruding about 1/4th distance from dorsum. Preanal appendages (pr.) long and oval in lateral view, each boat-shaped in dorsal view, setose dorsally but basal area membranous without setae, with few long setae ventrolaterally. Segment X (X) with pair of short intermediate appendages (int.), round triangular in lateral view, each with three long setae apically. Inferior appendages each 2-segmented: basal segment (b.s.) large, broad in ventral view, bilobed posteriorly, dorsal process long triangular in lateral view, apex slightly curved posteroventrad in lateral view, basal process short triangular in lateral view; distal segment (d.s.) arising from mesal face of basal segment, subrectangular in lateral view, posteroventral corner angulate. Phallus simple, slightly curved ventrad; phallotremal sclerite darkly pigmented, tongue-like in lateral view.

**Female genitalia** (Figs. 2E–2G). Sternite VIII large, trapezoidal, approximately as long as wide ventrally, each side with longitudinal black band. Tergum IX (IX) shorter than segment X. Segment X (X) bilobed; each lobe oval in dorsal view, setose dorsally; each ventral part slightly produced laterad. Spermathecal sclerite simple, longer than wide, with tiny spherical projection anteroventrally.

**Final instar larva** (Figs. 3A–3I, 6). Length up to 8 mm. Head 0.59–0.74 mm wide ( $n = 7$ ), light brown with distinct dark brown markings; frontoclypeal apotome with vase-shaped dark marking; each parietal with dark longitudinal band dorsally, with imbrication on gena; dorsum with U-shaped carina laterally and posteriorly; antennae located approximately midway between eyes and labrum; setae 1, 4, 6, 11, 13, and 18 transparent; setae 1, 4, 6, 13 curved, seta 18 tiny; ventral apotome square; submental sclerites rectangular. Mandibles each with pair of long setae laterally and mesal brush of fine hairs, with three or four apical teeth. Prosternal horn absent. Pronotal sclerites mostly light brown but darker posterolaterally, posterior margin dark; anterior margin with row of long setae; transverse ridge not reaching anterolateral margins, with few setae. Mesonotal sclerites mostly light brown, with long setae in each setal area. Metanotal *sa1* without sclerites or setae, *sa2* and *sa3* sclerites each oval with long setae. Forelegs short, less than half as long as mid- and hind legs; femora broad; mid- and hind legs slender, each with long tarsal claw. Abdominal segments without gills, lacking lateral fringes but with forked lamellae (f.l.) on



**FIGURE 1.** *Dolichocentrus sakura* n. sp., adults., male, head and pro- and mesonota, dorsal; 1B: male, head, frontal; 1C, male, head, left lateral; 1D, female, left maxillary palp, left lateral (1D1–1D3: variations); 1E, female, left labial palp, left lateral; 1F, male, right wing venation, dorsal, apical forks numbered; 1G: female, right wing venation, dorsal, apical forks numbered; 1H, male abdominal sternite VII, ventral; 1I, female abdominal sternites IV–VIII, ventral.



**FIGURE 2.** *Dolichocentrus sakura* n. sp., male genitalia. 2A, left lateral; 2B, ventral; 2C, dorsal; 2D, phallus, left lateral. Female genitalia: 2E, left lateral; 2F, dorsal; 2G, ventral. Abbreviations: IX, X = abdominal segments IX and X; b.s. = basal segment of an inferior appendage; d.s. = distal segment of an inferior appendage; int. = an intermediate appendage of segment X; pr. = a preanal appendage.

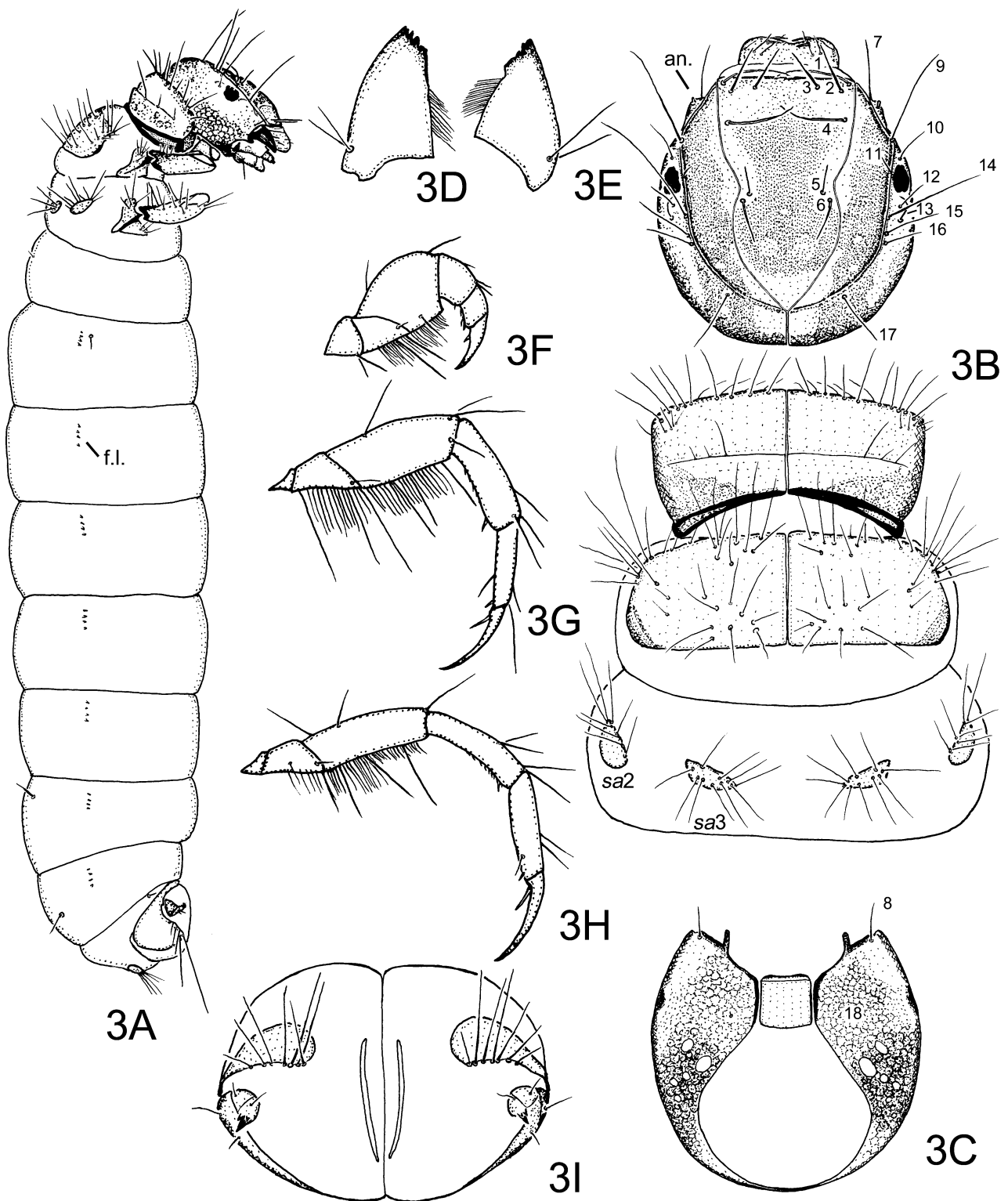
anterior parts of segments II to VIII. Dorsal sclerite of segment IX oval, with long setae posteriorly. Lateral sclerites of anal prolegs with long setae; anal claws each with two dorsal accessory hooks. Anal opening with light brown sclerotized band on each side.

**Pupa** (Figs. 4A–4C). Length 5–7 mm ( $n = 2$ ). Antennae approximate same length as body in male, shorter than body in female; scape with several minute setae basodorsally. Head with pair of long setae on frons dorsally, two pairs of short setae between each eye and mandible. Labrum with six pairs of long, apically-curved setae. Mandibles acute, each mesal margin very weakly serrated near apex. Tibiae and tarsi of each midleg with dense fringe of setae. Abdominal tergum I with pair of spined ridges near posterior margin; anterior hook plates present on terga III to VII, with 5 to 10 spines, segment V with pair of hook plates (rows of spines) posteriorly. Abdominal gills absent. Lateral fringe present from posterior part of segment V to posteroventral part of segment VIII. Anal processes slender.

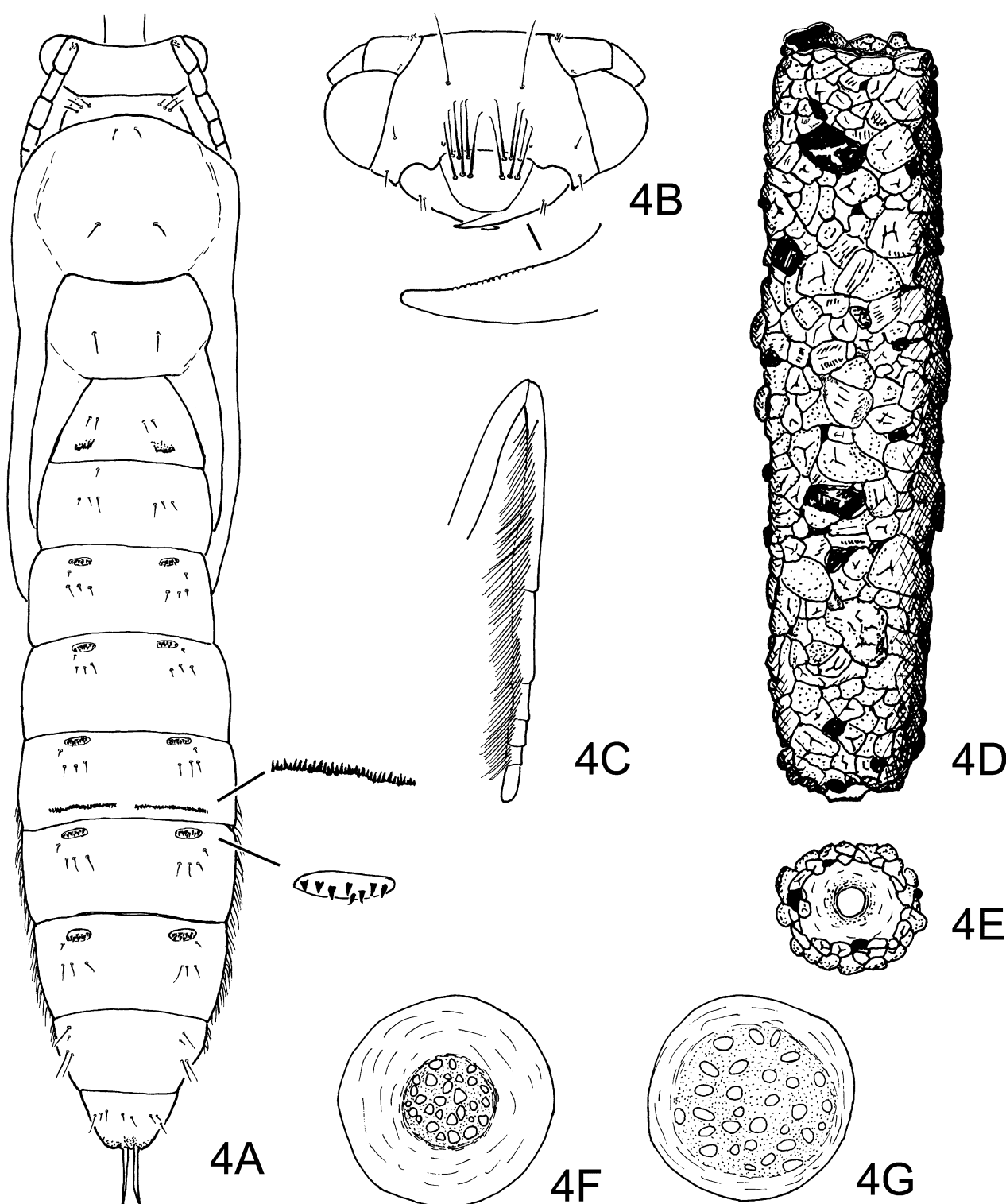
**Case** (Figs. 4D–4G, 6). Case of final instar larva up to 8 mm long, constructed of sand grains, mostly cylindrical but about 1/3rd to 1/4th from anterior opening slightly thicker; posterior end closed by silk with central

hole, slightly protruding posteriorly. In pupal case, both anterior and posterior openings closed by silken membrane with many perforations.

**Holotype.** Male (in alcohol). Myojo-zeki, Asahi-gawa River, Imzaike, Naka-ku, Okayama-shi, Okayama Prefecture, Honshu, Japan, 34°41'36"N, 133°56'40"E, alt. 4 m, 2.iv.2016, M. Sakata leg. (CBM-ZI 151365).



**FIGURE 3.** *Dolichocentrus sakura* n. sp., larva. 3A, right lateral; B, head and thorax, dorsal, primary setae on head numbered; 3C, head, ventral, primary setae numbered; 3D, left mandible, dorsal; 3E, right mandible, dorsal; 3F, right foreleg, right lateral; 3G, right midleg, right lateral; 3H, right hind leg, right lateral; 3I, abdominal segment X, caudal. Abbreviations: an. = antenna; f.l. = forked lamella.



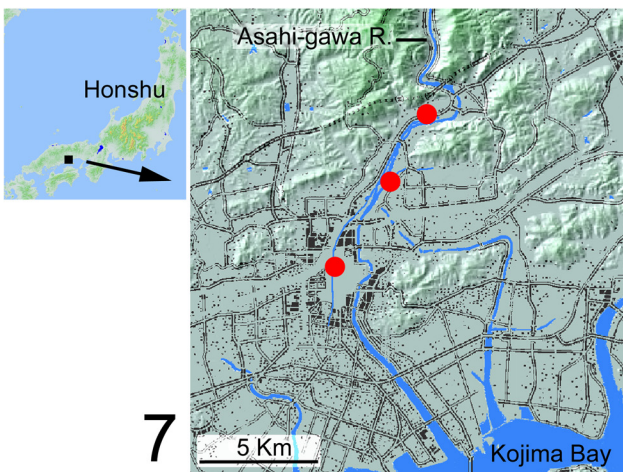
**FIGURE 4.** *Dolichocentrus sakura* n. sp., pupa. 4A, dorsal, row of spines (hook plate) of abdominal segment V and anterior hook plate of abdominal segment VI enlarged; 4B, head, frontal, apex of left mandible enlarged; 4C, tibia and tarsus of right midleg, right lateral. Case: 4D, lateral; 4E, posterior closure of larval case, caudal; 4F, anterior closure of pupal case, frontal; 4G, posterior closure of pupal case, caudal.

**Paratypes.** Same data as the holotype, 2 males (TN); same data except collector T. Nozaki, 7 males, 2 females (5 males, 1 female: CBM-ZI 151366–151371; 2 males, 1 female: USNM); same locality as the holotype, 5.iii.2016, M. Sakata, 2 males, 3 females (TN).

**Specimens examined.** Japan: Honshu, Okayama Prefecture: same locality as the holotype, 8.ii.2016, S.



Sanuki, 3 larvae, 2 prepupae (TN); *ibid.*, 21.ii.2016, M. Sakata, S. Sanuki, and T. Nozaki, 4 larvae, 2 pupae (TN); *ibid.*, pupae collected on 21.ii.2016 by M. Sakata, S. Sanuki, and T. Nozaki, adults emerged from 29.ii.2016 to 9.iii.2016 reared by T. Nozaki, 3 males, 3 females (TN); *ibid.*, 13.iii.2016, M. Sakata, 23 males (TN); Asahi-gawa River, Tamagashi, Kita-ku, Okayama-shi, 5.iv.2013, K. Nojima, 1 male (TN); *ibid.*, 2.iv.2016, T. Nozaki, 3 males, 1 female (TN); Nishi-gawa Channel, Nishiki-machi, Kita-ku, Okayama-shi, 20.iii.2016, M. Sakata, 12 males (MS); *ibid.*, 26.iii.2016, M. Sakata, 34 males, 5 females (24 males, 2 females: MS; 10 males, 3 females: TN).



**FIGURES 5–10.** Images, location, and habitats of *Dolichocentrus sakura* n. sp. 5, adult female (scale: 1 mm). 6, larva (scale: 1 mm). 7, map showing the collection sites (red circle). 8, a larval habitat at the type locality, a deep marginal pool of the mainstream with slow current. 9, another larval habitat at the type locality, a tributary just flowing into the mainstream, shallow rapid. 10, artificial channel (Nishi-gawa) where many adults were collected.

**Etymology.** The species name means “cherry blossom tree” in Japanese. The flight season of this species is spring when cherry blossoms bloom.

**Distribution** (Fig. 7). Japan (only known from Okayama Prefecture, western Honshu).

**Habitat** (Figs. 8–10). Larvae and pupae examined in this study were collected by a long-handled D-frame dipnet from both a deep marginal pool with slow current and a shallow rapid at the type locality. Most pupae were attached on aquatic plants. Adults were collected from riparian vegetation along the lower reaches of the Asahigawa River, and also from an artificial channel (Nishi-gawa) derived from the river.

**Japanese name.** Haruno-marutsutsu-tobikera.

## Discussion

Adults of the genus *Dolichocentropus* are similar to those of the genera *Brachycentrus* and *Amiocentrus* in the wing venation and tibial spur formula, but can be easily distinguished from these genera by the following character: Each inferior appendage is 2-segmented in *Dolichocentrus*, but 1-segmented in the latter two genera (Ross 1938, Flint 1984). The distal segment of each inferior appendage arises from the mesal face of the basal segment, rather similar to *Eobrachycentrus* and *Tsudaea* (Wiggins *et al.* 1985, Nozaki 2009). On the other hand, the larval stage of the genus *Dolichocentrus* is generally similar to that of *Micrasema* (Wiggins 1996), but lacks a pair of dorsolateral protuberances on abdominal segment VIII, and the transverse ridge on the pronotum does not reach the anterolateral margins. Among Phryganeoidea, the position of the antennae midway between the eyes and the labrum may be a unique feature of Brachycentridae, similar to the position in Limnephiloidea.

The discovery of this brachycentrid caddisfly from the lower reaches of a large river, and even from an artificial channel which flows in an urban area, was surprising. The early adult flight season of this species must be one of the reasons why the discovery was delayed. Males of *D. tenuis* were also collected in early spring (Martynov 1935). Furthermore, late instar larvae of this species must appear only in winter because they were not collected from the type locality in the summer of 2015 (Sakata *personal communication*). Further ecological study of this interesting species is needed for comparison with the biology of other brachycentrid species.

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