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## The *Polypedilum convictum* Species Group (Diptera, Chironomidae) from Japan, with Descriptions of Two New Species

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**Abstract** Five Japanese species of the *Polypedilum convictum* species group, *pedatum*, *cultellatum*, *convictum*, *hiroshimaense* and *aviceps*, are redescribed on adult males. Two new species, *paraviceps* and *surugense*, found in Japan, are added to the species group based on both male and female adults and immature forms.

**Key words:** Chironomidae; *Polypedilum*; *convictum* group; taxonomy; morphology.

### Introduction

The *convictum* species group of the genus *Polypedilum* KIEFFER, 1912, was first erected by LENZ (1941) for those species characterized by the pupae having 4–6 small branches in their thoracic respiratory organ, the larvae having the second median mentum teeth smaller than the first and third, and the two larval eye spots fused on each side of the head.

TOWNES (1945) reviewed the Nearctic Chironomini and divided the genus *Polypedilum* into three subgenera, *Polypedilum*, *Pentapedilum* and *Tripodura*. Within the subgenus *Polypedilum*, he recognized two species groups, the *fallax* group and the *convictum* group, based on the following adult male morphology: body size, antennal ratio, foreleg ratio and ending point of vein  $R_{4+5}$ . The *convictum* group was further divided into the *illinoense* sub-group and the *convictum* sub-group, based on the ratio of length to width of the gonostyle and shape of the superior volsella.

SASA (1989 a) divided the genus *Polypedilum* of Japan, except for *Pentapedilum* which was treated as a distinct genus, into four species groups, the *nubifer* group, the *nubeclosum* group, the *tripodura* group and the *cultellatum* group. The *cultellatum* group, however, corresponds with the *convictum* sub-group of TOWNES, since it is characterized by the boot-shaped superior volsella of male hypopygium, which is composed of a setigerous pad-like basal portion and a bare beak-like inner process.

Of the characters used by TOWNES for grouping, those except for the superior volsella are of no use, since they may vary between individuals. Although the feature of the vein  $R_{4+5}$ , either extending to the wing apex or ending a little before it, appears to be significant for grouping, it is not always useful, because it is some-

times indistinct. Only the feature of the superior volsella, being either boot-shaped or horn-shaped, is important and useful for separating the species groups. *Polypedilum pedatum* was originally described as a member of the *fallax* group by TOWNES (1945). Based on the feature of the superior volsella, the species is included in the *convictum* sub-group *sensu* TOWNES. In this paper, all the species of the subgenus *Polypedilum* with boot-shaped superior volsellae in the male hypopygium, including *pedatum*, are treated as members of the *convictum* group.

In Japan, this group has been represented by five species, *convictum* (WALKER, 1856), *cultellatum* GOETGHEBUER, 1931, *aviceps* TOWNES, 1945, *tamasemusi* SASA, 1983 and *hiroshimaense* KAWAI et SASA, 1985. In this paper, on account of its morphological features, *tamasemusi* is treated as a junior synonym of *pedatum*. SASA and KIKUCHI (1986) and SASA (1989 b) recorded "*aviceps*" from Tokushima and Kyoto Prefectures, respectively. However, the species from the two prefectures have been found different and both of them are treated as new species of this group, based on adults and immature forms collected from Shizuoka, Fukushima and Tochigi Prefectures. The true *aviceps* found in Shizuoka Prefecture is redescribed on adult male.

The adults of this group are similar to one another in their yellowish green coloration with the exception of *pedatum*, whose body is dark brown, and medium-sized body, and are frequently found together in the same locality. This paper contains brief redescriptions of the five known species on adult males and full descriptions of the two new species on adults, both male and female, and immature forms.

All the type specimens are deposited in the Department of Biology, Faculty of Education, Shizuoka University.

The terminology of the general morphology used in this paper follows SAETHER (1980).

#### *Polypedilum convictum* Species Group

*Polypedilum convictum* group: LENZ, 1941, Arch. Hydrobiol., 38: 19 (in part); TOWNES, 1945, Am. Midl. Nat., 34: 47 (as subgroup of *convictum* group).

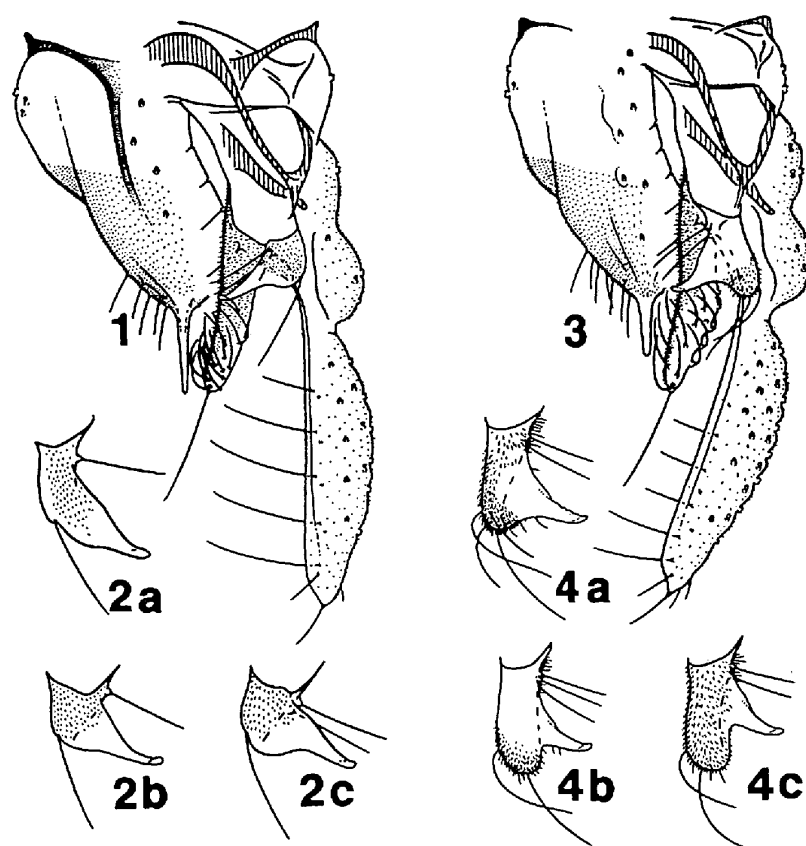
*Polypedilum cultellatum* group: SASA, 1989 a, Res. Rep. natn. Inst. envir. Stud., 125: 94.

This species group is separated from all other members of the subgenus *Polypedilum* KIEFFER, 1912, only by the feature of the male hypopygium, whose superior volsella is boot-shaped and is composed of a setigerous pad-like basal portion and a usually bare beak-like inner process.

#### *Polypedilum (Polypedilum) pedatum* TOWNES

(Figs. 1-2)

*Polypedilum (Polypedilum) pedatum* TOWNES, 1945, Am. Midl. Nat., 34: 55; SUBLETTE, 1960, Proc. U. S. natn. Mus., 112: 207.



Figs. 1-4. Adults of *Polypedilum* spp. — 1-2, *P. pedatum* TOWNES; 3-4, *P. cultellatum* GOETGHEBUER. — 1, 3, Male hypopygium (dorsal view); 2 a-c, 4 a-c, variation of superior volsella in male hypopygium.

*Polypedilum tamasemusi* SASA, 1983, Res. Rep. natn. Inst. envir. Stud., 43: 15.

*Male.* Body length 2.3-3.3 mm. Wing length 1.7-2.4 mm.

Body entirely dark brown. Legs yellow or yellowish brown except dark brown coxae.

Head: Weak frontal tubercles present or absent. Antennal ratio 0.91-1.14.

Thorax: Anteprenotum much reduced, not visible from above.

Wing: Membrane unmarked. Vein  $R_{2+3}$  almost in contact with  $R_1$ ;  $R_{4+5}$  ending at the wing apex; fCu distinctly beyond r-m, venarum ratio 1.23-1.29.

Legs: Foretibia with an apically pointed scale. Leg ratio 1.45-1.68 in foreleg, 0.52-0.57 in mid-leg, 0.68-0.71 in hind leg.

Hypopygium (Figs. 1-2): Tergite IX acute posteriorly with a long and slender anal point. Superior volsella (Fig. 2 a-c) variable in the shape of apical portion, barely to moderately projected posteriorly; basal portion largely pubescent on the dorsal surface, and bearing 1-2 long basal setae and 1 long apical seta; inner process

1.0–1.4 times as long as the average width of basal portion. Inferior volsella slender, not swelling at the apical or subapical portion, with a long apical seta extending caudad and 7–15 recurved setae on distal 1/3.

*Distribution.* North America: USA; Asia: Japan (Fukushima, Tokyo, Shizuoka and Nagano Prefs.).

*Remarks.* *Polypedilum pedatum* resembles *P. suliceps* TOWNES, but differs from the latter in the acute posterior portion of the tergite IX and the slender inferior volsella of the male hypopygium (in *suliceps*, tergite IX rounded posteriorly, inferior volsella swelling outwards at the subapical portion, according to TOWNES, 1945).

TOWNES (1945) divided nearctic *pedatum* into two subspecies, *pedatum* and *excelsius*, on the basis of the feature of the superior volsella. In his description of the subspecies *excelsius*, he said, "Point of superior appendage longer and more slender than in the subspecies *pedatum*". These two forms, however, appear to be individual variations, since they are found in the same population.

*Polypedilum tamasemusi* SASA, 1983, is regarded as a junior synonym of *pedatum*, since the two species almost entirely agree in their morphological features.

### *Polypedilum (Polypedilum) cultellatum* GOETGHEBUER

(Figs. 3–4)

*Polypedilum cultellatum* GOETGHEBUER, 1931, Bull. Annl. Soc. r. ent. Belg., 71: 212; BRUNDIN, 1947, Ark. Zool., 39: 64; PINDER, 1978, Freshwat. Biol. Assoc. scient. Publ., 37: fig. 168 C; SASA & HASEGAWA, 1983, Jpn. J. sanit. Zool., 34: 330.

*Microtendipes ureshinoensis* SASA, 1979, Res. Rep. natn. Inst. envir. Stud., 7: 19; REE & KIM, 1981, Proc. Coll. nat. Sci. Seoul natn. Univ., 6: 153.

*Polypedilum ureshinoense*: SASA, 1980, Res. Rep. natn. Inst. envir. Stud., 13: 37; SASA, 1989 a, *ibid.*, 125: 31 (as variety of *cultellatum*).

*Male.* Body length 2.5–3.8 mm. Wing length 1.7–2.7 mm.

Coloration largely yellow to yellowish green. Scutal vittae, postnotum and preepisternum of thorax brown to dark brown. Forelegs brown, mid- and hind legs yellow to pale brown.

Head: Frontal tubercles absent. Antennal ratio 1.22–1.88.

Thorax: Anteprepronotum much reduced, not visible from above.

Wing: Membrane unmarked. Vein  $R_{2+3}$  almost in contact with  $R_1$ ;  $R_{4+5}$  ending only a little before the wing apex; fCu distinctly beyond r-m, venarum ratio 1.16–1.24.

Legs: Foretibia with an apically pointed scale. Leg ratio 1.52–2.00 in foreleg, 0.48–0.56 in mid-leg, 0.66–0.70 in hind leg.

Hypopygium (Figs. 3–4): Tergite IX acute posteriorly with weak anal tergal bands; anal point narrow and relatively short. Superior volsella (Fig. 4 a–c) variable in the shape of apical portion, moderately to strongly projected posteriorly; basal portion pubescent apically or more extensively, and bearing 2–3 long basal setae and 2–7 long apical setae; inner process 1.3–1.9 times as long as the average

width of basal portion. Inferior volsella somewhat swelling outwards at the sub-apical portion, with a long apical seta extending caudad and 13–20 recurved setae on distal 1/2.

*Distribution.* Europe: widespread; Africa: Algeria; Asia: Lebanon, Korea, Japan (widespread).

*Remarks.* *Polypedilum cultellatum* is most closely related to *P. albicarpus* TOKUNAGA, but distinct from the latter on account of the apically pointed tibial scale of the forelegs (foretibial scale rounded apically in *albicarpus*, according to TOKUNAGA, 1964). This species is similar to *P. subcultellatum* SUBLETTE too, but separated from the latter by having a largely yellow body and subapically swollen inferior volsella (body largely brown, inferior volsella entirely slender in *subcultellatum*, according to SUBLETTE, 1960).

SASA and KIKUCHI (1986) distinguished the *ureshinoense*-form from the *cultellatum*-form in such characters as the number of apical setae on superior volsella and the extent of development of the posterior portion of superior volsella. The former has 2–3 long apical setae on an indistinct posterior lobe of superior volsella, while the latter has 4–5 long apical setae on a conspicuous posterior lobe. Recently, the author cultured an egg-mass of this species collected from a pond in Shizuoka City, and examined 71 adult males which emerged from it. About 90% of them had 2–3 long apical setae on the superior volsella, and about 10% had 4–5 long apical setae. The size of the posterior lobe in the superior volsella varied between individuals, having no relationship to the number of apical setae. Therefore, it is concluded that the two forms are only individual variations of this species.

### *Polypedilum (Polypedilum) convictum* (WALKER)

(Figs. 5–6)

*Chironomus convictus* WALKER, 1856, Ins. Brit. Dipt., 3: 161; EDWARDS, 1929, Trans. R. ent. Soc. Lond., 77: 404.

*Polypedilum convictum*: GOETGHEBUER, 1928, Faune Fr., 18: 92; TOWNES, 1945, Am. Midl. Nat., 34: 59; SASA & KAWAI, 1987, Bull. Toyama Sci. Mus., 10: 30.

*Male.* Body length 2.1–3.1 mm. Wing length 1.4–2.2 mm.

Coloration entirely yellow to yellowish green except pale brown foretarsi.

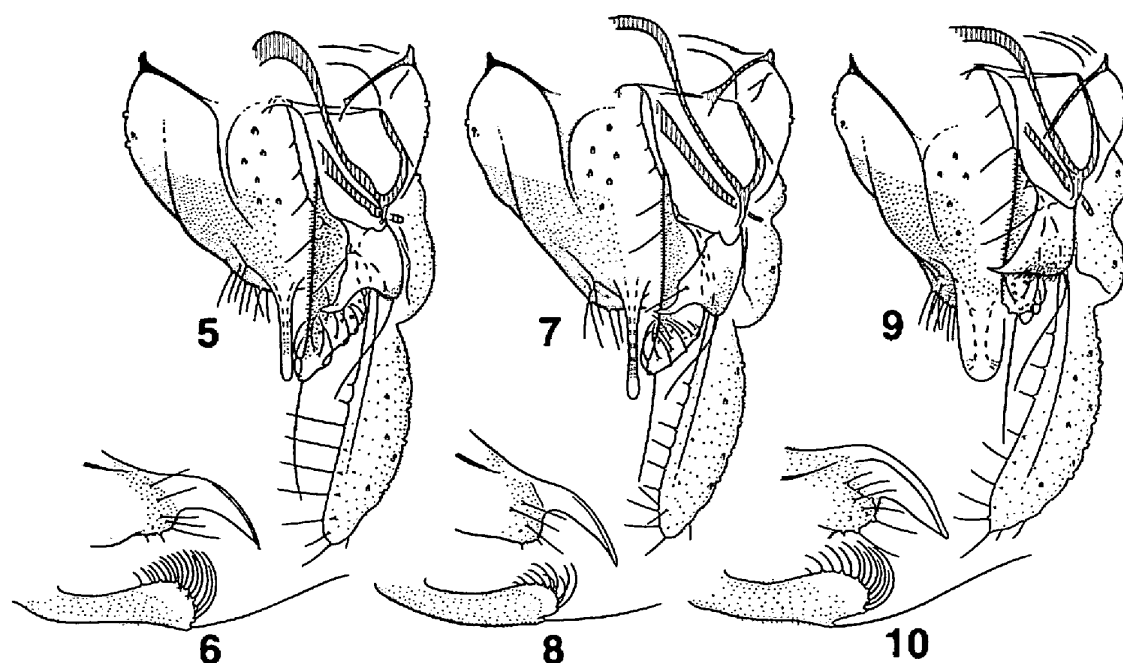
Head: Frontal tubercles absent. Antennal ratio 1.32–1.71.

Thorax: Antepnotum much reduced, not visible from above.

Wing: Membrane unmarked. Vein  $R_{2+3}$  almost in contact with  $R_1$ ;  $R_{4+5}$  ending a little before the wing apex; fCu distinctly beyond r-m, venarum ratio 1.21–1.30.

Legs: Foretibia with a scale rounded apically. Leg ratio 1.66–1.88 in foreleg, 0.52–0.57 in mid-leg, 0.70–0.75 in hind leg.

Hypopygium (Figs. 5–6): Tergite IX rounded posteriorly with a long and slender anal point. Superior volsella moderately projected posteriorly; basal por-



Figs. 5-10. Adults of *Polypedilum* spp. — 5-6, *P. convictum* (WALKER); 7-8, *P. hirosimaense* KAWAI et SASA; 9-10, *P. aviceps* TOWNES. — 5, 7, 9, Male hypopygium (dorsal view); 6, 8, 10, apex of abdominal tergite IX with anal point and inferior volsella in male hypopygium (lateral view).

tion pubescent apically, and bearing 1-3 long basal setae and 1 long apical seta; inner process 0.9-1.1 times as long as the average width of basal portion. Inferior volsella swelling outwards at the subapical portion, with a long apical seta extending caudad and 13-20 recurved setae on distal 1/3-1/2.

*Distribution.* Europe including CIS: widespread; Africa: Morocco; North America: Canada, USA; Asia: Kazakh SSR, Russian SFSR, Japan (Fukushima, Toyama and Shizuoka Prefs.).

*Remarks.* *Polypedilum convictum* closely resembles *P. kibatiense* GOETGHEBUER. FREEMAN (1958) said in his report on *kibatiense* from Africa, "The Palearctic species *convictus* WALKER is extremely similar and *kibatiense* may eventually prove only to be a form of this." But this species is distinct from *kibatiense* on account of the entirely yellow coloration (often darkened on the postnotum and pleura of the thorax, the halteres and the apical narrow portions of the abdominal segments in *kibatiense*, according to FREEMAN, 1958).

***Polypedilum (Polypedilum) hirosimaense* KAWAI et SASA**

(Figs. 7-8)

*Polypedilum hirosimaense* KAWAI et SASA, 1985, Jpn. J. Limnol., 46: 18.

*Male.* Body length 2.6–3.3 mm. Wing length 1.7–2.1 mm.

Coloration and general structures of head, thorax, wings and legs resembling those of *convictum*. Antennal ratio 1.46–1.64. Venarum ratio of wings 1.21–1.25. Leg ratio 1.74–1.91 in forelegs, 0.56–0.62 in mid-legs, 0.72–0.78 in hind legs.

Hypopygium (Figs. 7–8): Tergite IX rounded posteriorly; anal point long and narrow in dorsal view, relatively slender in lateral view. Superior volsella moderately projected posteriorly; basal portion pubescent caudally, and bearing 1 long apical seta; basal setae moderately long, 1–2 in number, and located near the base of the inner process; inner process 0.8–1.2 times as long as the average width of basal portion. Inferior volsella somewhat swelling outwards at the subapical portion, with a long ventral seta extending caudad and 13–15 recurved setae on distal 1/4–1/3.

*Distribution.* Asia: Japan (Hiroshima and Shizuoka Prefs.).

*Remarks.* *Polypedilum hiroshimaense* resembles *P. convictum*, but differs from the latter in the location of the basal setae, which arise near the base of the inner process of the superior volsella.

### *Polypedilum (Polypedilum) aviceps* TOWNES

(Figs. 9–10)

*Polypedilum (Polypedilum) aviceps* TOWNES, 1945, Am. Midl. Nat., 34: 61; SASA, KAWAI & UENO, 1988, Res. Rep. Toyama pref. envir. Pollut. Res. Cent., [1988]: 28.

*Male.* Body length 2.7–3.3 mm. Wing length 1.8–2.3 mm.

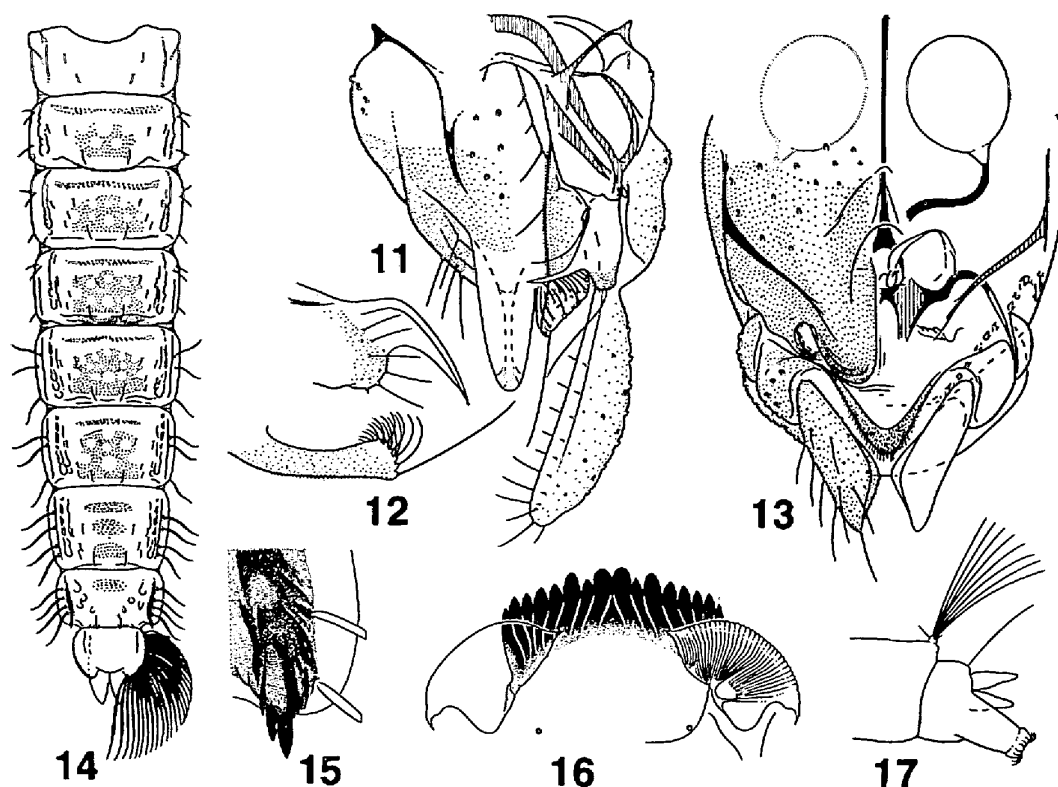
Coloration and general structures of head, thorax, wings and legs resembling those of *convictum*. Antennal ratio 1.56–1.83. Venarum ratio of wings 1.23–1.28. Leg ratio 1.65–1.84 in forelegs, 0.54–0.57 in mid-legs, 0.71–0.75 in hind legs.

Hypopygium (Figs. 9–10): Tergite IX rounded posteriorly; anal point broad, nearly parallel-sided and gradually tapering to rounded apex in dorsal view, stout in lateral view. Superior volsella slightly projected posteriorly; basal portion pubescent caudally, and bearing 1–2 long basal setae and 1 long apical seta; inner process short and 0.5–0.7 times as long as the average width of basal portion. Inferior volsella relatively short, barely extending beyond the caudal apex of the gonocoxite IX, and not swelling at the apical or subapical portion; a long ventral seta and 11–16 recurved setae present on distal 1/4.

*Distribution.* North America: USA; Asia: Japan (Toyama and Shizuoka Prefs.).

*Remarks.* *Polypedilum aviceps* resembles *P. obtusum* TOWNES, but differs from the latter in having a smaller posterior lobe and a shorter inner process of the superior volsella (TOWNES, 1945).

SASA and KIKUCHI (1986), SASA *et al.* (1988), and SASA (1989 b) recorded *aviceps* from Tokushima, Toyama and Kyoto Prefectures. However, their “*aviceps*” is a mixture of at least two species and the two species reported from Tokushima and



Figs. 11–17. *Polypedilum surugense* sp. nov. — 11–13, Adult: 11, male hypopygium (dorsal view); 12, apex of abdominal tergite IX with anal point and inferior volsella in male hypopygium (lateral view); 13, female genitalia (ventral view). — 14–15, Pupa: 14, abdomen (dorsal view); 15, caudolateral spur of abdominal segment VIII. — 16–17, Larva: 16, mentum; 17, posterior body segments.

Kyoto Prefecture under the name of *aviceps* do not agree with *aviceps* in the structure of their superior volsella. These are discussed under the next two new species. It is uncertain whether another species reported from Toyama Prefecture under the same name is true *aviceps* or not, since only its collecting record was given without a morphological account.

*Polypedilum (Polypedilum) surugense* sp. nov.

(Figs. 11–17)

*Polypedilum aviceps*: SASA & KIKUCHI, 1986, Jpn. J. sanit. Zool., 37: 25.

*Male*. Body length 2.9–3.6 mm. Wing length 1.8–2.2 mm.

Coloration similar to that of *convictum*.

Head: Temporals 10–16 in number. Frontal tubercles absent. Antennal ratio 1.70–1.90. Clypeus with 11–21 setae. First to 5th palpal segment lengths in Table 1.



Table 1. Lengths of palpal segments in the males of *P. surugense* sp. nov. and *P. paraviceps* sp. nov.

	n	Segment				
		I	II	III	IV	V
<i>P. surugense</i>	14	30-40 (39)	40-50 (46)	120-150 (140)	115-145 (133)	195-245 (215)
<i>P. paraviceps</i>	15	35-40 (39)	40-50 (42)	110-140 (126)	110-140 (118)	150-225 (189)

Measurements in  $\mu\text{m}$ ; means in parentheses. n, Number of specimens examined.

Table 2. Lengths of leg segments and leg ratios in the male of *P. surugense* sp. nov.

	Coxa	Trochanter	Femur	Tibia	Tarsomere 1
Forelegs	160-200 (179)	130-150 (139)	790-910 (859)	590-680 (624)	860-1030 (967)
Mid-legs	250-290 (274)	105-125 (113)	860-1000 (926)	750-860 (792)	430-500 (459)
Hind legs	220-280 (255)	100-120 (112)	880-1040 (958)	835-970 (882)	590-700 (637)
	Tarsomere 2	Tarsomere 3	Tarsomere 4	Tarsomere 5	Leg ratio
Forelegs	670-780 (722)	460-530 (490)	380-430 (399)	170-200 (180)	1.45-1.64 (1.55)
Mid-legs	250-290 (268)	180-210 (191)	115-140 (125)	65-80 (73)	0.56-0.60 (0.58)
Hind legs	330-400 (364)	270-320 (293)	180-210 (191)	90-105 (94)	0.69-0.75 (0.72)

Measurements in  $\mu\text{m}$ ; means in parentheses. Data based on 14 specimens.

Thorax. Antepnotum rather reduced, not visible from above. Scutum with 14-20 acrostichals, and 12-20 dorsocentrals usually in a row, sometimes partly in 2 rows. Prealar callus with 4-5 setae in a row. Scutellum with 13-22 setae in multiserial row.

Wing: Membrane unmarked. Vein  $R_{2+3}$  almost in contact with  $R_1$ ;  $R_{4+5}$  ending a little before the wing apex; fCu distinctly beyond r-m, venarum ratio 1.20-1.27. Squama with 9-13 setae.

Legs: Foretibia with an apically rounded scale. Bristle ratio 2.8-4.2 in foreleg, 3.9-5.8 in mid-leg, 5.6-8.7 in hind leg. Pulvilli well developed. Lengths of leg segments and leg ratios in Table 2.

Hypopygium (Figs. 11-12): Tergite IX rounded posteriorly with a broad anal point. Superior volsella strongly projected posteriorly; basal portion pubescent apically and bearing 0-1 long basal seta and a long apical seta; inner process slender, long and 1.3-1.7 times as long as the average width of basal portion. Inferior volsella swelling outwards at the subapical portion, and with a long apical seta extending caudad and 11-17 recurved setae on distal 1/4.

*Female.* Body length 2.0-3.0 mm. Wing length 1.6-2.1 mm.

Coloration similar to that of male.

Head: Antennal ratio 0.40-0.41; first to 5th flagellomere lengths in Table 3. Structures of thorax, wings and legs similar to those of male.

Genitalia (Fig. 13): Gonapophysis VIII divided into large dorsomesal lobe

Table 3. Lengths of flagellomeres of antennae in the females of *P. surugense* sp. nov. and *P. paraviceps* sp. nov.

	n	Flagellomere				
		I	II	III	IV	V
<i>P. surugense</i>	3	100–118 (107)	70–90 (81)	74–93 (82)	53–69 (62)	123–145 (134)
<i>P. paraviceps</i>	7	95–110 (105)	70–78 (75)	79–93 (84)	63–83 (71)	145–165 (160)

Measurements in  $\mu\text{m}$ ; means in parentheses. n, Number of specimens examined.

Table 4. Lengths of antennal segments in the larvae of *P. surugense* sp. nov. and *P. paraviceps* sp. nov.

	n	Segment				
		I	II	III	IV	V
<i>P. surugense</i>	19	54–65 (63)	20–28 (25)	4–5 (5)	5–7 (6)	5–6 (5)
<i>P. paraviceps</i>	9	55–63 (59)	18–20 (20)	5 (5)	7–9 (8)	4–6 (5)

Measurements in  $\mu\text{m}$ ; means in parentheses. n, Number of specimens examined.

and small ventrolateral lobe. Notum 138–148  $\mu\text{m}$  long. Seminal capsules oval, 95–100  $\mu\text{m}$  long, 58–68  $\mu\text{m}$  wide, and with a triangular neck region. Postgenital plate rounded at apex.

*Pupa.* Body length 3.3–4.6 mm.

Cephalothorax: Frontal apotome smooth with frontal setae; frontal warts and tubercles absent. Thorax with dorsal reticulation.

Abdomen (Fig. 14): Shagreen absent on tergites I and IX, more or less strong and extensive on II–VI, weak median and posterior on VII, weak anterior on VIII. Sternite I with strong shagreen anteriorly or more extensively. Tergite II with a row of 29–38 posterior hooklets. Transverse rows of anterior spines present on tergites II–VII, but sometimes indistinct on VII, on which spines are smaller. Con-junctive III/IV with or without spinules on the lateral portion, IV/V always with transverse rows of spinules. Pedes spurii A absent. Segment II–VI with 3 L-setae, VII–VIII with 4 L-setae on each side; L-seta short and simple on II–IV, long and lamelliform on V–VIII. Segment VIII with caudolateral spurs, which are composed of a few spines (Fig. 15). Anal lobe with a fringe of 41–58 lamelliform setae.

*Fourth instar.* Body length 6.1–6.6 mm. Head capsule length 420–450  $\mu\text{m}$ .

Head: Antennal ratio 1.48–1.61; lengths of antennal segments in Table 4. Antennal segment I with a ring organ near basal tip; blade extending beyond apex of segment IV, 40–48  $\mu\text{m}$  long; accessory blade 10–13  $\mu\text{m}$  long. Lauterborn organ 4–6  $\mu\text{m}$  long, style 5–8  $\mu\text{m}$  long on antennal segment II. Mentum (Fig. 16) with 8 pairs of teeth, of which 2nd median pair are smaller than 3rd.

Body (Fig. 17): Anal setae 8 in number. Four anal tubules well developed and tapered apically.

*Type materials.* Holotype: Male, emerged in the laboratory on 6. IV. 1985 from a larva collected at the Stream Shiotagawa in Shimizu, Shizuoka Pref., 1. VI. 1985, and slide-mounted in Canada Balsam with associated pupal and larval exuviae. Paratypes: 5 ♂♂, 4 pupal exuviae, 12 larvae (including 8 exuviae), same data as the holotype (adults emerged on 2. VI.–10. VI. 1985); 4 ♂♂, 3 ♀♀, 6 pupal exuviae, 6 larval exuviae, the Stream Iharagawa in Shimizu, 1. XI. 1989 (adults emerged in the laboratory on 3. XI.–7. XI. 1989); 4 ♂♂, 1 pupal exuvium, a tributary stream of the Fuji River in Shibakawa, Shizuoka Pref., 23. IX. 1991 (adults emerged in the laboratory on 28. XI.–27. XII. 1991).

*Distribution.* Asia: Japan (Tokushima and Shizuoka Prefs.).

*Remarks.* *Polypedilum surugense* is most closely related to *P. obtusum* TOWNES, but separated from the latter by the more slender and longer inner process of superior volsella (inner process about as long as the average width of the volsella in *obtusum*, according to TOWNES, 1945), as well as the greater posterior lobe of superior volsella (DILLON, personal communication).

The species previously reported under the name of *P. aviceps* from Tokushima (SASA & KIKUCHI, 1986) is undoubtedly *P. surugense*, since the two species almost entirely agree in morphological features, including the shapes of both the superior volsella, which is strongly projected posteriorly and has a long and slender inner process, and the inferior volsella, which is swollen outwards at the subapical portion.

### *Polypedilum (Polypedilum) paraviceps* sp. nov.

(Figs. 18–24)

*Polypedilum aviceps*: SASA, 1989 b, Res. Rep. Toyama pref. envir. Pollut. Res. Cent., [1989]: 63.

*Male.* Body length 2.7–3.5 mm. Wing length 1.8–2.3 mm.

Coloration similar to that of *convictum*.

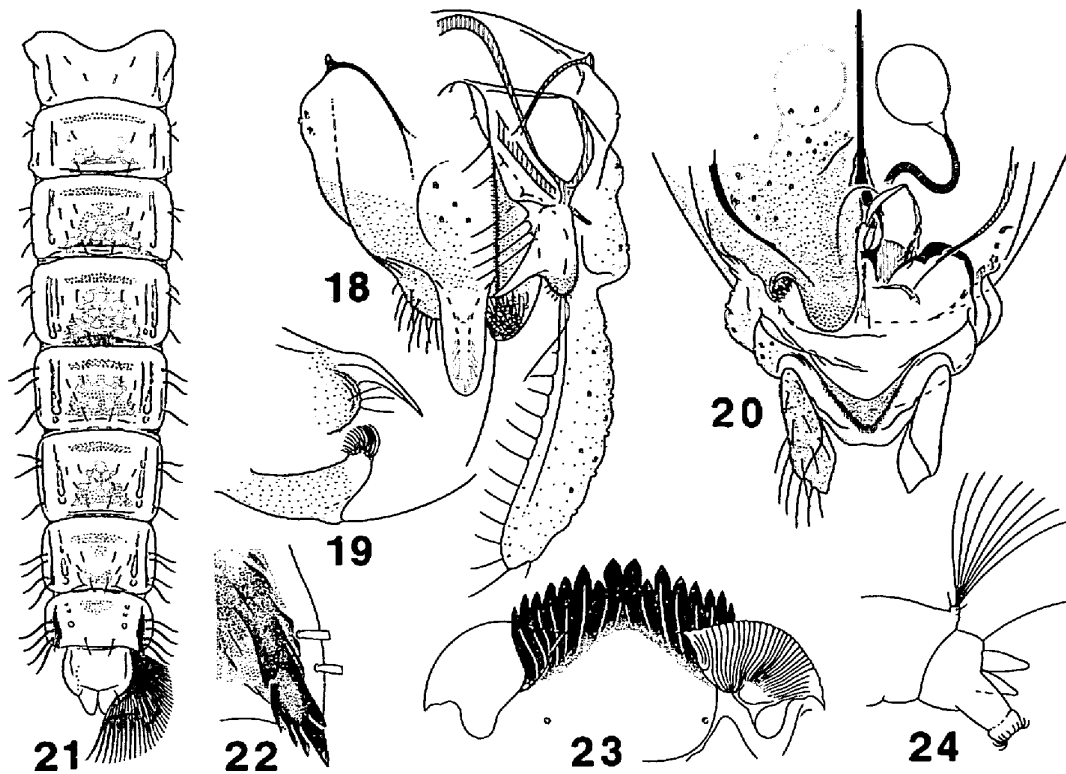
Head: Temporals 11–15 in number. Frontal tubercles absent. Antennal ratio 1.78–2.05. Clypeus with 13–21 setae. First to 5th palpal segment lengths in Table 1.

Thorax: Anteprenotum rather reduced, not visible from above. Scutum with 13–23 acrostichals, and 11–19 dorsocentrals in a row. Prealar callus with 4–6 setae in a row. Scutellum with 12–19 setae in multiserial row.

Wing: Membrane unmarked. Vein  $R_{2+3}$  almost in contact with  $R_1$ ;  $R_{4+5}$  ending a little before the wing apex; fCu distinctly beyond r–m, venarum ratio 1.20–1.27. Squama with 9–15 setae.

Legs: Foretibia with an apically rounded scale. Bristle ratio 2.3–3.3 in foreleg, 4.6–6.6 in mid-leg, 5.4–7.1 in hind leg. Pulvilli well developed. Lengths of leg segments and leg ratios in Table 5.

Hypopygium (Figs. 18–19): Tergite IX rounded posteriorly with a broad anal point. Superior volsella strongly projected posteriorly; basal portion pu-



Figs. 18–24. *Polypedilum paraviceps* sp. nov. — 18–20, Adult: 18, male hypopygium (dorsal view); 19, apex of abdominal tergite IX with anal point and inferior volsella in male hypopygium (lateral view); 20, female genitalia (ventral view). — 21–22, Pupa: 21, abdomen (dorsal view); 22, caudolateral spur of abdominal segment VIII. — 23–24, Larva: 23, mentum; 24, posterior body segments.

bescent apically, and bearing 2–4 long basal setae and a long apical seta; inner process well developed and 1.0–1.3 times as long as the average width of basal portion. Inferior volsella not swelling laterally, but ventrally bearing a large subapical tubercle, from which one long seta extends caudad; recurved setae 20–27 in number, relatively short and located on distal  $1/5$ – $1/4$  of the volsella.

*Female.* Body length 2.3–2.7 mm. Wing length 1.7–2.2 mm.

Coloration similar to that of male.

Head: Antennal ratio 0.44–0.50; first to 5th flagellomere lengths in Table 3.

Structures of thorax, wings and legs similar to those of male.

Genitalia (Fig. 20): Gonapophysis VIII divided into large dorsomesal lobe and small brush-like ventrolateral lobe. Notum 130–150  $\mu\text{m}$  long. Seminal capsules oval, 70–85  $\mu\text{m}$  long, 45–60  $\mu\text{m}$  wide, and with a triangular neck region. Postgenital plate rounded at apex.

*Pupa.* Body length 3.0–4.2 mm.

Cephalothorax: Frontal apotome smooth with frontal setae; frontal warts and tubercles absent. Thorax with weak dorsal reticulation.

Table 5. Lengths of leg segments and leg ratios in the male of *P. paraviceps* sp. nov.

	Coxa	Trochanter	Femur	Tibia	Tarsomere 1
Forelegs	150–195 (176)	120–150 (132)	740–880 (798)	500–620 (552)	850–1050 (948)
Mid-legs	220–300 (264)	95–110 (103)	825–1000 (890)	690–830 (754)	395–500 (439)
Hind legs	230–280 (246)	90–120 (103)	835–1005 (903)	755–940 (838)	550–710 (618)
	Tarsomere 2	Tarsomere 3	Tarsomere 4	Tarsomere 5	Leg ratio
Forelegs	660–820 (718)	430–520 (471)	345–415 (373)	150–200 (174)	1.66–1.82 (1.72)
Mid-legs	230–290 (255)	165–215 (188)	105–145 (124)	65–80 (74)	0.56–0.60 (0.58)
Hind legs	310–385 (339)	270–340 (293)	165–210 (184)	90–100 (93)	0.71–0.76 (0.74)

Measurements in  $\mu\text{m}$ ; means in parentheses. Data based on 15 specimens.

Abdomen (Fig. 21): Shagreen absent on tergites I and IX, somewhat strong median and posterior on II, more or less strong and extensive on III–VI, weak median and posterior on VII, weak anterior on VIII. Sternite I with weak anterior shagreen. Tergite II with a row of 34–45 posterior hooklets. Transverse rows of anterior spines present on tergites II–VII, but sometimes indistinct on VII, on which spines are smaller. Conjunctive III/IV with or without lateral patch of spinules, IV/V always with transverse rows of spinules. Pedes spurii A absent. Segment II–VI with 3 L-setae, VII–VIII with 4 L-setae on each side; L-seta short and simple on II–IV, long and lamelliform on V–VIII. Segment VIII with caudo-lateral spurs, which are composed of one large spine and several smaller spines (Fig. 22). Anal lobe with a fringe of 50–64 lamelliform setae.

*Fourth instar.* Body length 4.9–5.3 mm. Head capsule length 330–375  $\mu\text{m}$ .

Head: Antennal ratio 1.45–1.66; lengths of antennal segments in Table 4. Antennal segment I with a ring organ near basal tip; blade extending to the apex of segment IV, 30–38  $\mu\text{m}$  long; accessory blade 8–10  $\mu\text{m}$  long. Lauterborn organ 3–5  $\mu\text{m}$  long, style 5–8  $\mu\text{m}$  long on antennal segment II. Mentum (Fig. 23) with 8 pairs of teeth, of which 2nd median pair are smaller than 3rd.

Body (Fig. 24): Anal setae 8 in number. Four anal tubules well developed and subequal in length.

*Type materials.* Holotype: Male, emerged in the laboratory on 20. VIII. 1989 from a larva collected at the Stream Opisagawa in Hisanohama, Iwaki, Fukushima Pref., 14. VIII. 1989, and slide-mounted in Canada Balsam with associated pupal and larval exuviae. Paratypes: 6 ♂♂, 7 ♀♀, 13 pupae (including 12 exuviae), 7 larvae (including 5 exuviae), same data as the holotype (adults emerged on 20. VIII.–1. IX. 1989); 3 ♂♂, same locality as the holotype, 15. III. 1990; 4 ♂♂, 1 ♀, 3 pupal exuviae, 1 larval exuvium, a tributary stream of the Naka River in Bato, Tochigi Pref., 24. VIII. 1991 (adults emerged in the laboratory on 27. VIII.–10. IX. 1991).

*Distribution.* Asia: Japan (Fukushima, Tochigi and Kyoto Prefs.).

*Remarks.* *Polypedilum paraviceps* is most closely related to *P. aviceps*, but separated from the latter by the well-developed inner process and posterior lobe in the superior volsella, and the large ventral tubercle on the inferior volsella. Also *P. obtusum* is somewhat similar to *P. paraviceps*, but differs from the latter in the shape of the inferior volsella, which is swollen outwards at the subapical portion, but has no tubercle in the ventral portion (TOWNES, 1945; DILLON, personal communication).

The species reported under the name of *aviceps* from Kyoto (SASA, 1989 b) may be this new species, since the two species mostly agree in morphological features, including the shapes of both the superior and inferior volsellae in dorsal view, as well as the shape of the posterior portion of the abdominal tergite IX including the anal point.

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