

# Nine *Polypedilum* Species (Diptera, Chironomidae) New to Korea Collected Near Namdae-stream, Muju

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## ABSTRACT

Adult chironomids were collected at Dangsansan-ri, Muju-eup, Muju-gun, Jeollabuk-do on 5 September 2008, 22 May 2009 and 28 August 2009. A total of 221 specimens belong to the genus *Polypedilum* Kieffer from 1,113 adult midges collected were morphologically examined, and 16 *Polypedilum* species were identified. One species is new (*Polypedilum dangsanensis* Ree et Jeong sp. nov.) and eight species are newly recorded in Korea (*P. asakawaense*, *P. convictum*, *P. decemnotogutatus*, *P. japonicum*, *P. kamotertium*, *P. pullum*, *P. serugense*, and *P. unifascium*). These nine species are described with illustrations. *Polypedilum nubifer* was the most frequently collected species, consisting of 25.8% of the *Polypedilum* samples.

**Keywords:** Chironomidae, Muju-gun, *Polypedilum*, taxonomy

## INTRODUCTION

Chironomid adult collections were carried out near Namdae-stream located at Dangsansan-ri, Muju-eup, Muju-gun, Jeollabuk-do on 5 September 2008, 22 May 2009 and 28 August 2009. Namdae-stream runs through the western area of Muju-gun, and joins to the Keum-river. The many restaurants are located along the stream in the vicinity of the 120 m long Namdaechon-bridge in Muju-eup. Meadows border the surrounding bank and streamside, and streamside esplanades are present. A small reservoir exists close to the stream. A number of non-biting midges and mayflies arise from the stream every year.

Chironomid adults attracted to the light sources of public telephone booths at Muju health center and county hospital, notice board of the Muju police substation, advertising signage of the streamside restaurants and convenience stores, and windows of restaurants and shops were aspirated for 3-4 h after sunset. All collected midges were preserved in 75% ethanol. Later, they were dissected under stereomicroscope using fine needles to retrieve the antennae, head, wings, abdomen and hypopygium, and were mounted on polyvinyl alcohol medium. The type specimens were deposited in the collection of Arthropods of Medical Importance Resource Bank, Department of Environmental Medical Biology, Yonsei Uni-

versity. Terminology followed Seather (1980).

## SYSTEMATIC ACCOUNTS

Family Chironomidae Haliday, 1851  
Subfamily Chironominae Macquart, 1838  
Genus *Polypedilum* Kieffer, 1912

<sup>1</sup>\**Polypedilum asakawaense* Sasa, 1980

*Polypedilum (Polypedilum) asakawaense* Sasa, 1980, p. 34; Sasa, 1981, p. 103; Sasa, 1984, p. 59; Sasa, Kawai and Ueno, 1988, p. 28; Sasa, 1989, p. 28.

*Material examined.* 1 ♂: Dangsansan-ri, Muju-eup, Muju-gun, Jeollabuk-do; 5 Sep. 2008 (K.Y. Jeong and S.H. Nam). 10 ♂♂: Locality same; 22 May 2009 (K.Y. Jeong). 9 ♂♂: Locality same; 28 Aug. 2009 (K.Y. Jeong).

*Diagnosis.* Small to medium, brownish midge. WL 2.1 mm. Superior volsella completely bare, long, sharply bent internally at middle. Anal point relatively short, tapered apically. AR 1.87. LR 1.66.

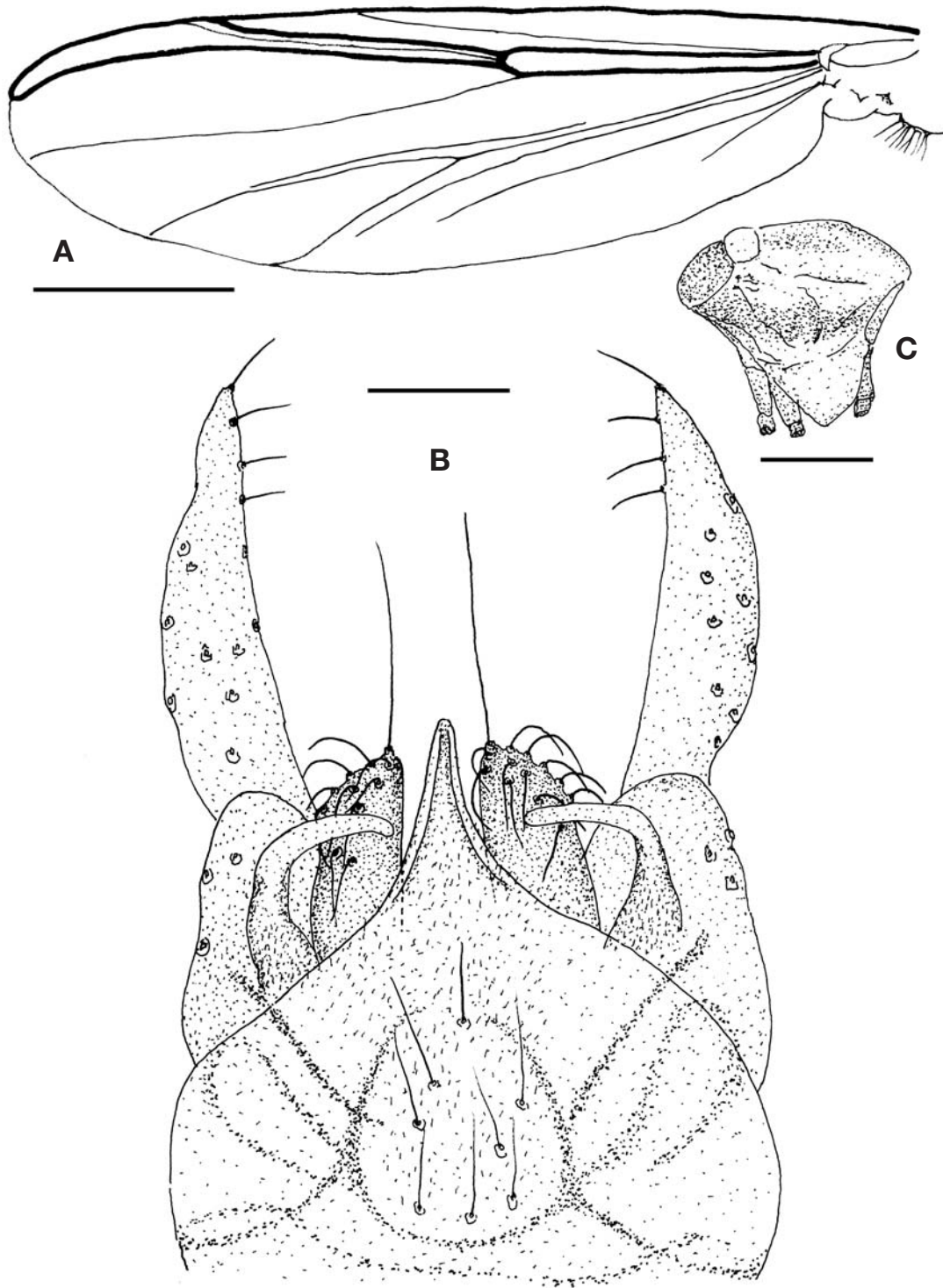
*Description (Male).* HEAD: Eye black, with dorsomedial projection. Frontal tubercle absent. 10-11 postoculars each side. Antenna black, with 13 segments; AR 1.87. Palp brownish pale yellow, with 5 segments; 46, 46, 132, 130, 214 μm (1:1:2.9:2.8:4.6). Clypeus pale yellow, with 15 setae. THORAX: Yellowish brown in ground color. Dark brown transversal band on the middle of lateral thorax (Fig.

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**Fig. 1.** *Polypedilum asakawaense* (Male). A, Wing; B, Hypopygium; C, Thorax (lateral). Scale bars=0.5 mm (A, C), 0.1 mm (B).

1C). Antepronotum dark brown ventrally, narrowed dorsally. Scutum yellowish brown, brownish vittae not clear. Scutellum pale yellow, with 18 scutellars. Postnotum dark brown. WING (Fig. 1A): WL 2.1 mm. Membrane bare. Costa not

produced.  $R_{2+3}$  running mid of  $R_1$  and  $R_{4+5}$ , and ending very close to  $R_1$ . FCu distal to RM.  $Cu_1$  almost straight. Brachiolum and arculus pale. An ending far beyond FCu. Anal lobe not developed. Squama fringed. LEGS: All segments

uniformly pale yellow, tarsi III-V slightly darker. Pulvillus developed. LR 1.66. ABDOMEN: All tergite uniformly vandike brown. HYPOPYGIUM (Fig. 1B). Anal tergite apically produced, with 7 median setae. Apodeme developed. Anal point relatively short, tapered apically. Superior volsella completely bare, very long, sharply bent internally at middle portion; Inferior volsella cylindrical, with a long apical seta and many recurved setae. Gonostylus tapered apically, inter-lateral margin slightly concaved, with 1 apical and 3 inter-lateral setae.

*Remarks.* All characters of the Korean specimens collected in Muju, Jeollabuk-do are well coincided to those of *Polypedilum asakawaense* described by Sasa (1980), This species easily distinguishable from other *Polypedilum* species by the unique superior volsella which is very long, and sharply curved at middle.

<sup>1</sup>\**Polypedilum convictum* (Walker, 1856)

*Chironomus convictus* Walker, 1856, p. 168.

*Chironomus (Polypedilum) convictus*: Edwards, 1929, p. 404.

*Polypedilum convictum*: Goetghebuer, 1928, p. 92; Townes, 1945, p. 59; Pinder, 1978, p. 136; Sasa and Kawai, 1987, p. 30; Sasa, 1989, p. 49; Sasa and Okazawa, 1991, p. 110.

*Material examined.* 1♂: Dangsari, Muju-eup, Muju-gun, Jeollabuk-do; 5 Sep. 2008 (K.Y. Jeong and S.H. Nam). 2♂♂: Locality same; 28 Aug. 2009 (K.Y. Jeong).

*Diagnosis.* Small, pale yellow speices. WL 1.6 mm. Wing membrane bare, without any marks. Anal point narrow, short, parallel-sided. Superior volsella apically narrowed, bent inwards, posterior lobe pubescent, with a long seta. Inferior volsella slightly expanded at tip, with 2 subequal apical setae. AR 1.63. LR 1.76.

*Description (Male).* HEAD: Eye black, bare, with developed dorsomedial projection. Frontal tubercle absent. 9-11 postoculars each side. Antenna dark brown, with 13 segments; AR 1.63. Palp dark brown, with 4 segments: 39, 107, 112, 179 μm (1 : 2.7 : 2.9 : 4.6). Clypeus brown, with 18 setae. THORAX: Brownish yellow in ground color. Anteprepronotum yellowish, narrowed dorsally, medially separated. Scutum slightly overreaching anteprepronotum, brownish yellow, vittae absent. Scutellum pale, with 11 setae. Postnotum yellowish brown. Wing (Fig. 2A): WL 1.6 mm. Membrane bare, no marks. Only vein R, R<sub>1</sub>, R<sub>4+5</sub> setosed. Costa not produced. R<sub>2+3</sub> adjacent to R<sub>1</sub>. FCu distal to RM. Cu<sub>1</sub> slightly bent at tip. An not reaching FCu. Anal lobe moderately developed. Squama fringed. Brachiolum pale, with 1 seta. LEGS: All segments yellow. Fore tibia with a weak scale at tip, mid and hind tibiae with 2 separated combs, one with a long spur. Pulvillus

developed. LR 1.76. ABDOMEN: Uniformly pale yellow. HYPOPYGIUM (Fig. 2B): Anal tergite produced distally, forming triangular-shape, with 5-6 median setae and 4 apical setae each side of anal point. Anal point short, narrow, parallel-sided. Superior volsella apically narrowed, bent inwards, posterior lobe pubescent, with a long seta. Inferior volsella cylindrical, slightly expanded apically, with 2 subequal apical setae and many recurved setae. Gonostylus apically tapered, with 2 apical setae and 6 interlateral setae.

*Remarks.* *Polypedilum convictum* is widely distributed in Europe, North America and Japan. They are generally similar in most characters, except the body size (wing length): 2.8 mm in England (Edwards, 1929), 2.3 mm in North America (Townes, 1945), 1.7 mm in Japan (Sasa, 1989), and 1.6 mm in Korea.

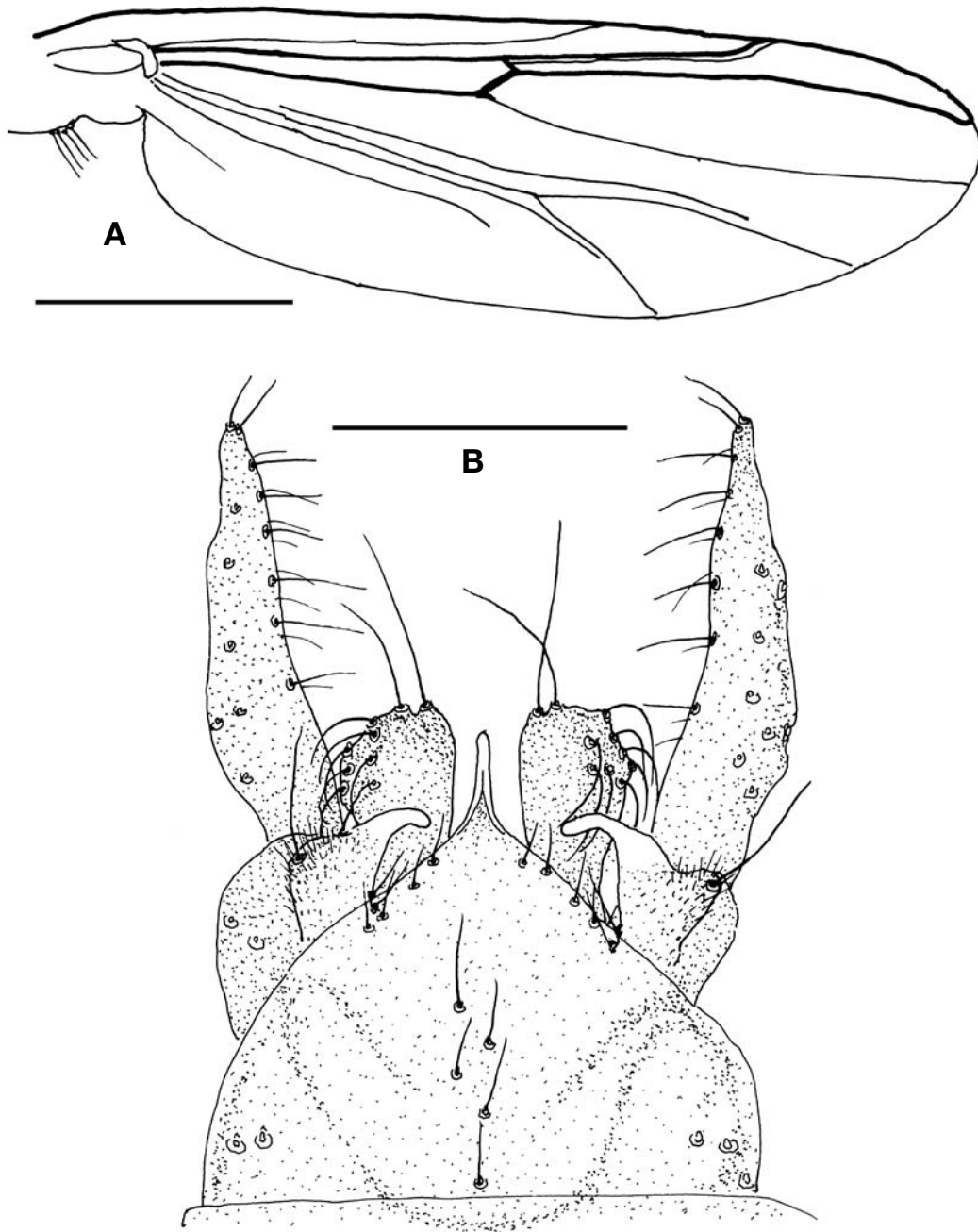
<sup>2</sup>\**Polypedilum dangsanensis* Ree and Jeong sp. nov.

*Material examined.* Holotype: 1♂ (R-CH 7038), Dangsari, Muju-eup, Muju-gun, Jeollabuk-do; 28 Aug. 2009 (K.Y. Jeong). Paratype: 3♂♂ (R-CH 6346, 6406, 6412), locality same; 5 Sep. 2008 (K.Y. Jeong and S.H. Nam). 3♂♂ (R-CH 6994, 7083, 7084), Data same as holotype.

*Diagnosis.* Pale yellow, small midge. Wing length 1.25 mm. Wing membrane bare, with 2 black markings: large one on r<sub>4+5</sub>, m<sub>1+2</sub>, m<sub>3+4</sub> and cu<sub>1</sub> (forming a vertical band), and small one on an. Anal point somewhat broad, slightly expanded at middle; lateral projection of anal point prominently developed, dark brown, tube-like, with microtrichiae at tip. Superior volsella broad, pad-like, with numerous short, weak setae along apical margin and 1 moderately long and 1 short setae outerapically. Inferior volsella with 2 long apical setae. AR 1.08. LR 2.05.

*Description (Male).* HEAD: Eye bare, dorsomedially produced. 6-7 postoculars each side. Antenna pale dark brown, with 13 segments, AR 1.08. Palp pale dark brown, with 5 segments: 22, 22, 77, 92, 117 μm (1 : 1 : 3.6 : 4.3 : 5.4). Clypeus brownish yellow, with 17 setae. Frontal tubercle absent. THORAX: Brownish yellow in ground color. Anteprepronotum brownish yellow, narrowed medially, separated each other; setae absent. Scutum overreaching anteprepronotum, 16 acrosticals, 9 dorsocentrals and 3 prealars each side. Scutellum pale yellow, with 6-7 setae. Postnotum dark brown. Halter pale. WING (Fig. 3A): WL 1.25 mm. Membrane bare, with 2 black markings: large one on r<sub>4+5</sub>, m<sub>1+2</sub>, m<sub>3+4</sub> and cu<sub>1</sub>, and small one on an. Vein R, R<sub>1</sub> and R<sub>4+5</sub> setosed. Costa not produced. R<sub>2+5</sub> running middle of R<sub>1</sub> and R<sub>4+5</sub> and ending near R<sub>1</sub>. FCu far distal to RM. Cu<sub>1</sub> slightly curved at tip. An reaching FCu. Anal lobe not developed. Squama with 4

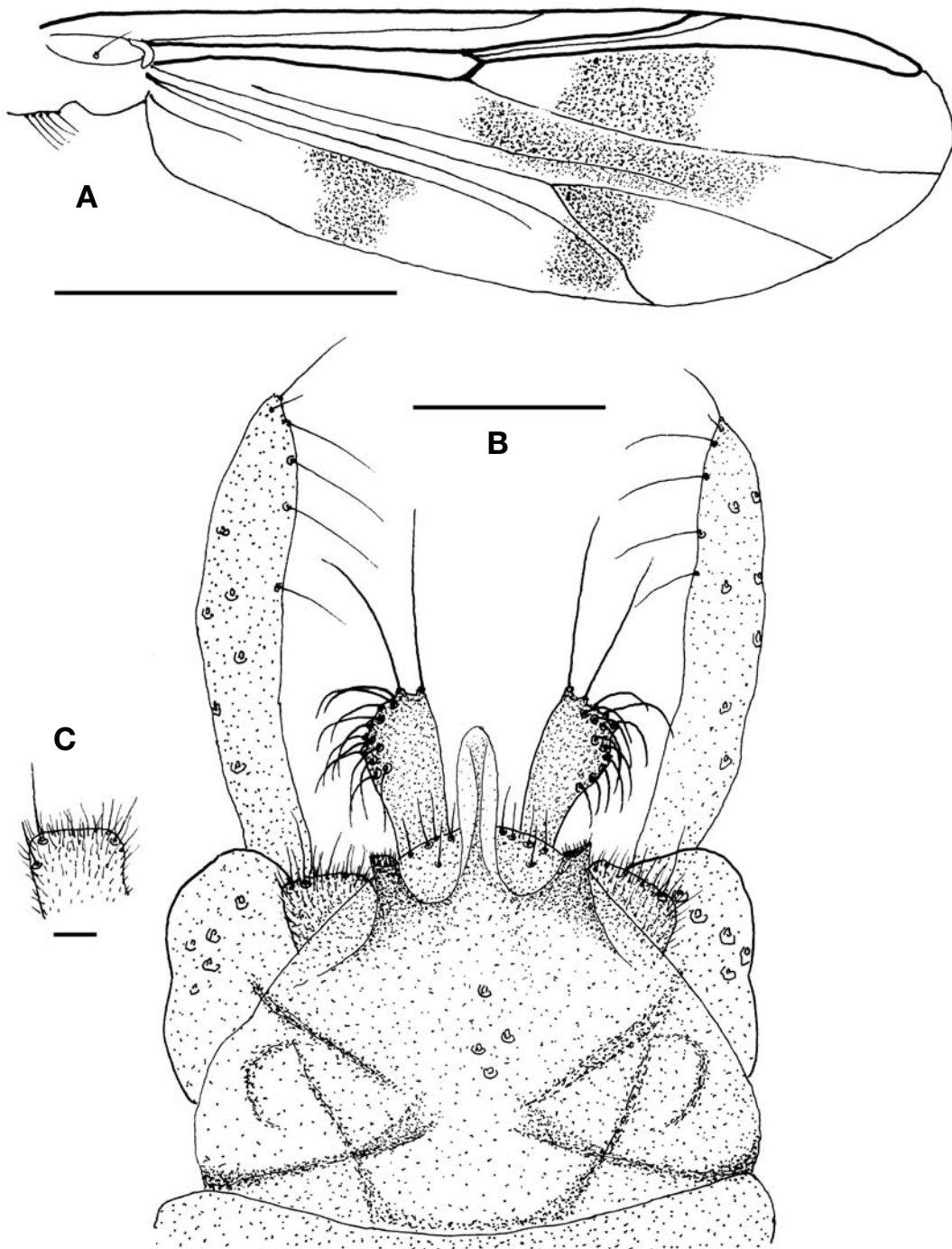
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**Fig. 2.** *Polypedilum convictum* (Male). A, Wing; B, Hypopygium. Scale bars=0.5 mm (A), 0.1 mm (B).

setae. Brachiolum pale, with 1 seta, arcus pale. LEGS: Femur pale yellow, with basal half pale dark brown. Tibia and all tarsi pale yellow. Fore tibial scale pointed; mid and hind tibial combs separated, with a long spur. Pulvillus developed. LR 2.05. ABDOMEN: Uniformly pale yellow. HYPOPYGIUM (Fig. 3B): Anal tergite smoothly produced, with 6-7 apical setae each side of anal point and 4 median setae; anal tergal band separated. Anal point rather broad,

slightly expanded at middle, tip rounded; lateral projection of anal point prominent, dark brown, tube-like, with microtrichiae at tip. Superior volsella (Fig. 3C) broad, pad-like, covered with microtrichiae, with numerous short, weak setae along apical margin and with 1 moderately long and 1 short setae outerapically. Inferior volsella cylindrical, bulbous at tip, with 2 long apical setae and 9-11 recurved setae. Gonocoxite short. Gonostylus somewhat narrowed, inner margin



**Fig. 3.** *Polypedilum dangsanensis* sp. nov. (Male). A, Wing; B, Hypopygium; C, Superior volsella (dorsal). Scale bars=0.5 mm (A), 0.05 mm (B), 0.01 mm (C).

almost straight, with 4 long inner-lateral setae.

*Remarks.* This new species resembles to *Polypedilum unifascium* in body color, superior volsella, inferior volsella and others; however, it has broad anal point (narrow and parallel-

sided in *unifascium*) and large dark band on  $r_{4+5}$  (much small in *unifascium*) (Sasa, 1985). Moreover, a unique key character of the new species is lateral projections of anal point, which is much large, stout and tube-like in form.

<sup>1</sup>\**Polypedilum decematoguttatum* (Tokunaga, 1938)

*Chironomus (Polypedilum) decematoguttatum* Tokunaga, 1938, p. 337.

*Polypedilum (Tripodura) decematoguttatum*: Sasa and Kikuchi, 1995, p. 118.

*Material examined.* 1 ♂ (R-CH 7181): Dangsari, Muju-eup, Muju-gun, Jeollabuk-do; 28 Aug. 2009 (K.Y. Jeong).

*Diagnosis.* Small to medium, brownish midge. WL 2.0 mm. Wing membrane with 11 dark markings: 3 on  $r_{4+5}$ , 1 on m, 2 on  $m_{1+2}$ , 2 on  $m_{3+4}$ , 2 on cu and 1 on an. Abdominal tergite I and VIII dark brown; tergite II-VII pale brown, with a dark, round marking on middle. Anal point notched at middle, with round tip. Superior volsella broad, pad-like, with short, weak setae apically and 3 outerlateral setae. AR 2.08.

*Description (Male).* HEAD: Eye black, bare, with well developed dorsal projection. Small frontal tubercle present. 8-9 postoculars each side. Clypeus brown, with 26 setae. Antenna dark brown, with 13 segments; AR 2.08. Palp pale brown, with 5 segments: 29, 39, 143, 155, 204  $\mu\text{m}$  (1 : 1.4 : 5.0 : 5.4 : 7.1). THORAX: Brown in ground color. Antepnotum brownish yellow, narrowed dorsally, medially separated. Scutum overreaching antepnotum, vittae not clearly defined. Scutellum yellowish brown, with 15 scutellars. Postnotum dark brown. WING (Fig. 4A): WL 2.0 mm. Membrane bare, with 11 dark markings: 3 on  $r_{4+5}$ , 1 on m, 2 on  $m_{1+2}$ , 2 on  $m_{3+4}$ , 2 on cu, and 1 on an. Brachiolum and arculus pale, bare. Costa not produced.  $R_{2+3}$  running mid between  $R_1$  and  $R_{4+5}$ , and ending near  $R_1$ .  $M_{1+2}$  ending under  $R_{4+5}$ . FCu distal to RM.  $Cu_1$  almost straight. An reaching FCu. Anal lobe moderately developed. Squama with 6-7 setae. LEGS: Femur basal 2/3 dark brown. Tibia all pale. Tarsus I of fore and mid legs pale brown; hind tarsus I dark patch basally. Tarsi II-IV pale with dark patch basally. Tarsi V pale. Pulvillus developed. ABDOMEN (Fig. 4C): Tergite II-VII pale brown, with dark brown, round marking on middle; tergite I and VIII dark brown. HYPOPYGIUM (Fig. 4B): Anal point notched at middle, with round apex; lateral projection of anal point conspicuous. Anal tergite roundly produced distally, with 13 median setae; apical setae absent. Superior volsella broad, pad-like, covered by microtrichiae, with 3 outerlateral setae. Inferior volsella pale, cylindrical, with many recurved setae and a moderately long apical seta. Gonocoxite rather short. Gonostylus long, slightly narrowed at base, with 7 long inner-lateral setae.

*Remarks.* This species is easily distinguishable from other *Polypedilum* species, by having a notched anal point at middle. Most characters of one specimen collected at Muju, Korea is well coincided with those of *Polypedilum decemato-*

*guttatum* collected in Kyoto, Japan, except that abdominal tergite II-VII is pale brown with dark brown markings in middle in the former, whereas they are uniformly brown in the later (Tokunaga, 1938).

<sup>2</sup>\**Polypedilum japonicum* (Tokunaga, 1938)

*Chironomus (Polypedilum) japonicum* Tokunaga, 1938, p. 333.

*Polypedilum japonicum*: Sasa and Kikuchi, 1982, p. 23; Sasa and Kawai, 1987, p. 24; Sasa, 1988, p. 56; Sasa, Kawai and Ueno, 1988, p. 28; Sasa, 1993, p. 56.

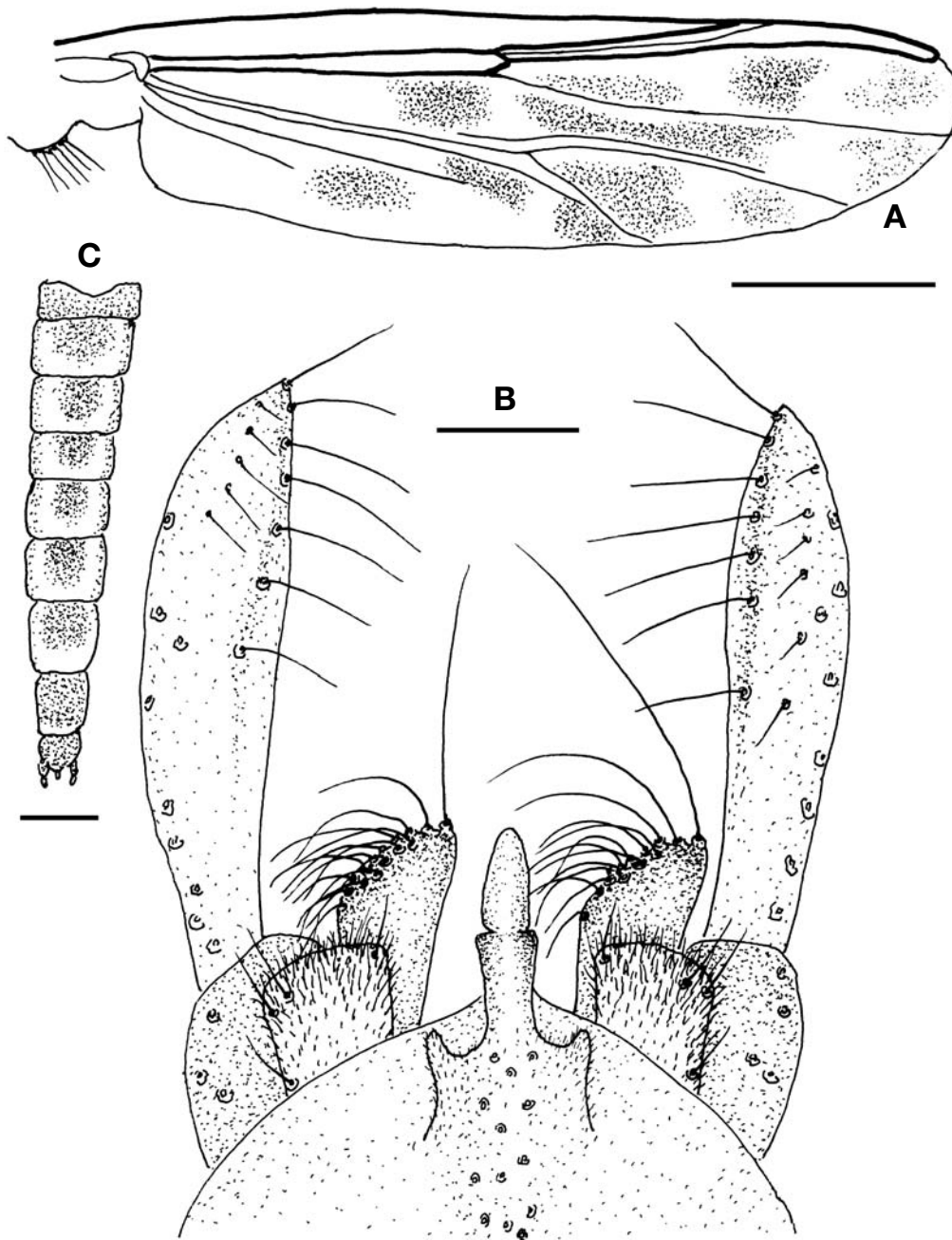
*Material examined.* 3 ♂♂: Dangsari, Muju-eup, Muju-gun, Jeollabuk-do; 5 Sep. 2008 (K.Y. Jeong and S.H. Nam), 4 ♂♂: same locality; 22 May 2009 (K.Y. Jeong). 3 ♂♂: same locality; 28 Aug. 2009 (K.Y. Jeong).

*Diagnosis.* Small to medium, yellowish brown species. WL 1.7 mm. Wing membrane with 4 distinct dark markings (1 on  $r_{4+5}$  and basal  $m_{1+2}$ , 1 on distal  $m_{1+2}$ , 1 on  $m_{3+4}$  and cu<sub>1</sub> and 1 on an). Anal point broad and short, with round tip. Superior volsella wide, pad-like, with 2 long, 3 short apical setae, and macrotrichiae distally. AR 1.25. LR 2.29.

*Description (Male).* HEAD: Eye bare, dorsomedially produced. Frontal tubercle absent. 8-9 postoculars each side. Antenna pale dark brown, with 13 segments; AR 1.25. Palp pale dark brown, with 4 segments: 31, 32, 86, 108, 166  $\mu\text{m}$  (1 : 1.0 : 2.8 : 3.5 : 5.4). Clypeus yellowish brown, with 17 setae. THORAX: Yellowish brown in ground color. Antepnotum yellowish brown, bare, medially separated. Scutum yellowish brown, with obscure brownish vittae. Scutellum brownish yellow, with 5 setae. Postnotum dark brown. Halter pale. WING (Fig. 5A): WL 1.7 mm. Membrane bare, with 4 distinct dark markings: 1 on  $r_{4+5}$  and basal  $m_{1+2}$ , 1 on distal  $m_{1+2}$ , 1 on  $m_{3+4}$  and cu<sub>1</sub>, 1 on an. Costa not produced.  $R_{2+3}$  adjacent to  $R_1$ . FCu distal to RM.  $Cu_1$  slightly curved. An reaching FCu. Anal lobe moderately developed. Squama fringed. Brachiolum and arculus pale, bare. LEGS: Femur pale yellow, with basal half and apical end brown. Tibia and all tarsi pale yellow. Fore tibia with a scale apically; mid and hind tibial combs separated, with a narrow, long spur. Pulvillus developed. LR 2.29. ABDOMEN: Uniformly brownish yellow. HYPOPYGIUM (Fig. 5B): Anal tergite roundly produced apically, with 15 short apical setae and 14 long median setae; anal tergal band widely separated. Anal point relatively short and broad, with round tip. Superior volsella wide, pad-form, with 2 relatively long, 3 short apical setae and macrotrichiae distally. Inferior volsella cylindrical, pale, with a relatively short apical seta and 8-11 recurved setae. Gonocoxite small. Gonostylus somewhat narrow, smoothly

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**Fig. 4.** *Polypedilum decematoguttatum* (Male). A, Wing; B, Hypopygium; C, Abdomen (dorsal). Scale bars=0.5 mm (A, C), 0.05 mm (B).

tapered apically, with 1 apical and 4-5 long innerlateral setae.

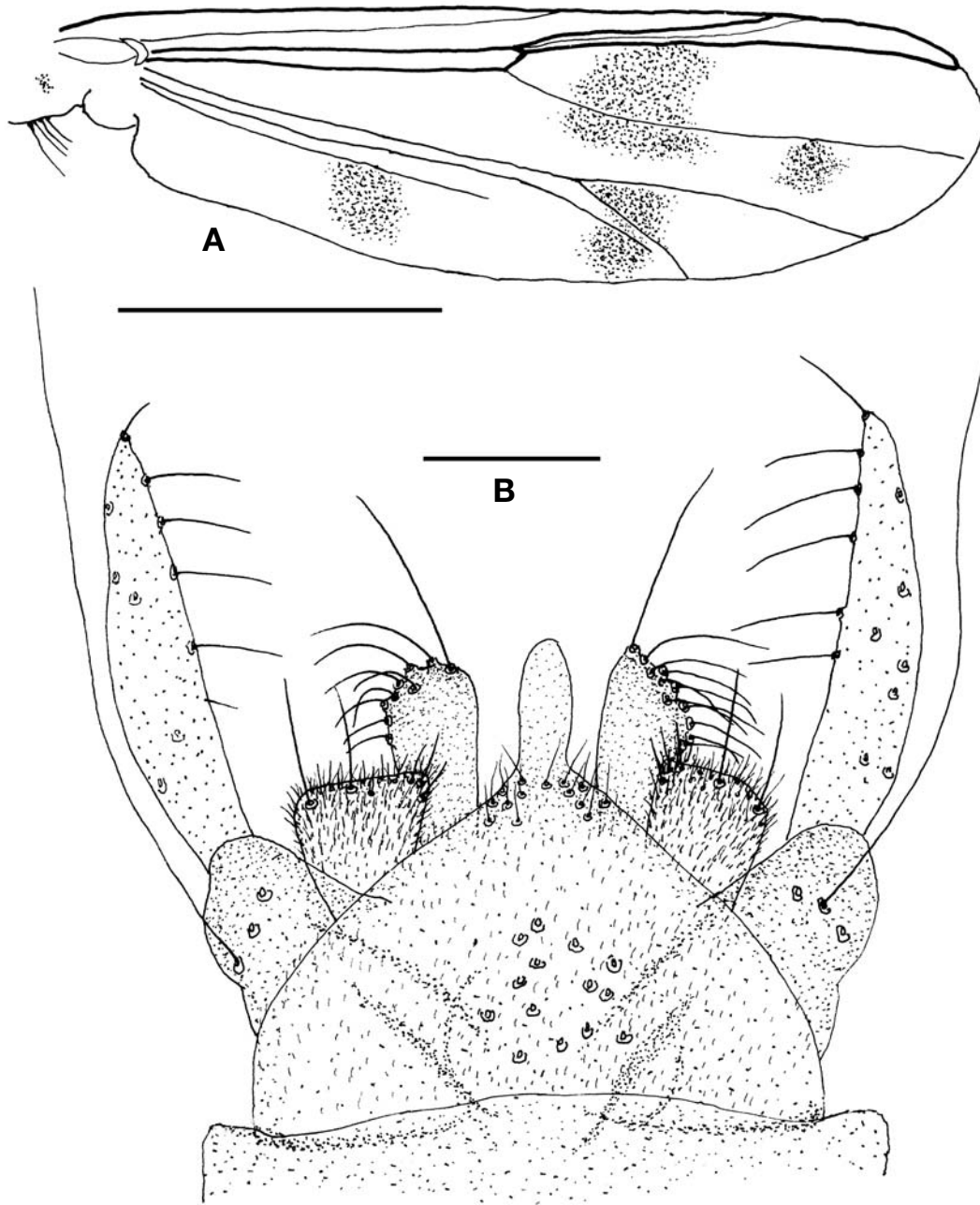
*Remarks.* The Korean specimens well fit *Polypedilum japonicum* in the key characters, such as the wing markings, body color, superior volsella, anal point, AR value (1.25 vs 1.4), LR value (2.29 vs 2.07), and others (Tokunaga, 1938).

<sup>1</sup>*\*Polypedilum kamotertium* Sasa, 1989

*Polypedilum kamotertium* Sasa, 1989, p. 64.

*Material examined.* 2♂♂: Dangsari, Muju-eup, Muju-gun, Jeollabuk-do; 5 Sep. 2008 (K.Y. Jeong and S.H. Nam). 1♂: Locality same; 28 Aug. 2009 (K.Y. Jeong).

<sup>1</sup>\*다모무늬깔따구 (신칭)



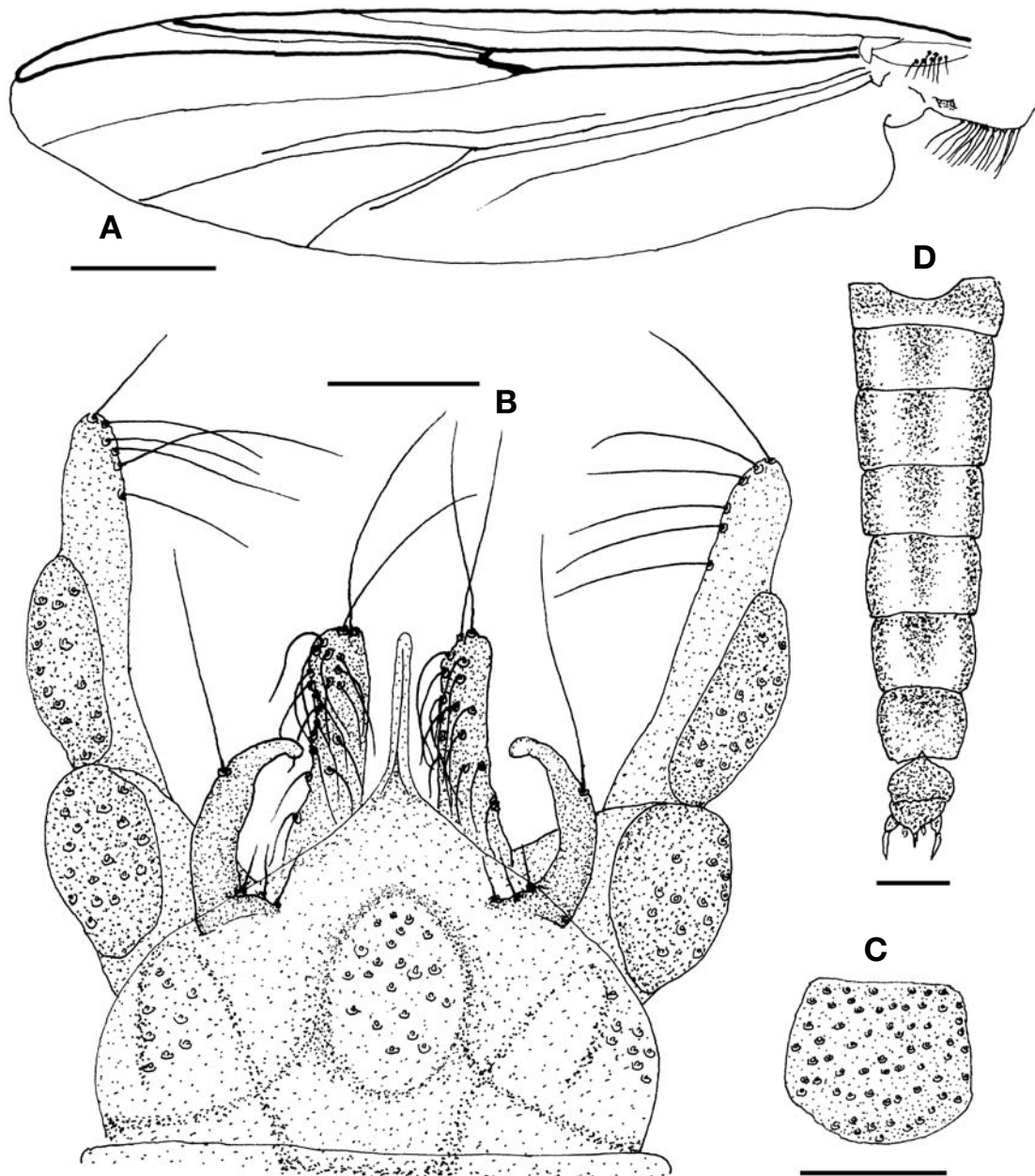
**Fig. 5.** *Polypedilum japonicum* (Male). A, Wing; B, Hypopygium. Scale bars=0.5 mm (A), 0.05 mm (B).

**Diagnosis.** Dark brown, medium sized midge (WL 2.8 mm). Clypeus with about 60 long setae. Tergite II-VII pale, with a dark marking on middle and lateral sides. Anal point long, narrow, parallel-sided. Superior volsella horn-shaped, narrowed apically, bent internally, with a long lateral seta on distal 1/3 and 3 basal setae. Inferior volsella with 2 long, apical setae. Gonocoxite and gonostylus with a darkened, hard plate. AR 1.24. LR 1.17.

**Description (Male).** Eye black, bare, shortly produced dor-

somedially. 15-17 postoculars each side. Antenna dark brown, with 13 segments; AR 1.24. Clypeus (Fig. 6C) dark brown, rectangular in shape, with about 60 long setae. Palp dark, with 5 segments: 61, 89, 228, 218, 243  $\mu\text{m}$  (1 : 1.5 : 3.7 : 3.6 : 4.0). THORAX: Brown in ground color. Anteprepronotum pale yellow dorsally, brown ventrally, narrowed, separated medially, with 9-11 setae. Scutum brown, vittae absent; many rather short acrosticals, dorsocentrals and prealars. Scutellum pale yellow, with more than 40 setae. Postnotum





**Fig. 6.** *Polypedilum kamatertium* (Male). A, Wing; B, Hypopygium; C, Clypeus; D, Abdomen (dorsal). Scale bars=0.5 mm (A, D), 0.1 mm (B, C).

dark brown. Halter pale. WING (Fig. 6A): WL 2.8 mm. Membrane bare. Only vein R, R<sub>1</sub>, R<sub>4+5</sub> setosed. R<sub>2+3</sub> running middle of R<sub>1</sub> and R<sub>4+5</sub> and ending adjacent to R<sub>1</sub>. FCu slightly distal to RM. Cu<sub>1</sub> almost straight. Anal lobe developed. Squama fringed. Brachiolum pale, with 7 setae. LEGS: Brownish yellow. Fore tibia with scale at tip. Combs of mid and hind tibiae slightly separated, with one rather short spur. Pulvillus developed. LR 1.17. ABDOMEN (Fig. 6D): Tergite I dark brown, pale along apical margin; tergite II-VII

pale, with a dark marking on middle and both lateral sides. HYPOPYGIUM (Fig. 6B): Anal tergite produced distally, with 25 median setae; lateral setae absent; anal tergite band developed, shielding median setae. Anal point long, narrow, parallel-sided. Superior volsella horn-shaped, narrowed apically, bent internally, with a long lateral seta on distal 1/3 and 3 basal setae. Inferior volsella cylindrical, rather narrow, with 2 long apical setae and many recurved setae along distal 2/3. Gonocoxite with darkened, round hard plate, bearing

many setae. Gonostylus abruptly narrowed at distal 1/3 and smoothly rounded apically, with 6 long apical and inter-lateral setae, also with darkened plate, bearing many long setae.

*Remarks.* Our specimens are undoubtedly *Polypedilum kamotertium*, as most morphological features are coincided each other. This species can be easily separated from other *Polypedilum* species by several very unique characters: more than 60 long clypeal setae (Fig. 6C), brachiolum with 7 setae (Fig. 6A), gonocoxite and gonostylus each with a large dark plate (Fig. 6B), abdominal tergite II-VII pale brown with dark patches on middle and both lateral sides (Fig. 6D), and others. This species must be extremely rare, because only five specimens have been collected so far, two in Japan by Sasa (1989) and three in Korea by us.

<sup>1</sup>\**Polypedilum pullum* (Zetterstedt, 1842)

*Chironomus pullum* Zetterstedt, 1982, p. 12.

*Chironomus (Polypedilum) pullum*: Goetghebuer, 1928, p. 92.

*Polypedilum pullum*: Pinder, 1978, p. 136.

*Material examined.* 2♂♂: Dangsari, Muju-eup, Muju-gun, Jeollabuk-do; 5 Sep. 2008 (K.Y. Jeong and S.H. Nam).

*Diagnosis.* Rather small, yellowish brown midge. WL 1.4 mm. Wing membrane with 3 dark markings on  $r_{4+5}$  and  $m_{1+2}$ ,  $m_{3+4}$  and  $cu_1$ , and an. Anal point rather short and broad, slightly narrowed at base, with round tip; lateral projection of anal point pubescent, narrow. Superior volsella wide, pad-like, with 2-3 inner-lateral setae and 1-2 outer-lateral setae. AR 1.22. LR 2.0.

*Description (Male).* HEAD: Eye dark purple, bare, dorsomedially produced. 7-8 postoculars each side. Antenna yellowish brown, with 13 segments; AR 1.22. Frontal tubercle absent. Palp pale, with 5 segments: 29, 29, 89, 96, 123  $\mu$ m (1:1:3.1:3.3:4.3). Clypeus yellow, with 15 setae on dorsal half. THORAX: Yellowish brown in ground color. Anteprepronotum brownish yellow, narrowed dorsally, widely separated each other. Scutum overreaching anteprepronotum, with brown, obscure vittae; 9 dorsocentrals and 3 prealars each side. Scutellum yellow, with 14 setae. Postnotum dark brown. Halter pale. WING (Fig. 7A): WL 1.4 mm. Membrane bare, with 3 dark markings: the first one on  $r_{4+5}$  and  $m_{1+2}$ , the second one on  $m_{3+4}$  and  $cu_1$ , and the third one on an. Costa not produced.  $R_{2+3}$  running middle of  $R_1$  and  $R_{4+5}$  and ending near  $R_1$ . FCu distal to RM.  $cu_1$  slightly curved at tip. An scarcely reaching FCu. Anal lobe not developed. Squama with 6 setae. Arculus pale; brachiolum pale, with 1 seta. LEGS: All segments brownish yellow, except basal half of mid and hind femur brown. Fore tibial scale round; mid and hind tibial combs separated, with one long spur. Pulvillus

developed. LR 2.0. ABDOMEN: Uniformly brownish yellow. HYPOPYGIUM (Fig. 7B): Anal tergite distally produced, with 5 median setae; apical setae absent. Anal point rather short and wide, narrowed at base, round at tip, lateral lobe pubescent, narrow. Superior volsella wide, pad-like, pubescent, with 2-3 inner-lateral and 1-2 outer-lateral setae. Inferior volsella cylindrical, with a rather short apical seta and recurved setae. Gonostylus narrow, apically tapered, with several inner-lateral setae.

*Remarks.* This species is very similar to *Polypedilum unifascium* in general morphology, but differs in shape of anal point. *Polypedilum pullum* has a broad anal point, constricted at base, whereas *P. unifascium* has a narrow, parallel-sided anal point. This species also resembles *Polypedilum japonicum*, but the wing membrane of the later has a additional marking on distal  $m_{1+2}$  (the former has not).

<sup>2</sup>\**Polypedilum serugense* Niitsuma, 1992

*Polypedilum (Polypedilum) serugense* Niitsuma, 1992, p. 700.

*Polypedilum aviceps*: Sasa & Kikichi, 1986, p. 25; Sasa and Okazawa, 1991, p. 110; Sasa, 1993, p. 56.

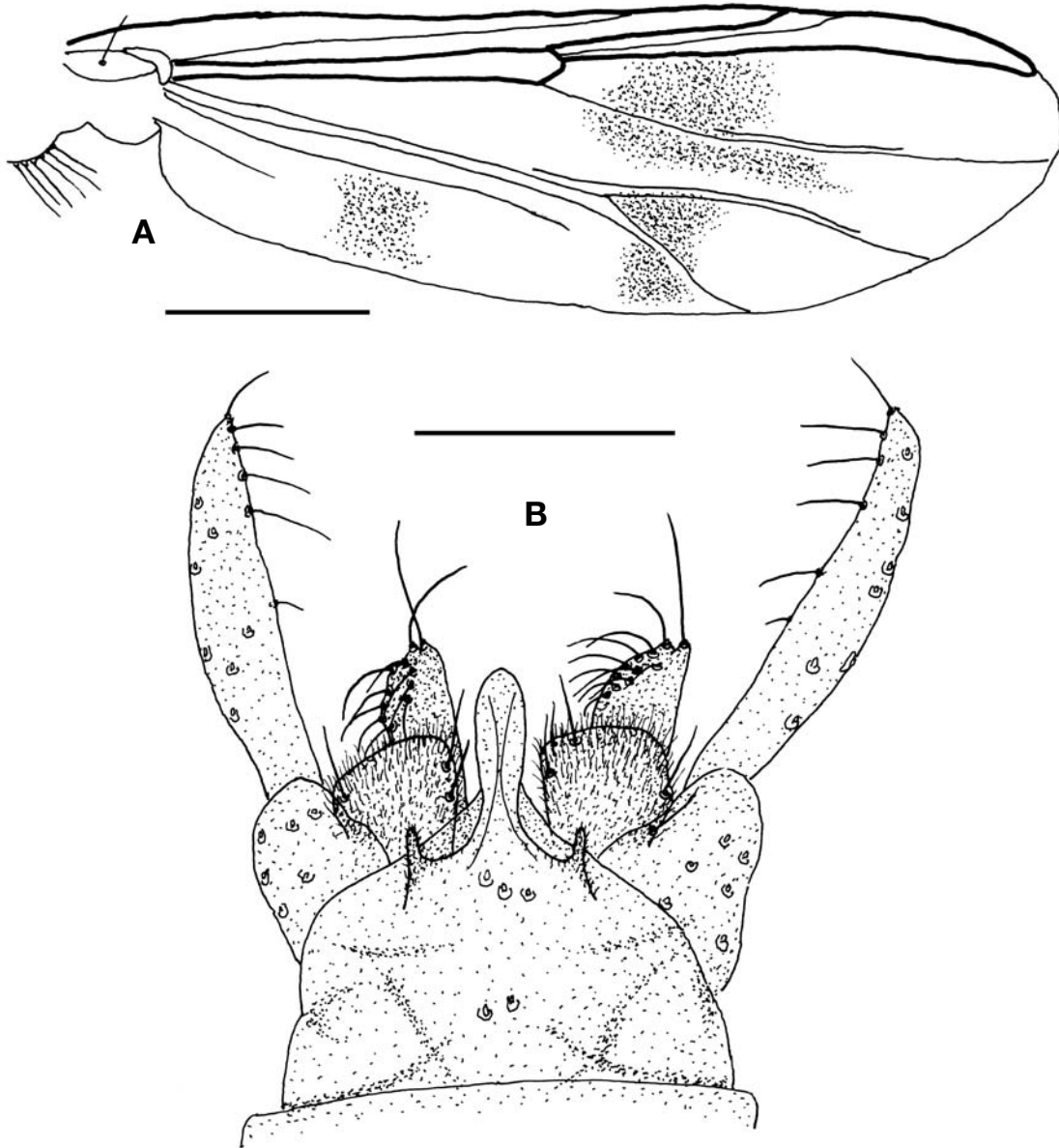
*Material examined.* 2♂♂: Dangsari, Muju-eup, Muju-gun, Jeollabuk-do; 5 Sep. 2008 (K.Y. Jeong and S.H. Nam).

1♂: Locality same (K.Y. Jeong); 22 May 2009. 3♂♂: Locality same (K.Y. Jeong); 28 Aug. 2009.

*Diagnosis.* Small to medium, yellowish species. Wing length 1.6 mm. Anal point broad, with round tip. Superior volsella extremely narrow and long apically, directed inward; base of superior volsella wide, produced posteriorly, with a long seta. Gonocoxite very short. Gonostylus long, inner-lateral margin almost straight, with 7-8 setae. AR 1.86. LR 1.75.

*Description (Male).* Eye black, bare, dorsomedially produced. Antenna dark brown, with 13 segments; AR 1.86. Palp pale yellow, with 5 segments: 43, 43, 140, 126, 194 (1:1:3.3:2.9:4.5). 10-11 postoculars each side. Clypeus yellow, with 17 setae. THORAX: Pale yellow in ground color. Anteprepronotum pale yellow, narrowed medially, widely separated each other. Scutum pale yellow, vittae absent. Scutellum pale, with 21 scutellars. Postnotum yellow. Halter pale. WING (Fig. 8A): WL 1.6 mm. Membrane bare. Costa not produced. Vein R,  $R_1$ ,  $R_{4+5}$  setosed.  $R_{2+3}$  adjacent to  $R_1$ . FCu distal to RM.  $cu_1$  almost straight. An just reaching FCu. Anal lobe moderately developed. Squama with 8-10 setae. Brachiolum and arculus pale. LEGS: Uniformly pale yellow. LR 1.75. ABDOMEN: Uniformly pale yellow. HYPOPYGIUM (Fig. 8B): Anal tergite round distally, with 7 median setae and 7-9 apical setae each side of anal point. Anal point broad, with round tip. Superior volsella extremely narrow and long api-

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**Fig. 7.** *Polypedilum pullum* (Male). A, Wing; B, Hypopygium. Scale bars=0.3 mm (A), 0.1 mm (B).

cally, directed internally, base of superior volsella wide, produced posteriorly, with a long seta and covered with microtrichiae. Inferior volsella short, with a long apical seta and relatively short, recurved setae. Gonocoxite very short. Gonostylus long, almost straight, tip smoothly rounded, with 7-8 setae along inner margin.

*Remarks.* *Polypedilum serugense* resembles *Polypedilum aviceps* Townes. *P. aviceps* reported by Sasa and Kikuchi (1986) and some other workers was not *P. aviceps* but *P. serugense* (Niitsuma, 1992). Distal half of superior volsella of *P.*

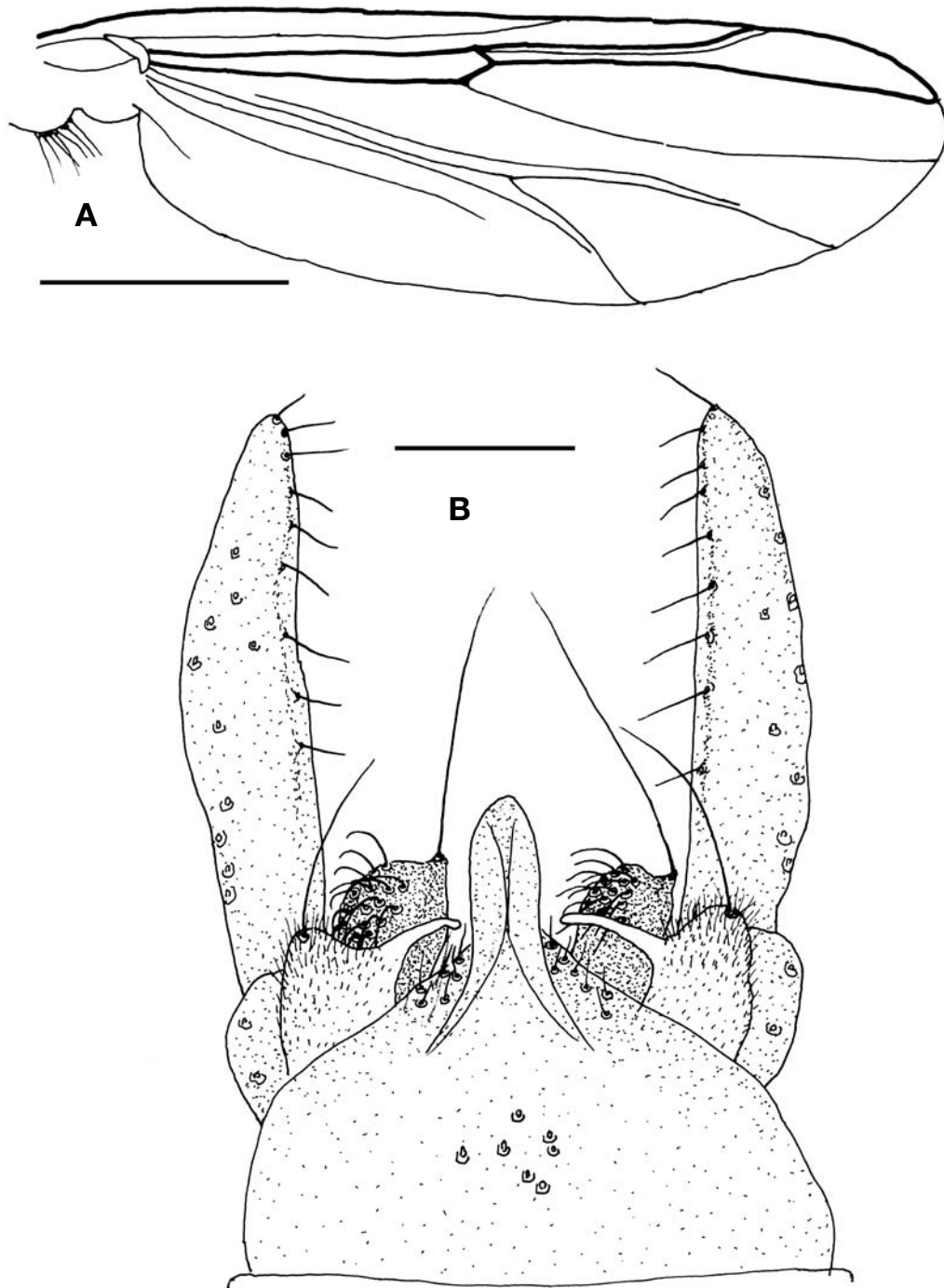
*serugense* is longer and narrower than that of *P. aviceps* and other allied species, and also posterior lobe of superior volsella is larger.

<sup>1</sup>*\*Polypedilum unifascium* (Tokunaga, 1938)

*Chironomus (Polypedilum) unifascium* Tokunaga, 1938, p. 335.

*Polypedilum unifascium*: Sasa, 1980, p. 32; Sasa, 1985, p. 119; Sasa, 1990, p. 121; Sasa, 1993, p. 130.

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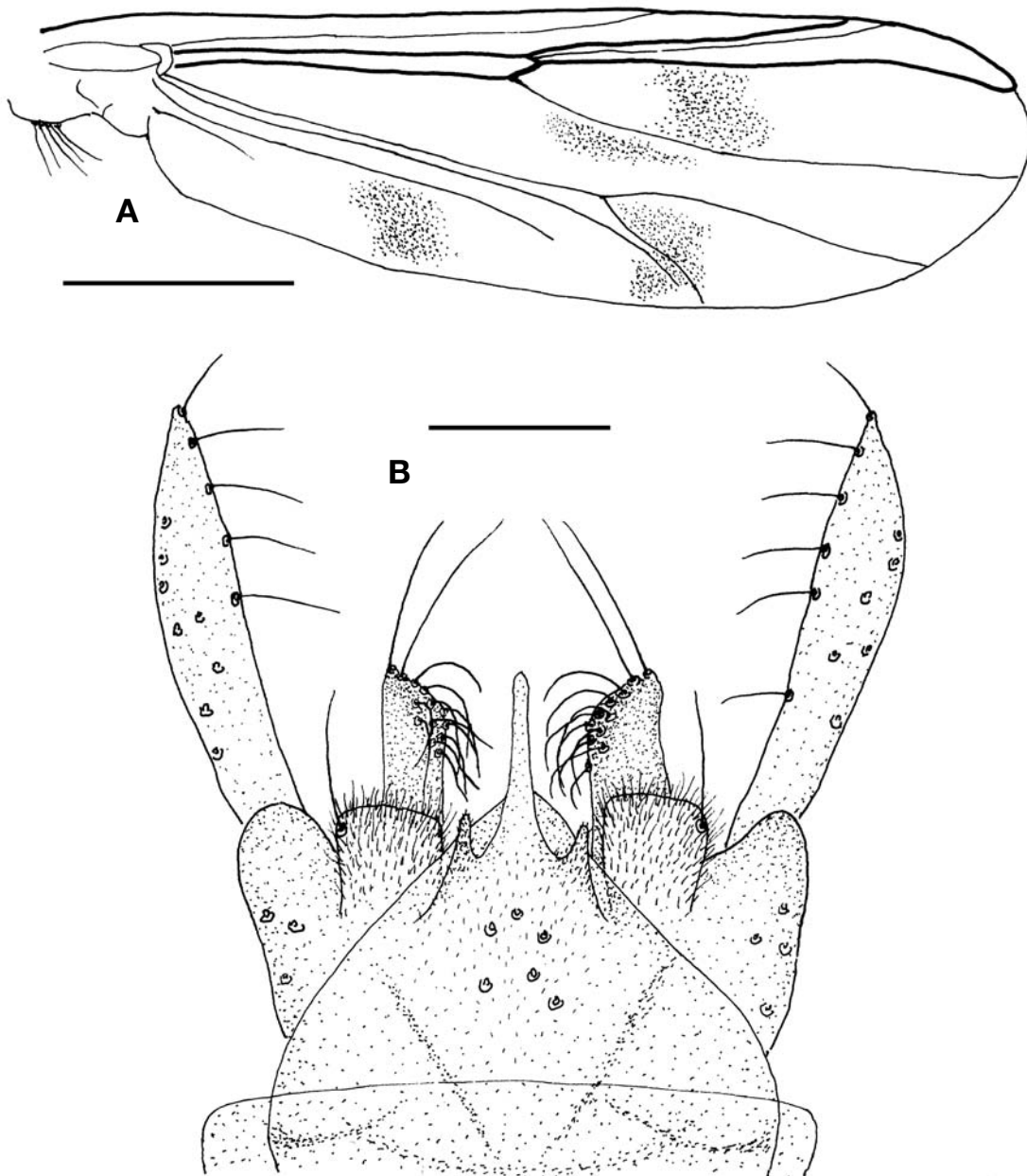
**Fig. 8.** *Polypedilum serugense* (Male). A, Wing; B, Hypopygium. Scale bars=0.5 mm (A), 0.05 mm (B).

*Material examined.* 1 ♂: Dangsari, Muju-eup, Muju-gun, Jeollabuk-do; 5 Sep. 2008 (K.Y. Jeong and S.H. Nam). 9 ♂♂: Locality same; 28 Aug. 2009 (K.Y. Jeong).

*Diagnosis.* Yellowish brown, small species. Wing length 1.25 mm. Wing membrane bare, with 4 distinct dark mark-

ings: on  $r_{4+5}$ , on  $m_{1+2}$ , on  $m_{3+4}$  and cu, and on an. Anal point narrow, long, parallel-sided, with narrow lateral projection each side. Superior volsella broad, pad-like, pubescent, with a long seta on outer-apical corner. AR 0.8. LR 2.06.

*Description (Male).* HEAD: Eye bare, with dorsomedial



**Fig. 9.** *Polypedilum unifascium* (Male). A, Wing; B, Hypopygium. Scale bars=0.3 mm (A), 0.05 mm (B).

projection. Frontal tubecle absent. 9-11 postoculars. Antenna pale dark brown, with 13 segments; AR 0.8. Clypeus brownish yellow, with 18 setae. Palp pale yellowish brown, with 5 segments: 21, 25, 67, 79, 104  $\mu\text{m}$  (1 : 1.2 : 3.2 : 3.8 : 5.0). THORAX: Yellowish brown in ground color. Anteprepronotum yellowish brown, bare, dorsomedially separated. Scutum overreaching anteprepronotum; brown vittae not clear; 10-11 dorsomedials each side. Scutellum pale yellow, with 11 scutellars. Postnotum dark brown. Halter pale. WING (Fig. 9A): WL 1.25 mm. Membrane bare, with 4 distinct dark markings:

on  $r_{4+5}$ , on  $m_{1+2}$ , on  $m_{3+4}$  and cu, and on an. Costa not produced.  $R_{2+3}$  adjacent to  $R_1$ . FCu distal to RM.  $Cu_1$  almost straight. An reaching under FCu. Brachiolum and arculus pale, bare. Anal lobe not developed. Squama with 5 setae. LEGS: All femurs pale, with basal 2/3 pale dark brown. All tibiae and tarsi pale. LR 2.06. ABDOMEN: All tergite yellowish brown, with slightly darker VII-VIII. HYPOPYGIUM (Fig. 9B): Anal tergite produced apically, forming triangular, with 5-6 median setae; anal tergal band poorly developed. Anal point narrow, long, parallel-sided, with narrow lateral

**Table 1.** Species of the genus *Polypedilum* collected in Muju-eup, Muju-gun, Jeollabuk-do, Korea

Species	No. collected	%
* <i>P. asakawaense</i> Sasa	20	9.1
* <i>P. convictum</i> (Walker)	3	1.4
<i>P. cultelatum</i> Goetghebuer	34	15.4
** <i>P. dangsanensis</i> Ree & Jeong n. sp.	7	3.2
* <i>P. decematoguttatum</i> (Tokunaga)	1	0.5
<i>P. edensis</i> Ree & Kim	46	20.8
* <i>P. japonicum</i> (Tokunaga)	10	4.5
* <i>P. kamotertium</i> Sasa	3	1.4
<i>P. nubifer</i> (Skuse)	57	25.8
* <i>P. pullum</i> (Zetterstedt)	2	0.9
<i>P. parviacumen</i> Kawai & Sasa	3	1.4
<i>P. pedestre</i> (Meigen)	1	0.5
* <i>P. serugense</i> Niitsuma	6	2.7
<i>P. scalaenus</i> (Schränk)	4	1.8
* <i>P. unifascium</i> (Tokunaga)	10	4.5
<i>P. yongsanensis</i> Ree & Kim	10	4.5
Unidentified	4	1.8
Total	221	100

\*Unrecorded species; \*\*New species

projection. Superior volsella broad, pad-like, pubescent, with a long seta on outer-apical corner. Inferior volsella cylindrical, with 2 long apical setae and many recurved setae. Gonocoxite rather small. Gonostylus slender, apically tapered, with an apical and 4-5 inner-lateral setae.

**Remarks.** Tokunaga (1938) described only the female of *Chironomus (Polypedilum) unifascium* sp. nov. Later, Sasa (1980) collected males of this species and described. General morphology of our specimens well fit to that of *Polypedilum unifascium* described by Sasa (1980) except LR value (2.06 vs 1.87) and apical setae of inferior volsella (2 vs 1).

## DISCUSSION

The genus *Polypedilum* Kieffer is one of the largest chironomid genera containing about 440 described species (Seather et al., 2010). Previous workers reported total 11 *Polypedilum* species in Korea (Ree and Kim 1981; Ree and Kim 1988; Ree, 1992; Na, 2004; Ree, 2009). In the present study, a total of 1,113 chironomid adults were collected. Among them 221 individuals (19.9%) belong to the genus *Polypedilum*, and 16 species including 1 new and 8 unrecorded species were confirmed (Table 1). The most frequently collected species in the study area was *Polypedilum nubifer*, consisting of 25.8% of the total *Polypedilum* samples, followed by *Polypedilum edensis* (20.8%). At present, a total of 21 *Poly-*

*pedilum* species are listed in Korean fauna.

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