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Three New Species of Chironomidae (Diptera) from Korea

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적 요

1977년부터 1978년에 걸쳐 전국 여러 곳에서 채집되어 액침 보존되어 온 갈따구 성충 표본의 일부를 동정한 결과 3신종을 발견하였으므로 *Pentapedilum parasordens* n. sp.(파라솔덴오각갈따구), *Microsectra koreana* n. sp. (한소장부갈따구)와 *Rheotanytarsus gayaensis* n. sp.(가야유장부갈따구)라고 각각 명명하고 기재 보고한다.

Key words: taxonomy, Chironomidae, new species, Korea.

INTRODUCTION

As part of the taxonomic studies on Korean Chironomidae, the alcohol-preserved adult specimens which had been collected either by light traps or sweeping at various localities during the period of 1977-1978 were slide-mounted with phenol balsom for permanent preparation and identified by observing external morphological characters. Three new species were confirmed and named *Pentapedilum parasordens* n. sp.,

This paper is dedicated to Professor Hoon Soo Kim on the occasion of his 70th birthday.

Micropsectra koreana n. sp. and *Rheotanytarsus gayaensis* n. sp. They were fully described with illustrations. The length of the wing was measured from tip to arculus and represents the size of the body. Terminology followed Seather (1980) and methodology followed Ree and Kim (1981).

DESCRIPTION

***Pentapedilum parasordens* n. sp.** (파라솔덴오각깔따구) (Fig. 1)

Material examined. Holotype: 1 ♂ (R-S-762, slide-mounted), Ubnai-ri, Muju-myon, Muju-gun, Chollabug-do, 3 June 1978 (H.I. Ree). Paratypes: 1 ♂ 3 ♀♀, same data as holotype; 1 ♂, Beobju Temple, Naisogri-myon, Boun-gun, Chungcheongbug-do, 2 October 1978 (H.I. Ree); 3 ♂♂, Haiin Temple, Gaya-myon, Geochang-gun, Kyongsangnam-do, 3 October 1978 (H.I. Ree).

Diagnosis. Rather small, brown species (Wing length 1.6mm in male, 2.0mm in female). Gonostylus long, large and somewhat clavate form, with 3 long inter-lateral setae. Superior volsella with a long outer-lateral seta bearing at 2/5 from tip. LR 1.6. AR 0.7.

Description. Male (n=6, 1 holotype and 5 paratypes). HEAD: Brown in ground color. Eye dark, bare, with well developed dorsal projection. Frontal tubercle absent. Temporal setae 9-10 each side in a single row. Antenna with 13 flagellomeres; pedicel brown, flagella pale brown; AR 0.70 ± 0.08 . Clypeus with 11 setae on middle. Maxillary palp with 4 palpomeres: 38 ± 5 , 88 ± 7 , 105 ± 12 , $152 \pm 32 \mu\text{m}$ (1 : 2.3 : 2.8 : 4.0). THORAX: Brown in ground color. Anterpronotum brown, reduced, not reaching up to front margin of scutum. Scutum dark brown; central and lateral vittae absent, with 12-14 acrostichals, 11-12 dorsocentrals and 4 prealars. Scutellum dark brown with 14 setae in irregular rows. Postnotum dark brown. Halter pale. WING (Fig. 1A): Length 1.57 ± 0.09 mm. Most of wing surface covered with macrotrichiae. Veins and arculus pale. Veins R, R₁ and R₄₊₅ with setae. Costa not produced. RM oblique, not pigmented. R₂₊₃ ending very near to R₁. R₄₊₅ well beyond tip of M₃₊₄, ending above tip of M₁₊₂. FCu well beyond RM. V_f well developed, reaching to 3/4 of M₃₊₄. An not reaching to FCu. Alula not developed. Squama with 8-9 setae. LEGS: All segments uniformly pale brown. Front tibia with a short, pale spur; mid and hind tibial combs separated, one with a long spur and the other unarmed. Pulvilli moderate. LR of fore, mid and hind legs : 1.77 ± 0.04 , 0.54 ± 0.01 , 0.74 ± 0.03 . Relative length of leg segments as in Table 1. ABDOMEN: Uniformly light brown. HYPOPYGIUM (Fig. 1B): Tergite smoothly rounded distally, with 8-10 central setae in disc. Anal point long, narrow, parallel-sided. Gonostylus large, expanded distally, abruptly rounded at tip, clavate formed, with 3 very long (71 - 82 μm) inter-lateral bristles, and a short apical seta. Superior volsella hooked apically with a long (104 μm), outer-lateral seta at about 2/5 from tip. Inferior volsella longer than gonocoxite, with one long apical seta (110 μm) and 10-11 recurved setae.

Female (n=3). General characters same as in male, except usual sexual differences. Wing length 2.0 ± 0.7 mm. Antenna with 5 flagellomeres: 119 ± 11 , 76 ± 5 , 86 ± 7 , 67 ± 3 , $172 \pm 6 \mu\text{m}$; 1st - 4th flagella light brown and 5th flagellum dark brown. Maxillary palp with 4 palpomeres: 44 ± 1 , 127 ± 13 , 135 ± 10 , $226 \pm 14 \mu\text{m}$ (1 : 2.9 : 3.1 : 5.1). LR of fore, mid and hind legs: 1.8 ± 0.04 , 0.5 ± 0.01 , 0.7 ± 0.03 . Relative length of leg segments as in Table 1.

Remarks. This species is similar to *Pentapedilum sordens* van der Wulp, but differs in several characters. According to the illustration of Pinder (1978) and the description of Tokunaga (1938), gonostylus of *P. sordens* is rather short in length and almost straight inter-laterally, with 5-6 rather short setae, whereas

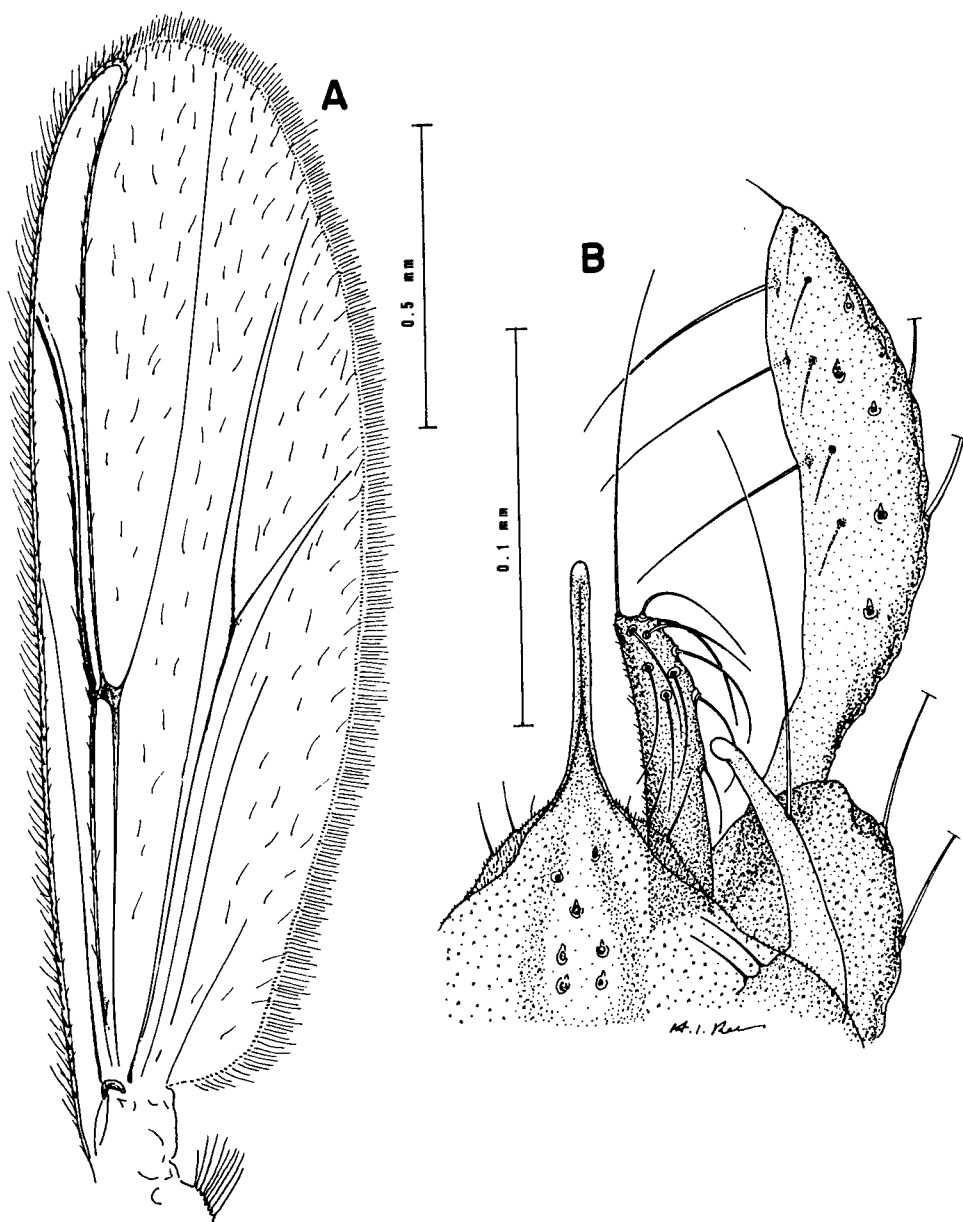


Fig. 1. Male of *Pentapedilum parasordens* sp. nov.

A, wing; B, hypopygium.

in this species gonostylus is longer and larger, showing a clavate form, with 3 very long inter-lateral setae. Superior volsella of *P. sordens* has an outer-lateral seta at about $2/3$ from tip, whereas that of *P. parasordens* has seta at $2/5$ from tip. Leg ratio (LR) of the former species is 1.2 (Edwards, 1929; Tokunaga, 1938), whereas the latter one is 1.6. The present new species is also similar to *Pentapedilum uncinatum* (refer the description and the illustration of Ree and Kim, 1988), but differs in shape of gonostylus, number of lateral setae of gonostylus and location of a lateral seta of superior volsella.

Table 1. Measurements (in μm) of leg segments of *Pentapedilum parasordens* n. sp.

Sex	Segment	Fore leg		Mid leg		Hind leg	
Male	Femur	648 ± 43	(638-702)	737 ± 59	(659-795)	790 ± 43	(727-836)
	Tibia	477 ± 20	(448-491)	634 ± 42	(577-692)	711 ± 51	(645-778)
	Tarsus I	782 ± 45	(750-813)	319 ± 19	(297-341)	463 ± 55	(386-517)
	Tarsus II	550 ± 11	(542-558)	232 ± 12	(213-246)	301 ± 14	(287-319)
	Tarsus III	376 ± 4	(373-378)	174 ± 16	(153-191)	260 ± 13	(243-272)
	Tarsus IV	283 ± 6	(279-287)	111 ± 9	(102-124)	160 ± 14	(147-172)
	Tarsus V	136 ± 2	(134-137)	70 ± 5	(66-78)	84 ± 5	(79-88)
	Leg Ratio	1.6 ± 0.1	(1.54-1.70)	0.5 ± 0.02	(0.48-0.53)	0.7 ± 0.1	(0.57-0.72)
Female	Femur	806 ± 34	(785-845)	897 ± 23	(877-922)	953 ± 51	(900-1002)
	Tibia	560 ± 43	(530-609)	779 ± 43	(750-829)	872 ± 60	(836-941)
	Tarsus I	989 ± 55	(957-1053)	421 ± 25	(405-450)	643 ± 9	(638-654)
	Tarsus II	710 ± 50	(670-766)	254 ± 18	(236-271)	332 ± 22	(319-357)
	Tarsus III	489 ± 35	(469-530)	185 ± 9	(179-195)	179 ± 19	(160-179)
	Tarsus IV	397 ± 19	(383-418)	102 ± 6	(96-108)	97 ± 5	(93-102)
	Tarsus V	158 ± 12	(150-172)	67 ± 3	(64-70)		
	Leg Ratio	1.8 ± 0.04	(1.7-1.8)	0.5 ± 0.01	(0.54-0.55)	0.7 ± 0.03	(0.7-0.76)

Average ± S.D. (Min.-Max.); n = male 6, female 3.

***Micropsectra koreana* n. sp.** (한소장부갈따구)

(Fig. 2)

Material examined. Holotype: 1 ♂ (R-S-761, slide-mounted), Ubnai-ri, Muju-myon, Muju-gun, Chollabug-do, 3 June 1978 (H. I. Ree). Paratypes: 4 ♂♂ 2 ♀♀, Mt. Soyo, Pocheon-gun, Gyonggi-do, 12 October 1977 (H. I. Ree); 2♂♂, Ichon-dong, Yongsan-gu, Seoul, 24 May 1978 (H. I. Ree); 1 ♂, same data as holotype.

Diagnosis. Small, greenish pale species; wing length 2.0mm in male, 1.8mm in female. LR 1.6. AR 1.2. Gonostylus long, slightly arched inter-laterally, with tapered apex. Superior volsella round, with long digitus, extending beyond superior volsella. Median volsella moderately long, with spoon shaped setae only distally.

Description. Male (n = 8, 1 holotype and 7 paratypes). HEAD: Brown in ground color. Eye black, with dorsomedial projection. Frontal tubercles absent. Antenna with 13 flagellomeres; pedicel brown, flagella dark brown; AR 1.23 ± 0.07 . Temporal setae 11 each side in a single row. Clypeus rectangular, with 14 setae. Maxillary palp pale dark brown, with 4 palpomeres: 55 ± 11 , 162 ± 29 , 147 ± 26 , $249 \pm 50 \mu\text{m}$ (1 : 2.9 : 2.7 : 4.5). THORAX (Fig. 2D): Pale brownish in ground color. Anteprenotum light brown, with lobes widely separated; anteprenotals absent. Scutum with well separated dark brown vittae, margin of which inconspicuous; scutal tubercle absent; 12 uniserial acrostichals, 11 uniserial dorsocentrals and 3 prealars. Scutellum pale, with 11 uniserial scutellars. Postnotum dark brown. Halter pale, with 10-13 setae near apex. WING (Fig. 2A): Length $2.0 \pm 0.2\text{mm}$. Membrane finely punctate, almost completely covered with macrotrichiae, especially in distal 1/2. Costa not produced, ending somewhat proximal to apex of M_{1+2} .

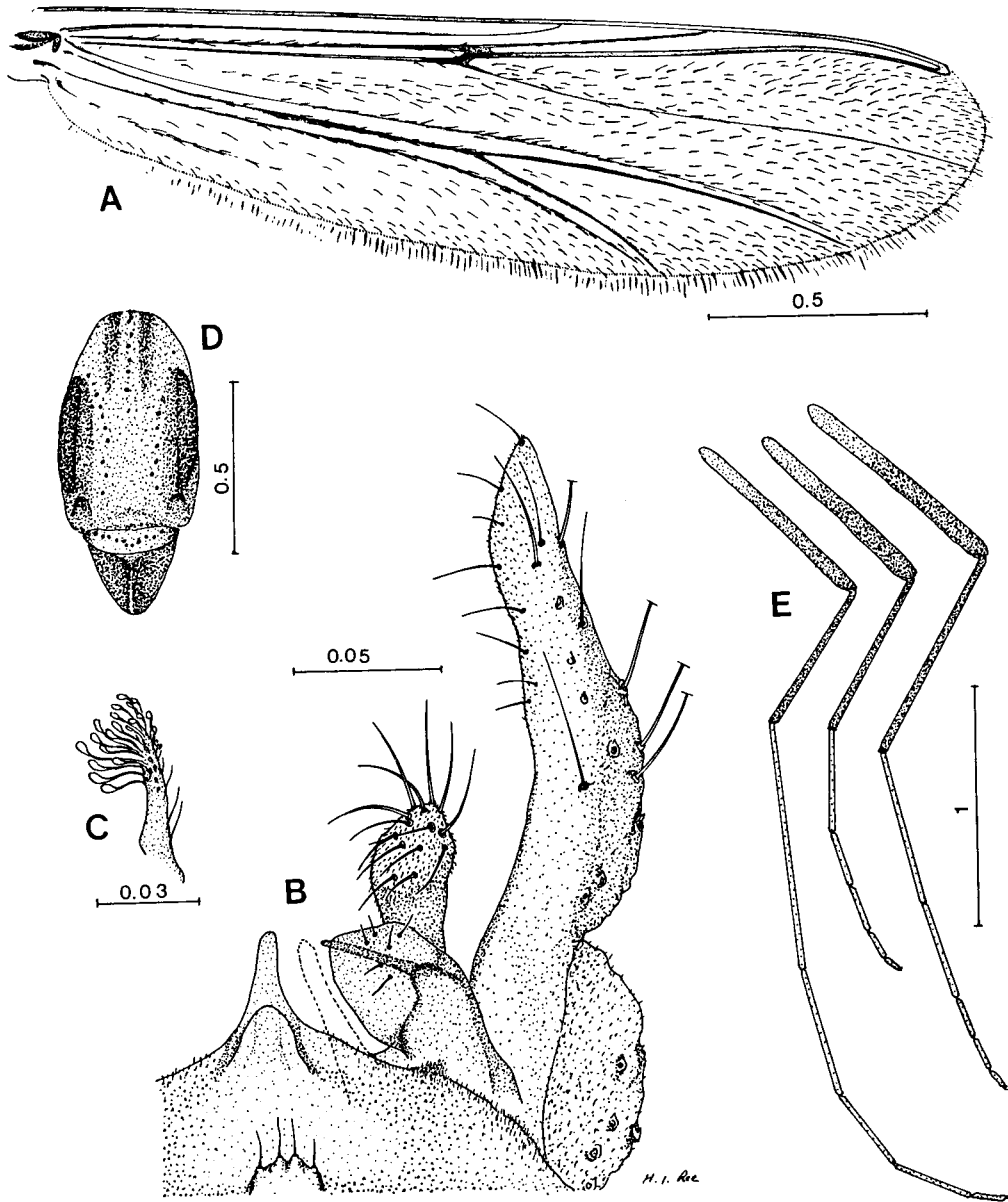


Fig. 2. Male of *Micropsectra koreana* sp. nov.

A, wing; B, hypopygium; C, median volsella; D, thorax (dorsal view); E, front, mid and hind legs, from left. Scale: mm.

R_{2+3} indistinct. RM almost parallel to wing axis, not pigmented. FCu slightly beyond RM. Cu_1 almost straight. Vannal fold well developed, ending near apex of M_{3+4} . An poorly developed. Anal lobe not developed. Squama bare. LEGS (Fig.2E): Femurs pale brown, proximal 1/3 paler. Tibiae light brown. Tarsal segments pale. Apex of fore tibia, with short spur. Combs of mid and hind tibiae contiguous without spurs. Pulvilli poorly developed. LR of fore, mid and hind legs : 1.63 ± 0.10 , 0.58 ± 0.04 , 0.75 ± 0.02 . Relative length of leg

segments as in Table 2. ABDOMEN: Uniformly yellowish green. HYPOPYGIUM (Fig. 2B): Anal point rather long (much longer than broad), parallel-sided, with smoothly rounded point. Gonostylus long, slightly arching inter-laterally, with tapered apex. Superior volsella round form, with 6 short setae dorsally; digitus slender, long (32 μm), extending beyond superior volsella. Median volsella (Fig. 2C) moderately long (37-40 μm), extending to tip of anal point, with spoon shaped setae distally only. Inferior volsella long, swollen distally, with 14-16 recurved setae.

Female (n = 2). General characters same as in male, except usual sexual differences and smaller in size than male. Wing length 1.8 ± 0.1 mm. Antenna light brown, with 5 flagellomeres: 98 ± 3 , 75 ± 7 , 83 ± 3 , 73 ± 7 , 102 ± 8 μm . LR of fore, mid and hind legs: 1.70 ± 0.01 , 0.55 ± 0.02 , 0.69 ± 0.01 . Relative length of leg segments as in table 2.

Remarks. The genera *Micropsectra* and *Paratanytarsus* resemble each other and most of the characters are identical. According to Cranston *et al.* (19^{cr}), the tibial combs bear spurs in *Paratanytarsus*, whereas in *Micropsectra* spurs are almost always absent (rarely one comb may possess a spur), and anal point of hypopygium in *Paratanytarsus* is short and broad, whereas in *Micropsectra* anal point is long, tapering to point or parallel-sided. Frontal tubercles in *Paratanytarsus* is always present, whereas in *Micropsectra* frontal tubercles minute (occasionally absent). A male specimen of this species had been sent to Dr. F. Reiss of Zoologische Staatssammlung Munchen, who identified this species as *Paratanytarsus* sp. However, after further examination, the author decided to place it in genus *Micropsectra*, because in this new species tibial combs of the mid and hind legs have no spur, the anal point is long and parallel-sided and frontal

Table 2. Measurements (in μm) of leg segments of *Micropsectra koreana* n. sp.

Sex	Segment	Fore leg		Mid leg		Hind leg	
Male	Femur	991 \pm 129	(798-1094)	991 \pm 127	(762-1081)	1107 \pm 172	(868-1210)
	Tibia	702 \pm 105	(526-778)	800 \pm 92	(638-861)	1022 \pm 143	(766-1101)
	Tarsus I	1076 \pm 107	(906-1276)	463 \pm 67	(431-504)	761 \pm 109	(571-849)
	Tarsus II	587 \pm 83	(504-670)	272 \pm 36	(207-300)	473 \pm 72	(345-520)
	Tarsus III	433 \pm 70	(364-504)	215 \pm 25	(172-239)	361 \pm 45	(278-396)
	Tarsus IV	332 \pm 52	(287-389)	132 \pm 18	(105-153)	217 \pm 25	(182-246)
	Tarsus V	173 \pm 32	(150-195)	95 \pm 12	(77-108)	123 \pm 20	(86-140)
	Leg Ratio	1.63 \pm 0.10	(1.53-1.72)	0.58 \pm 0.04	(0.51-0.62)	0.75 \pm 0.02	(0.73-0.78)
Female	Femur	957	(922-992)	868	(842-893)	965	(922-1008)
	Tibia	638	(590-686)	723	(699-746)	890	(845-935)
	Tarsus I	1084	(1000-1168)	394	(367-421)	614	(590-638)
	Tarsus II	566	(520-612)	238	(207-268)	397	(392-402)
	Tarsus III	419	(400-437)	179	(162-195)	287	(255-319)
	Tarsus IV	321	(310-332)	110	(99-121)	172	(156-188)
	Tarsus V	155	(150-160)	81	(73-89)	106	(99-112)
	Leg Ratio	1.70	(1.69-1.70)	0.55	(0.53-0.56)	0.69	(0.68-0.70)

Average \pm S.D. (Min.-Max.); n = male 6, female 2. As the numbers of females are so small that standard deviation is not calculated.

tubercles are absent, all of which are diagnostic characteristics of *Micropsectra*. This species is similar to *M. bidentata* (Goetghebuer) found in Europe and *M. tamaprima* Sasa reported in Japan, but differs them in several diagnostic characters. According to Goetghebuer(1928) and Pinder(1978), *bidentata* is larger species(wing length 2.5mm or longer), with longer median volsella and a pair of small tubercles on posterior margin of ninth tergite. *M. tamaprima* collected in Tama River, Japan and described by Sasa(1980) is a very small species, wing length of which is 1.64-1.67mm long, a pair of small triangular tubercles on anterior margin of ninth tergite is present, and median volsella is long(55 μ m), whereas this species is larger in body size(wing length 2.0 ± 0.2 mm), with shorter median volsella(37-40 μ m), and no tubercle on ninth tergite.

***Rheotanytarsus gayaensis* n. sp.** (가야유장부갈따구)

(Fig. 3)

Material examined. Holotype: 1♂, (R-S-2117, slide-mounted), Haiin Temple, Hapcheon-gun,

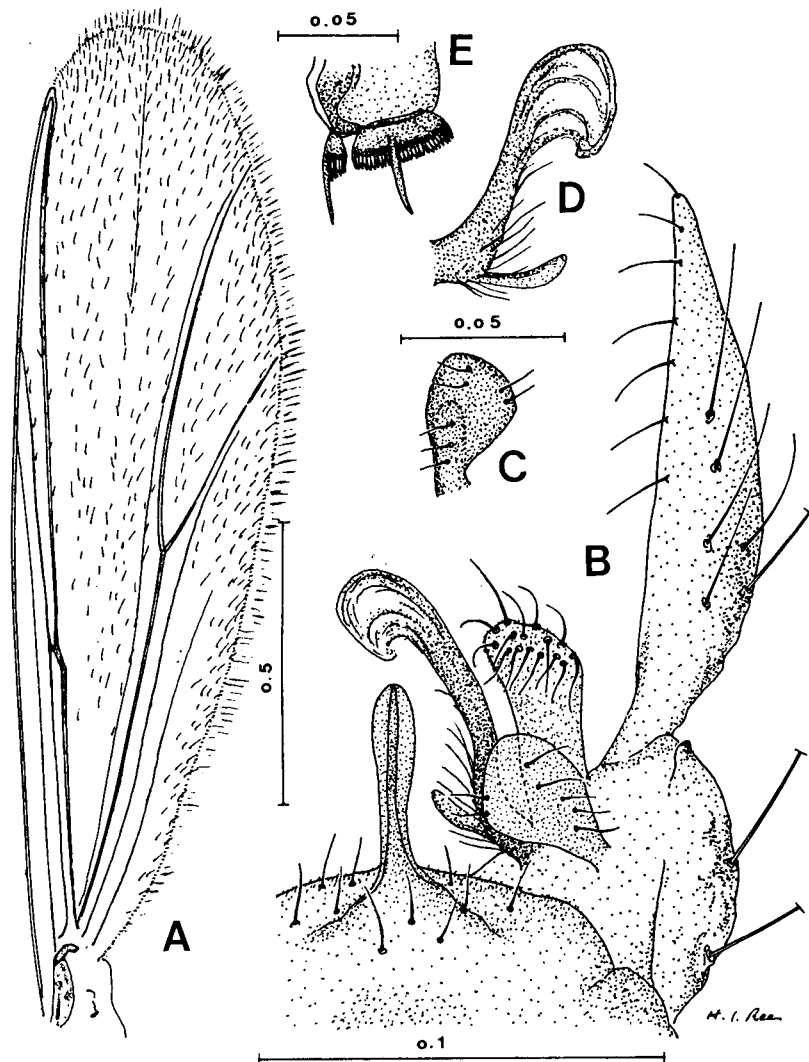


Fig. 3. Male of *Rheotanytarsus gayaensis* sp. nov.

A, wing; B, hypopygium; C, superior volsella; D, median volsella; E, comb scale of hind leg. Scale: mm.

Kyongsangnam-do, 3 October 1978 (H. I. Ree). Paratype: 73 ♂♂, 6 ♀♀, collection data same as holotype.

Diagnosis. Small light green species. Wing length of male 1.6mm and of female 1.7mm. Gonostylus gradually tapered in distal 1/3. Superior volsella roughly oval, with 2 inter-lateral setae and 5 uniserial, dorsal setae; digitus absent. Median volsella well developed (much longer than inferior volsella), with apical lamelliform setae fused to form plate-like structure and with basal, smaller lamelliform setae fused to form finger-like structure.

Description. Male (n = 10, 1 holotype and 9 paratypes). **HEAD:** Yellowish brown in ground color. Eye black and bare, with strong dorsomedial projection. Frontal tubercle absent. Temporal setae 8-10 each side in a single row. Antenna with 13 flagellomeres; AR 0.90 ± 0.03 (0.85-0.95). Clypeus rectangular, with 18-20 setae. Maxillary palp with 4 palpomeres: 39 ± 3 , 106 ± 6 , 112 ± 5 , 198 ± 10 μm (1: 2.6 : 2.9 : 5.1). **THORAX:** Ground color uniformly yellowish brown. Antep pronotum with lobes widely separated; antep notals absent. Scutum without vittae; 18-20 biserial acrostichals, 8-9 uniserial dorsocentrals, supraalars absent and prealars absent. Scutellum yellowish brown, with 7-8 scutellars, rather irregularly arranged. Halter pale. **WING** (Fig. 3A): Length 1.63 ± 0.04 (1.59-1.68) mm. Membrane densely covered with macrotrichiae, especially in distal 1/2. Cost not produced. R_{4+5} lying close to R_1 . R_{2+3} absent. RM almost parallel to wing axis, not pigmented, and well proximal to FCu. R_{4+5} well beyond tip of M_{3+4} . Vannal fold well developed. Anal lobe not developed. Squama bare. Aculus dark brown. **LEGS:** Uniformly light green. LR of fore, mid and hind legs: 2.14 ± 0.07 , 0.61 ± 0.01 , 0.69 ± 0.01 . Apex of fore tibia with short, pale, slender spur. Mid and hind tibiae with well separate combs, each with spur (Fig. 3E). Pulvilli absent. Relative length of leg segments as in Table 3. **ABDOMEN:** Uniformly light green. **HYPOPYGIUM** (Fig. 3B-D): Anal point rather

Table 3. Measurements (in μm) of leg segments of *Rheotanytarsus gayaensis* n. sp.

Sex	Segment	Fore leg	Mid leg	Hind leg
Male	Femur	815 \pm 28 (773-860)	811 \pm 29 (765-848)	891 \pm 33 (838-937)
	Tibia	437 \pm 18 (415-457)	608 \pm 17 (584-632)	763 \pm 23 (732-797)
	Tarsus I	935 \pm 40 (877-999)	371 \pm 13 (353-388)	529 \pm 13 (516-551)
	Tarsus II	501 \pm 19 (481-525)	193 \pm 8 (177-206)	313 \pm 13 (306-332)
	Tarsus III	374 \pm 15 (364-405)	151 \pm 5 (144-157)	273 \pm 10 (262-292)
	Tarsus IV	292 \pm 13 (278-306)	98 \pm 4 (94-104)	173 \pm 5 (164-179)
	Tarsus V	135 \pm 4 (131-139)	77 \pm 3 (75-81)	105 \pm 5 (101-110)
	Leg Ratio	2.14 ± 0.07 (2.04-2.27)	0.61 ± 0.01 (0.58-0.63)	0.69 ± 0.01 (0.67-0.71)
Female	Femur	780 \pm 31 (737-809)	764 \pm 29 (754-800)	826 \pm 17 (801-848)
	Tibia	420 \pm 14 (402-435)	588 \pm 32 (545-621)	744 \pm 47 (678-794)
	Tarsus I	914 \pm 44 (863-961)	342 \pm 15 (326-347)	477 \pm 20 (447-497)
	Tarsus II	476 \pm 28 (430-507)	179 \pm 6 (173-188)	282 \pm 19 (263-309)
	Tarsus III	363 \pm 14 (347-377)	129 \pm 7 (118-135)	238 \pm 10 (224-251)
	Tarsus IV	289 \pm 17 (268-313)	84 \pm 5 (77-89)	147 \pm 13 (133-165)
	Tarsus V	126 \pm 7 (123-136)	72 \pm 5 (64-75)	96 \pm 10 (86-112)
	Leg Ratio	2.18 ± 0.04 (2.15-2.23)	0.58 ± 0.02 (0.54-0.60)	0.63 ± 0.02 (0.63-0.66)

Average \pm S.D. (Min.-Max.); n = male 10, female 5.

long, slightly expanded distally. Gonostylus narrowed in apical 1/3, inter-lateral margin almost straight, outer margin gradually tapered, with 5-6 inter-lateral setae and one apical setae. Superior volsella (Fig. 3C) roughly oval, inter-lateral margin slightly more produced, with 2 setae inter-laterally and 5 uniserial setae dorsally; digitus absent. Inferior volsella well developed, extending well beyond of gonocoxite, somewhat expanded at apex with recurved setae. Median volsella (Fig. 3D) well developed, much longer than inferior volsella, apically with lamelliform setae fused to form plate-like structure, and basally with smaller lamelliform setae fused at tip to form somewhat finger-like structure.

Female (n=6). General characters same as in male, except usual sexual differences. Wing length 1.68 ± 0.09 (1.55-1.82) mm. Antenna with 5 flagelomeres: 101 ± 5 , 63 ± 5 , 72 ± 5 , 66 ± 4 , 78 ± 7 μm . Length of 4 palpomeres of maxillary palp: 37 ± 3 , 104 ± 11 , 113 ± 9 , 203 ± 11 m (1 : 2.8 : 3.1 : 5.5). LR of fore, mid and hind legs: 2.18 ± 0.04 , 0.58 ± 0.02 , 0.63 ± 0.02 . Measurements of leg segments as in Table 3.

Remarks. This species is very similar to *Rheotanytarsus photophilus* Goetghebuer. In *photophilus* the tip of gonostylus is curved downwards, almost hooked, and LR is 1.75 (Edwards, 1929; Coe, 1950), whereas in *gayaensis* gonostylus is not abruptly tapered, nor curved downwards, and LR is 2.1. In the key and the illustration of Pinder (1978), diagnostic characteristics of *photophilus* are: thorax brown, scutal vittae and postnotum dark brown, and posterior margin of superior volsella produced into a distinct 'beak', whereas in *gayaensis* thorax including postnotum is uniformly yellowish light green without vittae, and superior volsella is not beak-like. Also this new species has a unique median volsella, basally with small lamelliform setae which are fused at tip to form a somewhat finger-like structure in addition to larger, apical lamelliform setae.

ABSTRACT

Among alcohol preserved adult specimens of non-biting midges (Chironomidae, Diptera) which were collected at various localities in 1977-1978, three new species are identified and named *Pentapedilum parasordens* n. sp., *Micropsectra koreana* n. sp. and *Rheotanytarsus gayaensis* n. sp., which are fully described with illustrations.

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REFERENCES

- Coe, R. L., 1950. Family Chironomidae. Handbk Ident. Br. Insects, **9**: 121-207.
- Cranston, P. S., M. E. Dillon, L. C. V. Pinder and F. Reiss, 1989. The adult males of Chironomidae (Diptera: Chironomidae) of the Holarctic region — Keys and diagnosis. In: Wiederholm, T. (Ed.): The adult males of Chironomidae of the Holarctic region — Keys and diagnosis. Ent. Scand. Suppl., **34**: 353-502.
- Edwards, F. W., 1929. British non-biting midges (Diptera, Chironomidae). Trans. R. ent. Soc. Lond., **77**: 279-430.

- Goetghebuer, M., 1928. Dipteres(Nematoceres) III. Chironomidae. Faune Fr., **18**: 1-174 (in French).
- Pinder, L. S. V., 1978. A key to adult males of British Chironomidae. Freshwater Biol. Ass. Sci. Pub., **37**: 1-159.
- Ree, H. I. and H. S. Kim, 1981. Studies on chironomidae(Diptera) in Korea. Taxonomid study on adults of chironomidae. Proc. Coll. Nat. Sci., SNU, **6**(1):123-226.
- Ree, H. I. and M. S. Kim, 1988. Studies on Korean Chironomidae (Diptera) III. Description of two unrecorded species from Korea and three new species. Korean J. Syst. Zool., Special Issue **2**: 13-24.
- Sasa, M., 1980. Studies on the chironomid midges of the Tama River Part 2. Description of 20 species of chironomidae recovered from a tributary. Res. Rep. Nat. Inst. Env. Stud. No. **13**:9-107.
- Seather, O. A., 1980. A glossary of chironomid morphology and terminology(Diptera : Chironomidae). Ent. Scand. (Suppl.), **14**:1-51.
- Tokunaga, M., 1938. Chironomidae from Japan (Diptera). 10 New or little-known midges, with descriptions of the metamorphoses of several species. Philippine J. Sci., **65**(4): 314-383.

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