Three new species of *Simulium* (Wallacellum) (Diptera: Simuliidae) from the Philippines

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**Abstract:** Three new black fly species, *Simulium* (Wallacellum) marilogenense sp. nov., *S.* (*W.*) tenederoi sp. nov. and *S.* (*W.*) amplum sp. nov., are described based on reared adult, pupal and/or larval specimens collected from the Philippines. The male of *S.* (*W.*) ogonukii Takaoka is described for the first time.

Key words: black fly, *Simulium*, *Wallacellum*, Philippines, new species

The subgenus *Wallacellum* Takaoka, one of the small subgenera in the genus *Simulium* Latreille, is known to have an insular distribution (Takaoka, 1983, 2003). It is now represented by 11 species recorded from the Philippines (Takaoka, 1983, 2006) and one species from both Yonakuni Island, the Ryukyu Islands, Japan (Takaoka, 1972) and Lanyu Island, Taiwan (Chung, 1986), and two species from Indonesia (Takaoka, 2003). Recent surveys of various localities of the Philippines have revealed three more new species of the subgenus *Wallacellum*, which are described in this paper. In addition, the male of *S.* (*W.*) ogonukii Takaoka, which has remained unknown, is described for the first time.

The terms for morphological features used here follow those of Takaoka (2003). Holotype and paratype specimens of the new species are deposited at the Department of Infectious Disease Control, Faculty of Medicine, Oita University, Oita, Japan.

*Simulium* (Wallacellum) marilogenense sp. nov.

**DESCRIPTION. Female.** Body length 2.6 mm.

**Head.** Width as wide as thorax. Frons dark brown, not shiny, densely covered with whitish-yellow scale-like recumbent hairs interspersed with several dark brown simple longer hairs on each side; frontal ratio 1.43: 1.00 : 1.42; frons-head ratio 1.00 : 3.74. Fronto-ocular area (Fig. 1A) moderately developed, directed laterally. Clypeus dark brown, not shiny, densely covered with whitish-yellow scale-like recumbent hairs interspersed with several dark brown longer simple hairs along lateral margins and near lower margin. Labrum 0.83 times as long as clypeus. Antenna composed of scape, pedicel and 9 flagellomeres, yellow except base of 1st flagellomere reddish-brown and apical 4 flagellomeres light brown. Maxillary palp (Fig. 1B) composed of 5 segments, medium brown to brownish-black, proportional lengths of 3rd, 4th and 5th segments 1.00 : 0.70 : 1.13; 3rd segment (Fig. 1C) greatly enlarged; sensory vesicle elongated, 0.58 times as long as 3rd segment, with medium-sized opening medially. Labella with 9 or 10 inner and 12 or 13 outer teeth. Mandible with 19-22 inner teeth and lacking outer ones. Cibarium simple, without any tubercles. **Thorax.** Scutum dark brown, appearing to have faint darker mediolongitudinal vitta, slightly shiny at certain angle of light, densely covered with whitish-yellow scale-like recumbent short hairs interspersed with dark brown similar short hairs and few dark brown...
upright simple hairs on prescutellar area. Scutellum light brown, with dark brown simple upright long hairs as well as whitish-yellow scale-like short hairs. Postnotum medium brown, slightly shiny and thinly whitish pruinose at certain angle of light, and bare. Pleural membrane densely covered with whitish-yellow fine hairs interspersed with 4 or 5 dark brown hairs. Katepisternum longer than deep, medium brown, shiny at certain angle of light, densely covered with dark brown short hairs intermixed with whitish-yellow fine short hairs. **Legs.** Foreleg: coxa, trochanter and femur medium brown with apical cap of femur dark brown; tibia dark brown with base narrowly paler, and median large area of outer surface medium brown; tarsus dark brown, with dorsal crest of short hairs moderately developed on segments 1–3; basitarsus slightly dilated, 7.53 times as long as its greatest width. Midleg: coxa medium brown except posterolateral surface dark brown; trochanter light brown though basal 1/2 or little more of anterior surface paler; femur light to medium brown, with 2 pale broad basal bands (1 basally and 1 subapically); tibia dark brown except base narrowly paler, and with pale narrow subbasal band on outer surface (medial portion widely pale on inner surface); tarsus entirely dark brown. Hind leg: coxa medium brown; trochanter whitish-yellow except anterior surface light brown; femur light brown except apical cap dark brown; tibia (Fig. 1D) dark brown except base paler, and with pale broad submedial band (though pale portion much wider on inner surface); tibia (Fig. 1E) gradually widened toward apical 1/3, then slightly narrowed toward apex, with narrowly-constricted low process on anteromedial surface along shaft extending from base to little less than basal 1/2; this process covered with numerous small spear-shaped spinous scales (Fig. 1F), elaborately arranged on its surface; basitarsus (Fig. 1G) dark brown except submedial wide area yellowish-white; other tarsal segments light brown except basal 1/2 of 2nd tarsomere yellowish-white; basitarsus (Fig. 1G) slender, nearly parallel-sided, 6.09 times as long as wide, 0.67 times as wide as greatest width of tibia (hind femur depressed, then its greatest width not measured for comparison); saw-like anterior margin of basitarsus curved inward before reaching basal apex; basitarsus furnished with numerous slender hairs all over but 1 spine on outer surface (though there are numerous spines in cluster near base on inner surface); calcipala (Fig. 1G) greatly enlarged, extending to apex of 2nd tarsal segment, and nearly as wide as apical portion of basitarsus; pedisulus (Fig. 1G) well developed at basal 1/3 of 2nd tarsomere. All femora, tibiae and parts of tarsus covered with scale-like hairs as well as usual simple hairs on outer surface. All claws (Fig. 1H) with large basal tooth 0.56 times as long as claw. **Wing.** Length 2.3 mm. Costa with dark spinules and dark short hairs except subbasal portion with yellowish-white hairs; subcosta with dark brown hairs except near apex bare; basal portion of radial vein fully covered with dark brown hairs, rest of radial vein with dark brown hairs and dark spinules; hair tuft at base of radial vein dark brown; basal cell absent; humeral and r-m cross veins dark-spotted. **Abdomen.** Basal scale light brown, with fringe of whitish-yellow hairs; dorsal surface of abdomen light to dark brown, not shiny, and densely covered with whitish-yellow and dark brown scale-like recumbent hairs interspersed with dark brown simple hairs on posterior segments; ventral surface of segment 7 with large sternite medially. **Genitalia.** Sternite 8 (Fig. 1I) bare medially, covered with many short and medium-long hairs interspersed with several long stout hairs on each side. Ovipositor valve (Fig. 1I) triangular, rounded posteromedially, thin, membranous, densely covered with microsetae interspersed with 8–11 short setae; inner margins slightly sinuous, narrowly sclerotized except apical portion. Genital fork in ventral view (Fig. 1J) inverted-Y-shaped; each arm slender, with moderately-sclerotized distinct projection directed anteriorly and short triangular lobe directed posteromedially; genital fork in lateral view (Fig. 1K) S-shaped, with median portion greatly curved dorsally. Paraproct in ventral view (Fig. 1L) slightly longer than wide, covered with many simple hairs on ventral and lateral surface, and with 4 sensilla on anteromedial surface; paraproct in lateral view (Fig. 1M) moderately protruding ventrally beyond ventral margin of cercus, 1.52 times as wide as long. Cercus in ventral view (Fig. 1L) much shorter than paraproct; cercus in lateral view (Fig. 1M) rounded posteriorly, short (0.37 times as long as wide, and 0.35 times as long as paraproct), and moderately covered with
simple hairs. Spermatheca (collapsed), appearing to be nearly globular, well sclerotized except small area at its juncture with main duct unsclerotized, with reticulate surface patterns, and without internal setae; both accessory ducts slender, subequal in diameter to major
duct.

**Male.** Body length 2.6–3.0 mm. **Head.** Much wider than thorax. Holoptic. Upper eye consisting of large facets in 13 vertical columns and in 13 or 14 horizontal rows. Clypeus brownish-black, not shiny, moderately covered with dark brown simple medium-long and long hairs interspersed with few yellow simple short hairs. Antenna composed of scape, pedicel and 9 flagellomeres, yellow except basal 1/2 or little less of 1st flagellomere dark brown; 1st flagellomere elongated, twice as long as 2nd one. Maxillary palp medium brown to brownish-black, with 5 segments, proportional lengths of 3rd, 4th, and 5th segments 1.00 : 0.83 : 1.24; 3rd segment in lateral view (Fig. 2A) tapered form middle to apex and in front view (Fig. 2B) of moderate size, with sensory vesicle nearly globular, 0.17 times as long as 3rd segment, with small opening. **Thorax.** Scutum medium to dark brown, with 1 slightly darker medial longitudinal vitta, slightly shiny at certain angle of light, moderately covered with yellow scale-like recumbent short hairs intermixed with dark similar hairs anteriorly and laterally, and with few dark brown upright simple hairs on prescutellar area. Scutellum light brown, with dark brown upright simple hairs as well as yellow scale-like short hairs. Postnotum medium brown, slightly shiny and thinly whitish pruinose at certain angle of light, and bare. Pleural membrane moderately covered with whitish-yellow fine hairs and 0–4 dark brown hairs. Katepisternum longer than deep, medium to dark brown, shiny and thinly whitish pruinose at certain angle of light, densely covered with dark brown short hairs intermixed with pale fine short hairs. **Legs.** Color and shape (except claws) nearly as in female including hind basitarsus with 1 spine on outer surface. Fore basitarsus slightly dilated, 8.38 times as long as its greatest width. Hind basitarsus 5.50 times as long as wide, 0.70 and 0.60 times as wide as greatest widths of tibia and femur, respectively. **Wing.** Length 2.1 mm; other characters as in female except subcosta bare. **Abdomen.** Basal scale medium brown, with fringe of yellow long hairs; dorsal surface of abdomen medium brown to brownish-black, densely covered with golden-yellow scale-like recumbent hairs intermixed with dark brown recumbent and upright simple hairs; tergite 2 with pair of shiny dorsolateral areas, and tergites 3–7 each appearing to have pair of very slightly shiny dorsolateral or lateral areas at certain angle of light. **Genitalia.** Coxite in ventral view (Fig. 2C) subquadrate, 1.81 times as long as wide; coxite in medial view (Fig. 2D) somewhat flattened dorsoventrally. Style in ventral view (Fig. 2C) slender, directed dorsally and inwardly, with 1 apical spine; style in medial view (Fig. 2D) nearly parallel-sided, gently curved inwardly, 0.77 times as long as coxite; style in ventrolateral view (Fig. 2E) gradually narrowed toward apex. Ventrall plate in ventral view (Fig. 2C) transverse, wider than long, densely covered with microsetae on ventral surface except small areas along anterior and lateral margins bare, with anterior margin almost transparent medially and ill-defined though appearing produced anteriorly, both lateral margins gently rounded posteroventrally, and posterior margin nearly straight; basal arms short and slender, directed slightly outwardly, then forward; ventral plate in lateral view (Fig. 2F) with ventral margin nearly straight and arm short and stout; ventral plate in end view (Fig. 2G) with medial portion moderately produced ventrally, and densely covered with microsetae on posterior surface except both lateral areas bare; Median sclerite (Fig. 2C, F, H) arising slightly posterior to middle of anterior margin of ventral plate, thin, broad and rounded apically. Paramere (Fig. 2I) slender, well sclerotized, with 5 long stout hooks. Aedeagal membrane (Fig. 2J) densely covered with spinous setae on ventromedial surface but moderately with slender microsetae on posterior, posterodorsal and lateral surface, and moderately sclerotized along dorsal margin forming wide dorsal plate. Abdominal segment 10 (Fig. 2K) on each side with 1 or 2 distinct hairs on ventral surface and 1–3 distinct hairs on lateral surface. Cercus (Fig. 2K, L) small, not produced, encircled with 11 or 12 short hairs.

**Pupa.** Body length (excluding gill filaments) about 3.0 mm. **Head.** Integument light ochrous, bare (without any tubercle); frons with 2 pairs of simple very long trichomes with uncoiled apices (Fig. 3A); face with pair of simple very long trichomes with uncoiled apices (Fig. 3A); antennal sheath without any protuberances or tubercles (Fig. 3B). **Thorax.** Integument ochrous, almost bare or very sparsely covered with tubercles on anterior 1/2 and moderately covered with tubercles on
Fig. 2. Male of *Simulium* (Wallacellum) *marilogense* sp. nov. A and B, 3rd segments of maxillary palp with sensory vesicle (shown in dotted line in Fig. 2A) (right side; A, lateral view; B, front view); C, coxites, styles, ventral plate and median sclerite *in situ* (ventral view); D, coxite and style *in situ* (right side; medial view); E, style (right side; ventrolateral view); F, ventral plate and median sclerite *in situ* (lateral view); G, ventral plate (end view); H, median sclerite (anterior view); I, paramere (right side; dorsal view); J, aedeagal membrane and dorsal plate (right half; end view); K and L, 10th abdominal segments and cerci (left half; K, lateral view; L, end view). Scale bars. 0.02 mm for A–L.

posterior 1/2; thorax on each side with 2 simple very long mediodorsal trichomes with coiled or uncoiled apices (Fig. 3C) (additional simple long or bifid medium-long trichome in 1 female pupa, Fig. 3D), 2 simple anterolateral trichomes (1 very long, 1 medium-long) (Fig. 3E), 1 simple or bifid medium-long posterolateral trichomes with uncoiled apex (Fig. 3F) and 3 simple medium-long ventrolateral trichomes with uncoiled apices in 1 male pupa (Fig. 3G) or 1 simple or bifid medium-long, 1 simple short, 1 very short ventrolateral trichomes in 1 female pupa (Fig. 3H). Gill (Fig. 3I) composed of 4 thread-like filaments arranged in outer and inner pairs arising from very short common basal stalk; outer pair almost sessile or with very short stalk, inner pair with very short stalk; upper filament of inner pair first
Fig. 3. Pupa of Simulium (Wallacellum) marilogenae sp. nov. A, frons and upper portion of face with 2 frontal trichomes and 1 facial trichome in situ (left half; front view); B, antennal sheath (left side; outer view); C-H, thoracic trichomes (C and D, mediodorsal; E, anterolateral; F, posterolateral; G and H, ventrolateral); I, gill filaments with anterior part of thorax (left side; lateral view); J, short hair-like seta on dorsal surface of abdominal segment 1; K, very short hair-like and spinous setae on dorsal surface of abdominal segment 2; L, terminal hooks (dorsal view); M and N, cocoons (M, dorsal view; N, lateral view). Scale bars. 1.0 mm for M and N; 0.1 mm for I; 0.05 mm for A and B; 0.02 mm for C-H, J, K and L.

directed dorsomedially, then roundly bent forward, lower filament of inner pair directed forward, upper filament of outer pair slightly directed outward and forward, then forward, lower filament of outer pair slightly directed anteroventrally, then forwardly; all filaments medium to dark brown, subequal in length (1.5–2.0 mm long) and thickness, with well-
defined annular ridges and furrows on their surface, and covered with minute tubercles of various sizes, relatively larger ones on ridges and smaller ones on interridge spaces. Abdo-
men. Dorsally, segment 1 weakly sclerotized, light brown, without tubercles, with 1 simple slender medium-long seta (Fig. 3J) on each side; segment 2 weakly sclerotized and light brown on basal 1/2, without tubercles, with 6 medium brown stout needle-like short spines and 1 simple slender short seta (Fig. 3K) along poste-
orior border on each side; segments 3 and 4 nearly transparent, each with 4 hooked spines directed forward and 1 simple spinous short seta on each side; segments 5–8 transparent, with few simple short setae; segments 6–9 each densely covered with comb-like groups of minute spines directed posteriorly along ante-
orior margin (though minute spines on segment 6 less distinct and not so densely distributed); segment 9 weakly sclerotized, yellowish, with pair of distinct conical terminal hooks directed posteriorly (Fig. 3L). Ventrally, segment 3 transparent, with few simple short setae; segment 4 transparent, with 1 bifid hook (slightly smaller than those on segments 5–7) (usually accompanied by 1 simple hook developed to varying extent) and few simple short setae sub-
medially on each side; segment 5 transparent, with pair of bifid hooks and few simple short setae on each side; segments 6 and 7 transparent, each with 1 bifid inner hook and devoid of outer hook and few simple short setae on each side; segment 8 almost transparent, with few minute setae; segments 3–8 each with comb-
like groups of minute spines directed post-
eriorly on each side; segment 9 without grapnel-like hooklets ventrolaterally. Cocoon (Fig. 3M, N). Shoe shaped, loosely woven with small open interspaces, and extending ventrolaterally; individual threads visible; floor present on posterior 1/2; 4.5 mm long by 2.2 mm wide.

Mature larva. Body length 5.1–5.7 mm. Body (Fig. 4A, B) normal in shape, somewhat swollen on thoracic segments, narrow on ab-
dominal segments 1–4 (though slightly becom-
ing larger posteriorly), swollen from segment 5 to segment 6, and narrowed toward posterior end; body light to dark gray except ventral surface of abdominal segments 3–10 and dorsal and lateral surface of anterior 1/2 of thoracic segment 1 white, and dorsal and lateral surface of intersegmental areas between thoracic seg-
ment 3 and abdominal segment 4 white or whitish-gray; thorax with pair of reddish-
brown speckles overlaid dorsolaterally and laterally on somewhat darker gray annular band of segment 1, and pair of similar colored narrow speckles laterally on segments 2 and 3; abdomen with pair of reddish-brown speckles overlaid dorsolaterally and laterally on light gray area of segments 1–6 and 9, pair of similar colored speckles dorsolaterally on each of seg-
ments 7 and 8, similar colored area dorsally on anterior 1/2 of segment 10, though colored speckle on each side of segment 5 broken into 2 (1 dorsolateral and 1 lateral) and those on dorsolateral surface of segments 6–9 usually fused tandem to one another, those on dorsolateral surface of segment 9 also fused dorsomedially to each other near posterior margin. Head capsule (Fig. 4C–E) yellowish-
white to yellow though posterior margin of cephalic apomote somewhat darkened and areas in front of posterior margin of lateral and ventral surface slightly to moderately darkened to varying extent; all head spots well-
definite, medium brown; eyebrow weakly defined, slightly darkened. Cervical sclerite composed of 2 small narrow rod-like pieces, not fused to occiput, widely separated medially from each other. Antenna composed of 3 seg-
ments and apical sensillum, longer than stem of labral fan; proportional lengths of 3 seg-
ments from base to tip 1.00 : 1.06 : 0.94. Labral fan with 36 main rays; dorsalmost ray (Fig. 4F) with pectination different from that of other main rays (Fig. 4G). Mandible (Fig. 4H) with comb-teeth decreasing in size from 1st to 3rd; mandibular serrations composed of 2 teeth (1 large, 1 small); large tooth at right angle to mandible on apical side; supernumerary serra-
tions absent. Hypostoma (Fig. 4I) with 9 apical teeth in row; median tooth slightly longer than each corner tooth; median tooth of 3 intermediate teeth on each side shortest; lateral margin serrate; 7 or 8 hypostomal bristles per side, their sockets slightly diverging posteriorly from lateral margin. Postgenal cleft (Fig. 4E) hanging-bell shaped, with narrow ante-
romedian extension, 2.2 times as long as post-
genal bridge. Thoracic cuticle bare. Abdomi-
nal cuticle almost bare except each side of anal sclerite of last segment moderately covered with simple colorless setae. Rectal scales pre-
ent. Rectal organ simple, each of 3 lobes with-
out secondary lobules. Anal sclerite X-shaped,
Fig. 4. Mature larva of *Simulium* (*Wallacelum*) *marilogense* sp. nov. A and B, mature larvae showing characteristic color markings (A, dorsal view; B, lateral view); C-E, head capsules (C, dorsal view; D, lateral view; E, ventral view); F, dorsalmost main ray of labral fan; G, usual main ray of labral fan (medial portion); H, mandible; I, hypostoma. Scale bars. 0.5 mm for A and B; 0.1 mm for C-E; 0.02 mm for F, G and I; 0.01 mm for H.

with anterior arms somewhat broadened, and nearly as long as posterior ones; basal juncture with narrow deep unsclerotized median incision posteriorly; no sensilla on basal juncture and behind posterior arms; accessory sclerite absent. Last abdominal segment expanded ventrolaterally forming large ventrolateral bulge and smaller ventral bulge on each side,
latter visible as small ventral papilla when viewed from side; ventrolateral bulge moderately covered with minute colorless setae. Posterior cerclet with 113 rows of up to 19 hooklets per row.

**TYPE SPECIMENS.** Holotype female with associated pupal exuviae and cocoon (in ethanol), reared from a pupa, collected from a small stream (width 1–2 m, shallow, bottom rocky and sandy, water temperature 19°C, shaded, altitude 1,000–1,040 m) moderately flowing in a natural forest, at Epol Waterfalls, Marilog, Davao City, Mindanao, Philippines, 27. II. 2008, by H. Takaoka and V. Tenedero. Para-types: 2 males, and 2 mature larvae, same data as those of holotype.

**ECOLOGICAL NOTES.** The pupae and larvae of this new species were collected from fallen tree leaves in a small stream together with *S. (Gomphostilbia) apoense* Takaoka, *S. (G.) mindanaense* Takaoka and *S. (G.) salazarae* Takaoka.

**ETYMOLOGY.** The species name *marilogense* refers to the name of the locality, Marilog, where this new species was collected.

**REMARKS.** This new species appears to be closely related to *S. (W.) ogonukii* Takaoka from Mindanao Island (Takaoka, 1983) and *S. (W.) molawinense* Takaoka from Luzon Island (Takaoka, 2006) in having the shoe-shaped cocoon (Fig. 3M, N). However, *S. (W.) marilogense* sp. nov. is easily distinguished from *S. (W.) ogonukii* by the pupal antennal sheath without saw-like spines (Fig. 3B), and from *S. (W.) molawinense* by the pupal gill filaments with distinct annular ridges and furrows and the ventral plate which has no cavities on its posterior margin (Fig. 2C).

**Simulium (Wallacellum) ogonukii**

Takaoka


This species was originally described from female, pupal and larval specimens collected from Davao, Mindanao Island, the Philippines (Takaoka, 1983). The male of this species is here described on the basis of a single male reared from a pupa which was reliably identified by the key (Takaoka, 1983). The color patterns of the scutum and legs of the male are very similar to those of the female of this species originally described (Takaoka, 1983).

**DESCRIPTION. Male.** Body length 3.0 mm. **Head.** Much wider than thorax. Holoptic. Upper eye consisting of large facets in 13 vertical columns and in 13 or 14 horizontal rows. Clypeus brownish-black, not shiny, moderately covered with dark brown simple medium-long and long hairs interspersed with few yellow short hairs. Antenna composed of scape, pedicel and 9 flagellomeres, yellow except basal 1/2 or little less of 1st flagellomere dark brown; 1st flagellomere elongated, twice as long as 2nd one. Maxillary palp medium brown to brownish-black, with 5 segments, proportional lengths of 3rd, 4th, and 5th segments 1.00 : 0.86 : 1.53; 3rd segment in lateral view (Fig. 5A) somewhat enlarged; 3rd segment in front view (Fig. 5B) with ellipsoidal sensory vesicle 0.26 times as long as 3rd segment and having small opening. **Thorax.** Scutum medium brown except narrow area along each lateral margin, and prescutellar area dark brown, with 3 dark brown longitudinal vittae (1 medial, 2 submedial), of which all connected to dark brown prescutellar area and 2 submedial vittae much widened near anterior margin and also before reaching dark brown prescutellar area; scutum slightly shiny when illuminated at certain angle of light, densely covered with golden-yellow scale-like recumbent short hairs intermixed with dark similar hairs anteriorly, and with few dark brown upright simple hairs on prescutellar area. Scutellum medium brown, with dark brown simple upright long hairs as well as golden-yellow scale-like short hairs. Postnotum medium brown, slightly shiny and thinly whitish pruinose when illuminated at certain angle of light, and bare. Pleural membrane moderately covered with whitish-yellow fine hairs and 0–2 dark brown hairs. Kate-
pisternum longer than deep, medium to dark brown, shiny and thinly whitish pruinose when illuminated at certain angle of light, densely covered with dark brown short hairs intermixed with pale fine short hairs. **Legs.** Color and shape (except claws) nearly as in female of *S. (W.) marilgense* sp. nov. (though left hind basitarsus without any spine on outer surface). Fore basitarsus slightly dilated, 8.56 times as long as its greatest width. Hind basitarsus 5.50 times as long as wide, 0.78 and 0.61 times as wide as greatest widths of tibia and femur, respectively. **Wing.** Length 2.4 mm; other characters as in female of *S. (W.) marilgense* sp. nov. except subcosta bare. **Abdomen.** Basal scale medium brown, with fringe of yellow long hairs; dorsal surface of abdomen medium brown to brownish-black, densely covered with golden-yellow scale-like recumbent hairs interspersed with dark brown simple hairs; tergites 2–7 each with pair of slightly shiny dorsolateral areas when illuminated at certain angle of light. **Genitalia.** Coxite in ventral view (Fig. 5C) subquadrate, 1.88 times as long as wide; coxite in medial view (Fig. 5D) somewhat flattened dorsoventrally. Style in medial view (Fig. 5D) slender, 0.77 times as long as coxite, nearly parallel-sided, gently curved inwardly, with 1 apical spine; style in ventrolateral view (Fig. 5E) gradually narrowed toward apex. Ventral plate in ventral view (Fig. 5C) transverse, rounded posteriorly, wider than long, densely covered with microsetae on ventral surface.

**Fig. 5.** Male of *Simulium (Wallacellum) ogonukii* Takaoka. A and B, 3rd segments of maxillary palp with sensory vesicle (shown in dotted line in Fig. 5A) (right side; A, lateral view; B, front view); C, coxites, styles, ventral plate and median sclerite in situ (ventral view); D, coxite and style in situ (right side; medial view); E, style (right side; ventrolateral view); F, ventral plate and median sclerite in situ (lateral view); G, ventral plate (end view). Scale bars. 0.02 mm for A–G.
except small anterolateral portions bare, with anterior margin concave except central portion produced anteriorly, and with basal arms short and slender, directed forward; ventral plate in lateral view (Fig. 5F) with ventral margin nearly straight, with short and stout arm; ventral plate in end view (Fig. 5G) moderately rounded ventrally, and densely covered with microsetae on posterior surface except most of both lateral areas bare; Median sclerite nearly as in S. (W.) marilogenae sp. nov. except its base arising slightly in front of anterior tip of ventral surface of ventral plate (Fig. 5C). Paramere with 5 long stout parameral hooks as in S. (W.) marilogenae sp. nov. Aedeagal membrane as in S. (W.) marilogenae sp. nov. Ventral surface of 10th segment with 3–5 distinct hairs on ventral surface and 1 or 2 distinct hairs on lateral surface on each side. Cercus small, encircled with 12–14 hairs.

SPECIMEN EXAMINED. 1 male (with associated pupal exuviae and cocoon) reared from a pupa, collected from a grass trail in water of a moderately-flowing small stream (width 1–3 m, shallow, bottom stony, water temperature 19°C, shaded, altitude 1,360 m), at Mainit, Kapatagan, Pigos, Davao del Sur, Mindanao, Philippines, 26. II. 2008, by H. Takaoka and V. Tenedero.

**Simulium (Wallacelum) tenederoi** sp. nov.

*Simulium (Wallacelum)* sp.: Takaoka and Tenedero, 2008: 11–12.

DESCRIPTION. Female. Body length 3.1–3.6 mm. **Head.** Nearly as wide as thorax. Frons brownish-black, not shiny, densely covered with white scale-like recumbent short hairs interspersed with dark simple longer hairs; frontal ratio 1.37–1.46: 1.00: 1.43–1.50; frons-head ratio 1.00: 3.90–4.26. Fronto-ocular area (Fig. 6A) moderately developed, narrowed laterally. Clypeus brownish-black, not shiny, densely covered with white scale-like recumbent short hairs interspersed with dark simple longer hairs except narrow area along upper margin bare. Labrum 0.73 times as long as clypeus. Antenna composed of scape, pedicel and 9 flagellomeres, light brown except scape, pedicel and few basal flagellomeres yellow to ochrous. Maxillary palp composed of 5 segments, medium brown to brownish-black, proportional lengths of 3rd, 4th, and 5th segments 1.00: 0.73: 1.21–1.26; 3rd segment in frontal view (Fig. 6B) slender, with ellipsoidal sensory vesicle 0.22 times as long as 3rd segment, with medium-sized or large opening; 3rd segment in lateral view (Fig. 6C) somewhat enlarged. Lacinia with 8 or 9 inner and 8–10 outer teeth. Mandible with 14–16 inner teeth and lacking outer ones. Cibarium simple, without any tubercles. **Thorax.** Scutum light to medium brown except each shoulder, narrow area along each lateral margin, and prescutellar area dark brown, with 3 faint to distinct darker longitudinal vittae (1 medial, 2 submedial), all connected posteriorly to dark brown prescutellar area and 2 submedial vittae each connected anteriorly to dark brown triangular spot on each shoulder, not shiny or very slightly shiny when illuminated at certain angle of light, densely covered with whitish-yellow scale-like recumbent short hairs interspersed with dark brown recumbent short hairs anteriorly and posteriorly, and few dark upright long hairs on prescutellar area. Scutellum light brown, with dark brown simple upright long hairs as well as whitish-yellow scale-like short hairs. Postnotum medium brown, not shiny and bare. Pleural membrane densely covered with whitish-yellow fine hairs interspersed with several dark brown hairs. Katepisternum longer than deep, light to medium brown, densely covered with dark brown short hairs. **Legs.** Foreleg: coxa, trochanter and femur medium brown with apical cap of femur dark brown; tibia dark brown with base very narrowly light brown; tarsus dark brown, with dorsal crest of short hairs moderately developed on segments 1–3; basitarsus slightly dilated, 7.08 times as long as its greatest width. Midleg: coxa dark brown; trochanter dark yellow to light brown; femur light brown with 2 pale broad bands (1 basally and 1 subapically), and apical cap medium brown; tibia dark brown with paler extreme base and narrow submedial band; tarsus medium to dark brown. Hind leg: coxa light to medium brown; trochanter pale yellow except lower surface light brown; femur light brown with apical cap dark brown; tibia dark brown with paler base and rather broad submedial band; tibia (Fig. 6D) widened from base.
Fig. 6. Female of *Simulium* (*Wallacellum*) *tonederoi* sp. nov. A, fronto-ocular area (right side); B and C, 3rd segments of maxillary palp with sensory vesicle (shown in dotted line in Fig. 6C) (left side; B, front view; C, lateral view); D, hind tibia showing a narrowly-constricted low process on its anteromedial surface (right side; inner view); E, hind tarsus showing calcipala and pedisulcus (left side; outer view); F, tarsal claw; G, 8th sternite and ovipositor valves *in situ* (ventral view); H, genital fork (ventral view); I and J, paraprocts and cerci (right side; I, ventral view; J, lateral view); K, spermatheca; L, spermatheca (slightly collapsed) with ducts showing abnormal branching of right accessory duct. Scale bars. 0.1 mm for D and E; 0.04 mm for A–C; 0.02 mm for G–L; 0.01 mm for F.
to basal 1/3, then nearly parallel-sided though slightly narrowed near apex, with narrowly-constricted low process on anteromedial surface along basal 3/5 of shaft; this process covered with numerous small spear-shaped spinous scales, elaborately arranged on its surface; tarsus (Fig. 6E) dark brown with medial large portion of basitarsus and basal 1/2 of 2nd segment grayish-white; basitarsus slender, nearly parallel-sided or very slightly widened from middle toward joint with 2nd segment, 5.44 times as long as its greatest width, 0.76 and 0.63 times as wide as greatest widths of tibia and femur, respectively; saw-like anterior margin of basitarsus curved inward before reaching basal apex; basitarsus furnished with numerous slender hairs all over but without any spine on outer surface (though numerous spines present near base on inside surface); calcipala (Fig. 6E) very greatly enlarged, extending beyond apex of 3rd tarsomere, and its base as wide as apical portion of basitarsus; pedisculus (Fig. 6E) well developed at basal 1/3 of 2nd tarsomere. All femora, tibiae and parts of tarsus covered with scale-like hairs as well as simple hairs on outer surface. All claws (Fig. 6F) with large basal tooth 0.48 times as long as claw. Wing. Length 2.5-2.6 mm. Other characters as in female of S. (W.) marilognese sp. nov.

**Abdomen.** Basal scale light to medium brown, with yellow hairs. Dorsal surface of abdomen medium to dark brown, not shiny, densely covered with yellow recumbent hairs except anterior 2/3 of segment 3 and most of segment 4 densely covered with dark brown recumbent short hairs, and also interspersed with dark simple hairs. Ventral surface of segment 7 with large dark sternal plate medially.

**Genitalia.** Sternite 8 (Fig. 6G) bare medially, covered with numerous short to long hairs on each side. Ovipositor valve (Fig. 6G) triangular, rounded posteromedially, thin, membranous though very weakly sclerotized along inner margin, very densely covered with microsetae interspersed with 5–7 short setae; inner margins slightly concave medially, lying close to each other; posterior portion irregularly folded dorsally probably due to anteriorly-elongated paraproct. Genital fork (Fig. 6H) inverted-Y shaped; each arm slender, with moderately-sclerotized large projection directed anterodorsally and very weakly sclerotized smaller projection directed medioposteriorly. Paraproct in ventral view (Fig. 6I) much longer than wide, widely pale on little less than anterior 1/2 except strongly sclerotized anterior margin, densely covered with microsetae except narrow portion along anterior margin bare, and covered also with many short to long hairs on little more than posterior 1/2; paraproct in lateral view (Fig. 6J) roundly produced anteroventrally, with bare sclerotized portion narrowly on outer surface along anterior margin; paraproct with 6 or 7 sensilla on anteromedial surface. Cercus in lateral view (Fig. 6J) rounded posteriorly, 0.46 times as long as wide, and moderately covered with dark simple hairs. Spermatheca (Fig. 6K) ovoid, well sclerotized except small area at its juncture with main duct unsclerotized, with reticulate surface pattern though weakly defined on posterior surface, and without internal setae; both accessory ducts slender, subequal in diameter to each other and to major duct; right accessory duct branched into 2 ducts in 1 female (Fig. 6L).

**Male.** Body length 3.1–3.5 mm. **Head.** Much wider than thorax. Holoptic. Upper eye consisting of large facets in 14 or 15 vertical columns and in 14 or 15 horizontal rows. Clypeus brownish-black, not shiny, moderately covered with dark simple long hairs interspersed with few pale shorter hairs. Antenna composed of scape, pedicel and 9 flagellomeres, yellow except basal 1/2 of 1st flagellomere dark brown; 1st flagellomere elongate, 1.84 times as long as 2nd one. Maxillary palp medium brown to brownish-black, with 5 segments, proportional lengths of 3rd, 4th, and 5th segments 1.00: 0.79: 1.29; 3rd segment in front view (Fig. 7A) slender, with ellipsoidal sensory vesicle 0.15–0.18 times as long as 3rd segment, with medium-sized opening; 3rd segment somewhat enlarged when viewed laterally (Fig. 7B). **Thorax.** Nearly as in female. **Legs.** Color and shape (except claw) nearly as in female except hind tibia (Fig. 7C) with narrowly-constricted low process on anteromedial surface along little less than basal 3/5 of shaft. Fore basitarsus slightly dilated, 7.82 times as long as its greatest width. Hind basitarsus (Fig. 7D) 5.46 times as long as wide, 0.76 and 0.60 times as wide as greatest widths of tibia and femur, respectively. Wing. Length 2.1–2.4 mm; other characters as in female except subcosta bare. **Abdomen.** Basal scale medium to dark brown, with fringe of yellow long hairs; dorsal surface of abdomen medium to dark brown,
not shiny, and densely covered with yellow scale-like recumbent short hairs intermixed with dark brown short hairs; ventral surface of abdomen light to medium brown, moderately covered with dark short hairs. **Genitalia.** Coxite in ventral view (Fig. 7E) subquadrate, 1.97 times as long as wide; coxite in medial view (Fig. 7F) flattened dorsoventrally. Style
in medial view (Fig. 7F) slender, 0.67 times as long as coxite, nearly parallel-sided, gently curved inwardly, with 1 apical spine; style in ventrolateral view (Fig. 7G) gradually narrowed toward apex. Ventral plate in ventral view (Fig. 7E) transverse, 2.19 times as wide as long, densely covered with microsetae on ventral surface except anterolateral portions bare,
with anterior margin slightly produced medially, posterior margin slightly rounded posteriorly; basal arms short and slender, directed forwardly, then slightly inwardly; ventral plate in lateral view (Fig. 7H) with posterior portion somewhat produced ventrally; ventral plate in end view (Fig. 7I) moderately rounded ventrally, and densely covered with microsetae on posterior surface except most of both lateral areas bare. Median sclerite (Fig. 7J) nearly as in S. (W.) marilogense sp. nov. Paramere with 6 long stout hooks. Aedeagal membrane and dorsal plate similar to those of S. (W.) marilogense sp. nov. except minute spinous setae not so prominent. Ventral surface of 10th segment (Fig. 7K, L) with 1–4 distinct hairs on ventral surface and no or 1 distinct hairs on lateral surface on each side. Cercus (Fig. 7K, L) small, encircled with 17–19 hairs.

**Pupa.** Body length (excluding gill filaments) 3.2–3.8 mm. **Head.** Integument (Fig. 8A) ocherous, bare except small area near base of facial trichome densely covered with small conical tubercles on each side: frons with 2 simple very long trichomes on each side; face with 1 simple or bifid very long trichome on each side; antennal sheath without any projections and tubercles. **Thorax.** Integument light ocherous to medium brown, widely bare except posterior 1/4 moderately covered with small conical tubercles on dorsal surface; thorax on each side with 2 simple or bifid long mediadorsal trichomes (Fig. 8B), 2 long anterolateral trichomes (1 simple, 1 bifid) (Fig. 8C), 1 simple or bifid medium-long posterolateral trichome (Fig. 8D), 3 simple medium-long trichomes (Fig. 8E). Gill (Fig. 8F) composed of 4 thread-like stout filaments arranged in dorsal and ventral pairs arising from very short common basal stalk; both pairs of filaments with very short stalks; upper filament of dorsal pair directed dorsally, then bent forward, other filaments directed forward though lower filament of ventral pair slightly directed anteroventrally, then forward; all filaments medium to dark brown, subequal in length (1.9–2.8 mm long, length varying by pupae) and thickness, with well-defined annular ridges and furrows on their surface, and covered with minute tubercles of various sizes, relatively larger ones on ridges and smaller ones on interridge spaces. **Abdomen.** Almost similar to that of S. (W.) marilogense sp. nov. except dorsal surface of segment 8 weakly sclerotized and light yellow, segments 5–8 moderately to densely covered with minute spines directed posteriorly on almost entire dorsal surface, and segment 9 moderately sclerotized, dark yellow, covered with comb-like groups of minute spines directed posteriorly on each dorsolateral surface and also sparsely covered with small tubercles on dorsal and dorsoposterior surface between terminal hooks (Fig. 8G). **Cocoon.** (Fig. 8H, I). Shoe shaped, loosely woven with relatively large open interspaces anteriorly, not extending ventrolaterally (all pupae collected were attached to slender substrates anteriorly, not extending ventrolaterally) even when they are woven on flat substrates like wide tree leaves fallen in the water; individual threads visible; floor present on posterior 1/2; 4.2–4.7 mm long by 1.5–1.8 mm wide.

**Mature larva.** Body length 7.0–7.7 mm. Body (Fig. 9A, B) normal in shape similar to that of S. (W.) marilogense sp. nov.; body light to dark gray except ventral surface of abdominal segments 3–9 almost entirely white, dorsal and lateral surface of thoracic segment 1 white narrowly along anterior margin, dorsal and lateral surface of intersegmental areas between thoracic segment 3 and abdominal segment 5 whitish-gray, and dorsal surface of segment 6–9 grayish-black; abdomen with characteristic reddish-brown markings: 2 pairs of speckles (1 lateral and 1 ventrolateral) on each of segments 1 and 2, 1 pair of lateral speckles on segment 3, 5 speckles (1 in form of transverse band dorsomedially near anterior margin, 2 in form of round spots dorsosubmedially on posterior 1/2, 2 in irregular forms dorsolaterally) on each of segments 4 and 5, 1 pair of small spots dorsosubmedially and 1 pair of large speckles dorsolaterally and laterally in form of number 7 when viewed laterally on segment 6, 2 pairs of small round spots (anterior pair black, posterior pair brownish-brown or black) dorsosubmedially and 1 pair of speckles dorsolaterally on segment 7, 1 pair of speckles dorsolaterally on each of segments 8–10 though those on segments 8 and 9 connected to each other; 1 pair of black large round spots laterally on each of segments 6 and 8 though black spot overlaid on reddish-brown area on each side of segment 6. Head capsule (Fig. 9C–E) whitish-yellow to yellow though posterior
Fig. 9. Mature larva of *Simulium (Wallacellum) tenederoi* sp. nov. A and B, mature larvae showing characteristic color markings (A, dorsal view; B, lateral view); C–E, head capsules (C, dorsal view; D, lateral view; E, ventral view); F, mandible; G, hypostoma; H, accessory sclerite (left side; lateral view). Scale bars. 1.0 mm for A and B; 0.1 mm for C–E; 0.02 mm for G; 0.01 mm for F and H.

Margin of cephalic apotome slightly darkened and area on each side of postgenal cleft of ventral surface slightly to moderately darkened; all head spots and eyebrow well-defined, medium brown. Cervical sclerite composed of 2 light brown small narrow rod-like pieces, not fused to occiput, widely separated medially from each other. Antenna composed of 3 segments and apical sensillum, longer than stem of labral fan; proportional lengths of 3 segments from base to tip 1.00:1.06:0.85. Labral fan with 56 main rays; dorsalmost ray having different pectination from that of other main rays, as in *S. (W.) mariogense* sp. nov. Mandible (Fig. 9F) with comb-teeth decreasing in size from 1st to 3rd; mandibular serrations
composed of 2 teeth (1 large, 1 small); large tooth at right angle to mandible on apical side; supernumerary serrations absent. Hypostoma (Fig. 9G) with 9 apical teeth in row; median tooth slightly longer than each corner tooth; median tooth of 3 intermediate teeth on each side shortest; lateral margin serrate; 8 or 9 hypostomal bristles per side, lying slightly divergent posteriorly from lateral margin. Postgenal cleft (Fig. 9E) hanging-bell shaped, with narrow anteromedian extension. 1.05 times as long as postgenal bridge; sub-esophageal ganglion well pigmented. Thoracic cuticle bare. Abdominal cuticle almost bare except each side of anal sclerite of last segment moderately covered with simple colorless setae. Rectal scales present. Rectal organ simple, each of 3 lobes without secondary lobules. Anal sclerite X-shaped, with anterior arms somewhat broadened, nearly as long as posterior ones; basal juncture with narrow deep unsclerotized median incision posteriorly; 5 sensilla on basal juncture and 1 sensillum behind posterior arms; accessory sclerite present in form of light brown irregularly-shaped plate on each lateral surface just in front of posterior circket (Fig. 9H). Last abdominal segment expanded ventrolaterally forming large ventrolateral bulge and smaller ventral bulge on each side, latter visible as small ventral papilla when viewed from side; ventrolateral bulge sparsely covered with minute colorless setae. Posterior circket with 152 rows of up to 21 hooklets per row.

TYPE SPECIMENS. Holotype female with associated pupal exuviae (in ethanol) reared from a pupa, collected from a small stream (width 0.2–0.5 m, bottom rocky, current slow to moderate, water temperature 25.0°C, exposed to sun, altitude 110–130 m) flowing down a grassy hill with coconut trees near the national road, Barangay Magsaysay, Western Samar Province, Samar, Philippines, 20. II. 2008, by H. Takaoka and V. Tenedero. Paratypes: 5 females, 5 males (with associated pupal exuviae and cocoons), and 1 mature larva, same data and date as those of the holotype.

ECOLOGICAL NOTES. The pupae and larva of this new species were collected from fine grass leaves, stalks and roots in a small stream, together with S. (G.) salazarae.

ETYMOLOGY. The species name *tenederoi* is in honor of Mr. Victor F. Tenedero, who has kindly assisted H. T. in the surveys carried out in the Philippines since 2005 and collected this new species in Samar.

REMARKS. This new species appears to be most closely related to *S. (W.) claveriaense* Takaoka and *S. (W.) makilingense* Takaoka described from Luzon Island (Takaoka, 1983, 2006), because of the similarities of the genitalia of both sexes. However, this new species is easily distinguished from these two known species by the shoe-shaped cocoon (Fig. 8H, I).

**Simulium (Wallacellum) amplum** sp. nov.

DESCRIPTION. Female. Body length 2.2 mm. **Head.** Width slightly narrower than thorax. Frons dark brown, not shiny, densely covered with whitish-yellow scale-like recurrent hairs interspersed with several dark brown simple longer hairs on each side; frontal ratio 1.29 : 1.00 : 1.50; frons-head ratio 1.00 : 3.97. Fronto-ocular area (Fig. 10A) moderately developed, directed laterally. Clypeus dark brown, not shiny, densely covered with whitish-yellow scale-like recurrent hairs interspersed with several dark brown longer simple hairs along lateral margins and near lower margin. Labrum 0.76 times as long as clypeus. Antenna composed of scape, pedicel and 9 flagellomeres, light brown except scape and pedicel whitish-yellow and basal 1/2 of 1st flagellomere somewhat darkened. Maxillary palp composed of 5 segments, light to medium brown, proportional lengths of 3rd, 4th and 5th segments 1.00 : 0.72 : 1.09; 3rd segment (Fig. 10B, C) slender in front view but somewhat enlarged in lateral view; sensory vesicle ellipsoidal, small, 0.25 times as long as 3rd segment, with large opening apically. Lacinia with 8 inner and 10 or 11 outer teeth. Mandible with 16 inner teeth and lacking outer ones.
Cibarium simple, without any tubercles. **Thorax.** Scutum orange-yellow to yellowish-brown except small quadrat portion on each shoulder, narrow band along each lateral margin and large quadrat portion on presumellar area light to medium brown and without dark medial and submedial longitudinal vitta; scutum not shiny, moderately covered with whitish-yellow scale-like recumbent short hairs interspersed with dark brown similar short hairs; presumellar area also with few dark brown simple upright hairs on each side. Scutellum dark yellow, with dark brown simple upright long hairs as well as whitish-yellow scale-like short hairs. Postnotum yellowish-brown and bare. Pleural membrane dark brown, densely covered with whitish-yellow fine hairs. Katepisternum longer than deep, dark yellow except narrow area along upper margin dark brown, moderately covered with dark brown short hairs and whitish-yellow fine short hairs. **Legs.** Foreleg: coxa, trochanter and femur light brown with apical cap of femur medium brown; tibia light brown except subbasal portion and apical cap medium brown; tarsus medium brown, with dorsal crest of short hairs moderately developed on segments 1–3; basitarsus slightly dilated, nearly parallel-sided, 8.11 times as long as its greatest width. Midleg: coxa yellowish-brown except posterolateral surface dark brown; trochanter dull yellow; femur dull yellow except apical cap medium brown; tibia medium brown except base and narrow subbasal band dull yellow on outer surface (medial portion widely pale on inner surface); tarsus medium brown. Hind leg: coxa dark yellow to yellowish-brown; trochanter dull yellow; femur dull yellow except apical cap medium brown; tibia medium brown except base and median broad area dull yellow; tibia (Fig. 10D) gradually widened toward apical 2/5, then slightly narrowed toward apex, with narrowly-constricted low process on anteromedial surface (similar to that of S. (W.) marilogense sp. nov.) along shaft extending from base to little more than basal 1/2; basitarsus (Fig. 10E) medium brown except submedial wide area yellowish-white; other tarsal segments light to medium brown except basal 1/2 of 2nd tarsomere yellowish-white; basitarsus (Fig. 10E) nearly parallel-sided, 5.33 times as long as wide, 0.75 and 0.60 times as wide as greatest widths of tibia and femur, respectively, without short spines on outer surface (Fig. 10E); calcipala (Fig. 10E) elongate, extending to middle or little more of 3rd tarsomere; pediculus (Fig. 10E) well developed. **Wing.** Length 2.2 mm. Other characters as in female of S. (W.) marilogense sp. nov. **Abdomen.** Nearly as in female of S. (W.) tenedori sp. nov. **Genitalia.** Sternite 8 (Fig. 10G) bare medially, covered with numerous short to long hairs on each side. Ovipositor valve (Fig. 10G, H) tounge-like, rounded posteromedially, thin, densely covered with microsetae (except small area near medioposterior tip bare) interspersed with 8 or 9 very short setae; inner margins slightly concave medially, lying close to each other. Genital fork (Fig. 10L, J) inverted-Y shaped; each arm of moderate width, extending posteriorly and forming moderately-sclerotized large ridge, and with 2 triangular projections (1 directed anterolaterally and 1 directed dorsolaterally). Paraproct in ventral view (Fig. 10K) much longer than wide, pale on anterior 1/4 except strongly sclerotized anterior margin, densely covered with microsetae except narrow portion along anterior margin bare, and covered also with many short to long hairs on posterior 3/5; paraproct in lateral view (Fig. 10L) roundly produced anteriorly, with bare sclerotized portion narrowly on outer surface along anterior margin; paraproct with 5 or 6 sensilla on anteromedial surface. Cercus in lateral view (Fig. 10L) triangular, 0.37 times as long as wide, and moderately covered with dark simple hairs. Spermatheca (Fig. 10M) ovoid, 1.18 times as long as wide, well sclerotized except wide area at its juncture with main duct un sclerotized, with reticulate surface pattern and without internal setae; both accessory ducts slender, subequal in diameter to each other and to major duct. **Male.** Body length 2.3–2.5 mm. **Head.** Nearly as wide as thorax. Holoptic. Upper eye consisting of large facets in 11–13 vertical columns and in 11–13 horizontal rows. Clypeus dark brown, not shiny, moderately covered with yellow simple hairs intermixed with dark brown simple hairs near upper and lateral margins. Antenna composed of scape, pedicel and 9 flagellomeres (in 1 paratype male, right antenna shows incomplete separation between 1st and 2nd, and between 5th and 6th flagellomeres, Fig. 11A, and left antenna also shows incomplete separation between 1st and 2nd flagellomeres), dark yellow except scape.
and pedicel yellowish-white and basal 1/2 of 1st flagellomere light to medium brown; 1st flagellomere elongate, 1.95 times as long as 2nd one. Maxillary palp with 5 segments, proportional lengths of 3rd, 4th, and 5th segments 1.00 : 0.78–0.82 : 1.24–1.36; 3rd segment in

Fig. 10. Female of *Simulium* (*Wallacellum*) *amplum* sp. nov. A, fronto-ocular area (right side); B and C, 3rd segments of maxillary palp with sensory vesicle (shown in dotted line in Fig. 10C) (right side; B, front view; C, lateral view); D, hind tibia showing a narrowly-constricted low process on its anteromedial surface (right side; inner view); E, hind tarsus showing calcipala and pedisulcus (left side; outer view); F, tarsal claw; G, 8th sternite and ovipositor valves *in situ* (ventral view); H, ovipositor valve (right side); I and J, genital forks (I, ventral view; J, lateral view); K and L, paraprocts and cerci (right side; K, ventral view; L, lateral view); M, spermatheca. Scale bars. 0.1 mm for D and E; 0.04 mm for A–C; 0.02 mm for G and I–M; 0.01 mm for F and H.
Fig. 11. Male of Simulium (Wallacellum) amplum sp. nov. A, antenna showing incomplete separation between flagellomeres 1 and 2 and between flagellomeres 5 and 6; B and C, 3rd segments of maxillary palp showing sensory vesicles with different-sized openings (front view; B, right side; C, left side); D, hind tibia showing a narrowly-constricted low process on its anteromedial surface (right side; inner view); E, hind tarsus showing spindle-shaped basitarsus (left side; outer view); F, coxites, styles, ventral plate and median sclerite in situ (ventral view); G, coxite and style in situ (left side; medial view); H, style (right side; ventrolateral view); I, ventral plate and median sclerite in situ (lateral view); J, ventral plate (end view); K and L, 10th abdominal segments and cerci (K, lateral view; L, end view); M, male hind tarsus of S. (W.) recurvum Takaoka showing parallel-sided basitarsus (left side; outer view). Scale bars. 0.1 mm for D, E and M; 0.04 mm for A; 0.02 mm for B, C and F–L.

front view (Fig. 11B, C) of moderate size, with sensory vesicle ellipsoidal, 0.18–0.22 times as long as 3rd segment, with medium-sized to large opening (different on each side and also by males). Thorax. Scutum dark orange-yellow to yellowish-brown except small quadrate portion on each shoulder, narrow band along each lateral margin and large quadrate
portion on prescutellar area light to medium brown; scutum with 3 light to medium brown longitudinal vittae (1 medial, 2 submedial), all of which are connected posteriorly to large dark portion on prescutellar area and 2 submedial vittae each connected anteriorly to inner margin of small dark portion on each shoulder; scutum not shiny, moderately covered with whitish-yellow scale-like recumbent short hairs interspersed with dark brown similar short hairs; prescutellar area also with few dark brown simple upright hairs on each side. Scutellum yellowish-brown, with dark brown simple upright long hairs as well as whitish-yellow scale-like short hairs. Postnotum medium-brown and bare. Pleural membrane dark brown, densely covered with whitish-yellow fine hairs and few to several dark brown hairs. Katepisternum longer than deep, orange-yellow except narrow area along upper margin light brown, moderately covered with dark brown short hairs and whitish-yellow fine short hairs. **Legs.** Foreleg: coxa, trochanter and femur light brown with apical cap of femur medium brown; tibia dark brown with base narrowly paler, and median large area of outer surface light brown; tarsus dark brown, with dorsal crest of short hairs moderately developed on segments 1–3; basitarsus slightly dilated, nearly parallel-sided, 7.89 times as long as its greatest width. Midleg: coxa yellowish-brown except posterolateral surface dark brown; trochanter light brown with basal 1/2 pale yellow; femur light brown except base pale yellow and apical cap medium brown; tibia dark brown except base narrowly pale, and with pale narrow subbasal band on outer surface (medial portion widely pale on inner surface); tarsus medium to dark brown. Hind leg: coxa yellowish-brown; trochanter whitish-yellow; femur dark yellow to light brown except apical cap medium brown; tibia (Fig. 11D) medium to dark brown except base pale, and with pale broad submedial band (though pale portion much wider on inner surface); tibia (Fig. 11D) gradually widened toward apical 2/5, then slightly narrowed toward apex, with narrowly-constricted low process on anteromedial surface (similar to that of *S. (W.) marilognense*) along shaft extending from base to little more than basal 1/2; basitarsus (Fig. 11E) medium brown except submedial wide area yellowish-white; other tarsomeres light to medium brown except little less than basal 1/2 of 2nd tarsomere yellowish-white; basitarsus spindle-shaped (i.e., slightly widened from base to little beyond middle, then gradually narrowed toward apex), 4.05–4.45 times as long as wide, 0.77–0.80 and 0.70–0.77 times as wide as greatest widths of tibia and femur, respectively, with 0–2 short spines on outer surface (Fig. 11E); calcipala (Fig. 11E) elongate, extending to middle or little more of 3rd tarsomere; pedipalpus (Fig. 11E) well developed. **Wing.** Length 2.0–2.1 mm; other characters as in male of *S. (W.) marilognense* sp. nov. **Abdomen.** Basal scale light to medium brown, with fringe of whitish-yellow long hairs; dorsal surface of abdomen light to medium brown, densely covered with whitish-yellow scale-like recumbent hairs intermixed with dark brown recumbent and upright simple hairs. **Genitalia.** Coxite in ventral view (Fig. 11F) subquadrate, 2.07 times as long as wide; coxite in medial view (Fig. 11G) somewhat flattened dorsoventrally. Style in ventral view (Fig. 11F) directed dorsally and inwardly, with 1 apical spine; style in medial view (Fig. 11G) nearly parallel-sided, curved inwardly, 0.61 times as long as coxite; style in ventrolateral view (Fig. 11H) sharply narrowed toward apex. Ventral plate in ventral view (Fig. 11F) transverse, slightly wider than long, densely covered with microsetae on ventral surface except areas along lateral margins bare, with anterior margin produced anteromedially, both lateral margins markedly convergent posterolaterally, and posterior margin concave medially; basal arms slender, directed slightly outward, then inward; ventral plate in lateral view (Fig. 11I) with ventral margin produced in middle ventrally and arm slightly curved dorsally; ventral plate in end view (Fig. 11J) narrow, gently rounded ventrally, with medial portion moderately produced ventrally, and covered with microsetae medially on posterior surface. Median sclerite (Fig. 11F, I) arising somewhat posterior to middle of anterior margin of ventral plate, thin, broad and rounded apically. Paramere similar to that of *S. (W.) marilognense* sp. nov. except 4 long stout hooks. Aedeagal membrane and dorsal plate similar to those of *S. (W.) marilognense* sp. nov. except minute spinous setae not so prominent. Segment 10 (Fig. 11K, L) without distinct hairs on ventral and lateral surface. Cercus (Fig. 11K, L) small, not so produced, encircled with 10–12 short hairs.
Pupa. Body length (excluding gill filaments) 2.5–2.7 mm. **Head.** Integument light brown, without any tubercles; frons with 2 pairs of simple long trichomes with uncoiled apices; face with pair of simple or bifid long trichomes with uncoiled apices; antennal sheath without any protuberances or tubercles. **Thorax.** Integument light brown, almost bare (without tubercles) except dorsal surface of posterior 1/2 sparsely covered with tubercles; thorax on each side with 1 simple very long anterodorsal trichome with uncoiled apex, 2 mediodorsal trichomes (2 simple very long, or 1 simple very long and 1 bifid long) with uncoiled apices, 2 medium-long anterolateral trichomes (2 simple, or 1 simple and 1 bifid) with uncoiled apices; simple short or medium-long posterolateral trichome with uncoiled apex and 3 simple short ventrolateral trichomes with uncoiled apices. Gill (Fig. 12A, B) composed of 4 thread-like filaments arising independently at base; upper filament directed upward, then curved medially and slightly downward (upper filament of right side directed upwards, curved medially, then directed posteriorly in 1 of 6 males examined), inner 1 of 2 middle filaments directed upward and forward, curved downward, then directed forwards, outer 1 of 2 middle filaments and lower filament usually directed forward; all filaments ochreous, subequal in thickness, but different in length from one another (outer middle filament longest (1.7–1.8 mm long), upper filament shortest and other 2 filaments intermediate), with no annular ridges and furrows on their surface, and densely covered with minute tubercles. **Abdomen.** Similar to that of *S. (W.) marilagense* sp. nov. except dorsal surface of segments 1 and 2.

![Fig. 12. Pupa of *Simulium*(Wallacellum) amplum sp. nov. A and B, gill filaments with anterior part of thorax (right side; A, dorsal view; B, lateral view); C and D, cocoons (C, dorsal view; D, lateral view). Scale bars. 0.5 mm for C and D; 0.1 mm for A and B.](image)
very sparsely covered with small tubercles, and dorsal surface of segment 5 (in addition to segments 6–9) moderately covered with minute spines directed posteriorly. **Cocoon** (Fig. 12C, D). Wall-pocket shaped, loosely woven with small open interspaces, and extending ventrolaterally; individual threads visible; floor present on posterior 1/2; 3.5–3.7 mm long by 1.7–2.2 mm wide.

**Mature larva.** Unknown.

**TYPE SPECIMENS.** Holotype male with associated pupal exuviae and cocoon (in ethanol) reared from a pupa, collected from a mountain stream (width 3–5 m, shaded, water temperature 23.8°C, altitude 169 m), at María Makiling Falls, Barangay Lalakay, Los Baños, Laguna Province, Luzon, Philippines, 22. IX. 2006, by H. Takaoka. Paratypes: 1 female and 2 males (all with associated pupal exuviae and cocoons), same date and data as those of the holotype; 1 male (with associated pupal exuviae and cocoon) reared from a pupa, collected from a small forest stream (width 1–2 m, shaded, water temperature 20°C, altitude 1,110 m) near the road from Banaue to Abatan, Banaue, Ifugao Province, Luzon, Philippines, 2. VIII. 1999, by H. Takaoka; 2 males (with associated pupal exuviae and cocoons), reared from pupae, collected from a moderately flowing stream (width 6–10 m, shaded, water temperature 21.0°C, altitude 600 m), a tributary of Cristalino River at Banahau, Kinabuhayan, Dolores, Quezon Province, Luzon, Philippines, 25. I. 2001, by H. Takaoka

**ECOLOGICAL NOTES.** The pupae of this new species were found on grass leaves trailing in the water. Associated species were S. (G.) *liliwense* Takaoka, S. (G.) *luzonicum* Takaoka, S. (Simulium) *baltazarae*, S. (W.) *carinatum* Delfinado, S. (W.) *recurvum* Takaoka, S. (W.) *tuyense* and S. (W.) *molawinense* Takaoka.

**ETYMOLOGY.** The species name *amplus* refers to the enlarged hind basitarsus. The Latin adjective *amplus* signifies large.

**REMARKS.** The female and pupa of this new species are almost indistinguishable from those of S. (W.) *recurvum* Takaoka described from Luzon and Negros Islands (Takaoka, 1983) though it appears to be barely distinguished in the pupa from the latter species by the dorsal filament directed upward, then curved medially (Fig. 12A, B) (not posteriorly as in S. (W.) *recurvum*).

The male of this new species is easily distinguished from that of S. (W.) *recurvum* by the head which is nearly as wide as the thorax in this new species but much wider than the thorax in S. (W.) *recurvum*, the large eye-facets which are in 11–13 vertical columns and in 11–13 horizontal rows in this new species but in 15 vertical columns and in 14–16 horizontal rows in S. (W.) *recurvum* (the number of the horizontal rows was erroneously cited as 12 in Takaoka, 2006), and the hind basitarsus which is spindle-shaped and 4.05–4.45 times as long as its greatest width (Fig. 11E) in this new species but parallel-sided and 5.60–5.76 times as long as its greatest width (Fig. 11M) in S. (W.) *recurvum*. The data on S. (W.) *recurvum* used here are based on the observation of three males reared from pupae collected together with S. (W.) *amplus* sp. nov. from the same stream as noted above at the type locality.

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