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TWO NEW SPECIES OF *SIMULIUM* (*SIMULIUM*) (DIPTERA: SIMULIIDAE) FROM THAILAND

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Abstract: Two new black-fly species of the subgenus *Simulium* (*Simulium*) are described and illustrated, based on female specimens captured while approaching a human near a mountain summit in Doi Inthanon National Park, Chiang Mai Province, northern Thailand. The first species, *Simulium suchariti* sp. nov., is assigned to the *griseifrons* species-group and is distinguished from most other related species by the cibarium with tubercles near the base of its medial projection; the second, *S. setsukoae* sp. nov., is very similar to *S. rufibasis* of the *tuberosum* species-group but is distinguished from the latter by the shorter length of clustered stout hairs on the seventh abdominal segment and the ovipositor valve with its posteromedial corner widely bare.
Key words: black fly, Simuliidae, *Simulium*, Thailand, new species, *griseifrons* species-group, *tuberosum* species-group

During our recent collections of adult black flies using a human attractant in Doi Inthanon National Park, Chiang Mai, northern Thailand, we obtained females of two undescribed species of the subgenus *Simulium* Latreille s. str. of the genus *Simulium* Latreille s. l. The first species seems to belong to the *griseifrons* species-group (Takaoka and Davies, 1996) in that it possesses five longitudinal vittae on the scutum, simple claws and triangular ovipositor valves; while the second is conspecific to *Simulium* sp. D, recorded from the same national park by Takaoka and Suzuki (1984). The latter species is very closely related to *S. rufibasis* Brunetti, 1911 and *S. weji* Takaoka, 2001, of the *tuberosum* species-group, by the presence of a pair of clustered hairs on the ventral surface of the seventh abdominal segment of the female (Puri, 1932a; Takaoka, 2001). These two species are new to science and so described below.

The morphological features and terms used herein follow those of Takaoka (2003).

Holotype and paratype specimens will be deposited at the Natural History Museum (BMNH), London, U.K.

Simulium (*Simulium*) *suchariti* sp. nov.

DESCRIPTION. **Female.** Body length about 2.4 mm. ***Head.*** Narrower than width of thorax. Frons slaty black, shiny, widely bare except for several dark stout hairs along each lateral margin; frontal ratio 1.4:1.0:1.2－1.3; frons-head ratio 1.0:3.5－4.1. Fronto-ocular area (Fig. 1) moderately developed. Clypeus slaty black, white pruinose, shiny, sparsely covered with dark stout hairs except for the medial portion widely bare longitudinally. Labrum about 0.7 times as long as clypeus. Antenna composed of 2+9 segments, all brownish black to black though base of 1st flagellar segment narrowly light brown; 1st flagellar segment 1.7－2.0 times as long as 2nd one. Maxillary palp composed of 5 segments, black except 4th and 5th segments greyish black, with proportional lengths of 3rd, 4th and 5th segments 1.0: 1.0:2.0－2.1; 3rd segment (Fig. 2) of moderate size; sensory vesicle large, elongate, with rugged surface, about 0.4 times length of 3rd segment, with medium-sized round opening near apex. Maxillary lacinia with 13－15 inner and 14－16 outer teeth. Mandible with 24－28 inner and 12 outer teeth. Cibarium (Fig. 3) with a narrow medial projection directed dorsally, and covered with many minute tubercles on this projection and 10－12 somewhat larger ones near its base. ***Thorax.*** Scutum black (except anterolateral calli medium brown), shiny, whitish-grey pruinose, with 5 dark longitudinal non-pruinose vittae (i.e., 1 very narrow medial, 2 rather broad submedial, and 2 rather broad lateral vittae), all united on prescutellar area when illuminated dorsally and viewed anterodorsally (this color pattern reversed when viewed from behind); scutum with a pair of white submedial spots near anterior margin when illuminated anteriorly and viewed dorsally; scutum densely covered with yellow recumbent fine hairs interspersed with long upstanding dark hairs on prescutellar area. Scutellum dark brown,

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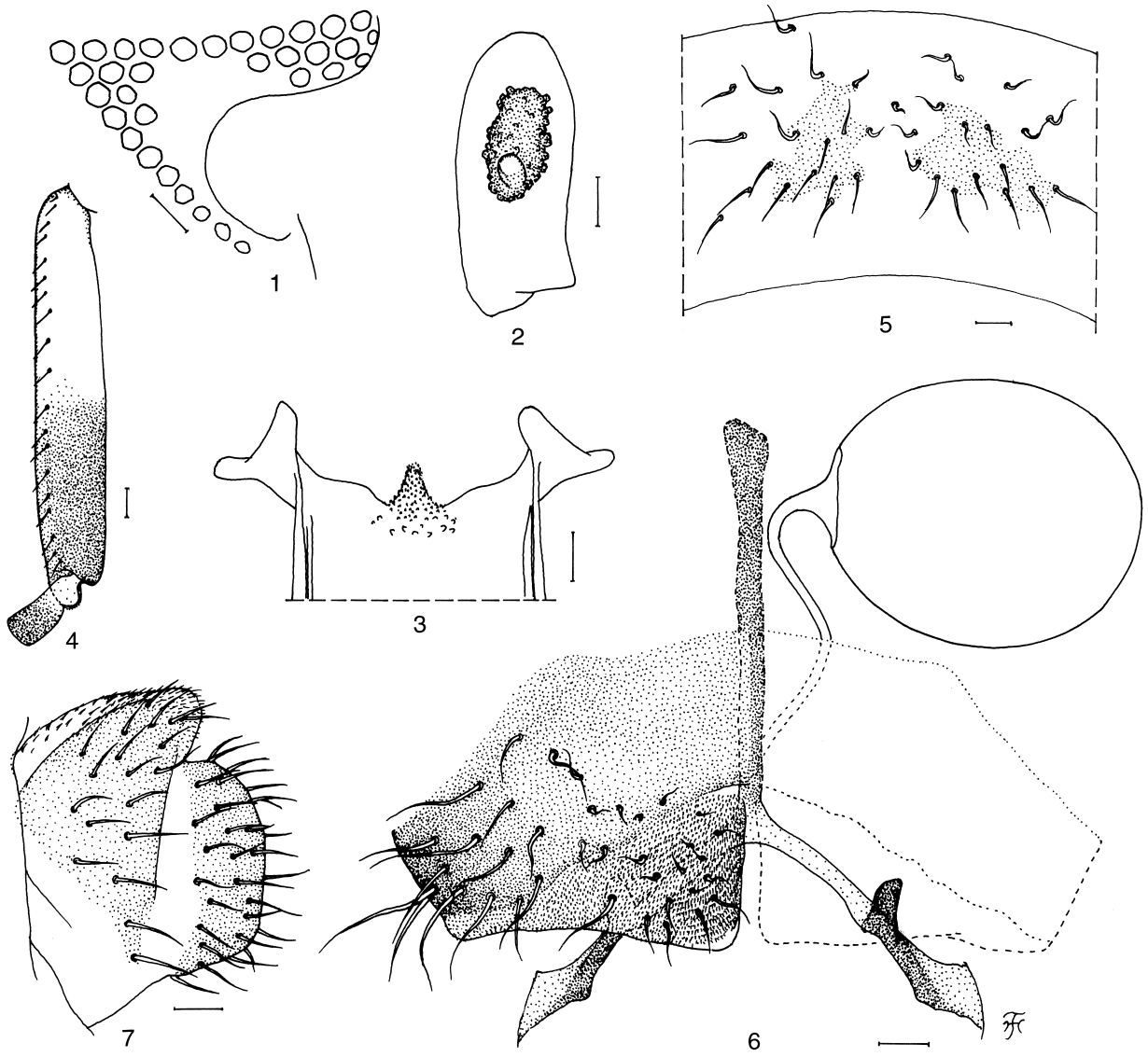
shiny, whitish-grey pruinose, with long dark and short yellow hairs. Postnotum dark brown to brownish black, shiny, whitish-grey pruinose, without hairs. Pleural membrane bare. Katepisternum longer than deep, and bare. ***Legs***. Foreleg: coxa whitish yellow; trochanter dark brown except under surface yellow basally; femur yellow on basal 1/2 and brownish black on apical 1/2; tibia whitish yellow except apical 1/4 brownish black; tarsus entirely black; basitarsus, 2nd and 3rd tarsal segments somewhat dilated; basitarsus about 6.4 times as long as its greatest width. Midleg: coxa brownish black; trochanter dark brown to brownish black except base yellow; femur brownish black except dorsal surface of basal 1/5 and ventral surface of basal 1/4 or 1/3 yellow; tibia white except apical 1/3 brownish black; tarsus brownish black except base of basitarsus dark yellow. Hind leg: coxa dark brown to brownish black; trochanter yellow; femur brownish black except basal 1/4 yellow; tibia white except a little less than apical 1/3 brownish black; tarsus brownish black except basal 1/2 of basitarsus and base of 2nd tarsal segment whitish yellow; basitarsus (Fig. 4) nearly parallel-sided, about 5.6 times as long as wide, about 0.8 and 0.7 times as wide as hind tibia and femur, respectively;



Figures 1-7. Morphological characters of female *Simulium suchariti* sp. nov. 1, fronto-ocular area; 2, 3rd segment of maxillary palp with sensory vesicle; 3, cibarium; 4, basitarsus and 2nd tarsal segment of hind leg (left side and outside view); 5, medial portion of ventral surface of the abdominal segment 7 showing a pair of submedial sternal plates; 6, sternite 8, ovipositor valves, genital fork and spermatheca *in situ* (ventral view); 7, right paraproct and cercus (lateral view). Scale bars. 0.05 mm for all figures.

calcipala distinct, 0.9 times as long as wide and about 0.5 times as wide as the width of apical portion of basitarsus; pedisulcus distinct. All tarsal claws simple, without basal or subbasal tooth. ***Wing.*** Length 2.4—2.7 mm. Costa with dark spinules and hairs; subcosta haired except apical 1/5 to 2/5 bare; basal section of radial vein bare; R_1 with spinules and hairs; R_2 with hairs only; hair tuft at base of stem vein dark brown; basal cell absent. ***Abdomen.*** Basal scale dark brown, with a fringe of dark long hairs on each side; dorsal surface of abdominal segments light to medium brown and somewhat greyish, with many vertical wrinkles except tergites dark brown and smooth; tergite 2 with a pair of silvery shiny dorsolateral patches not connected medially to each other; tergites 3, 4 and 5 small, nearly as long as wide; tergite 6 about 1.5 times as wide as long, tergites 7—9 large and wide, tergites 6—9 shiny; dorsal surface of segments 2 and 3 almost bare, but that of the remaining segments sparsely covered with dark short hairs. Ventral surface of abdominal segments 2—7 ocherous except a pair of submedial sternal plates on segment 7 (Fig. 5) dark brown, and sparsely covered with dark hairs except 2nd and 3rd segments almost bare. ***Genitalia*** (Figs. 6 and 7). Sternite 8 well sclerotized, dark brown to brownish black, bare medially, and with 17—19 long stout hairs as well as a few short hairs laterally on each side; ovipositor valve triangular in shape, membranous, covered with 12—16 stout hairs as well as numerous microsetae; inner border nearly straight, well sclerotized except near apex transparent. Genital fork inverted-Y-shaped, with well-sclerotized stem; arms slender, each with strongly sclerotized apical bulge having a distinct projection directed anteriorly. Paraproct in ventral view with distinct shallow concavity on ventral surface along anteromedial margin; anteromedial surface of paraproct moderately sclerotized, and with a few short sensilla; paraproct much produced ventrally, covered with 14—19 short stout hairs on ventral and lateral surfaces. Cercus in lateral view much wider, about 2.7 times as wide as long, covered with many short stout hairs. Spermatheca nearly ovoid, 1.2 times as long as wide, well sclerotized (though duct and large area around the base of duct unsclerotized), with faint reticulate surface pattern; minute internal setae present; accessary ducts subequal in diameter to each other, and somewhat larger than the major one.

TYPE SPECIMENS. Holotype female, collected with a hand net while approaching a human, near the mountain summit of Ang Ka, altitude 2,465 m, Doi Inthanon National Park, Chiang Mai Province, northern Thailand, 21. IX. 2003, by W. Choochote. Paratype 1 female, same data as holotype except date, 19. IX. 2003.

ETYMOLOGY. The species name *suchariti* is in honor of Prof. Supat Sucharit, former head of the Department of Medical Entomology, Faculty of Tropical Medicine, Mahidol University, Bangkok, Thailand, whom the junior author, WC, thanks for his advice and encouragement.

REMARKS. *Simulium suchariti* sp. nov. is similar in the female to *S. kawamurae* Matsumura, 1915 from Japan (Bentinck, 1955) in that it has the triangular ovipositor valve with several stout hairs and the cibarium with a medial projection directed anteriorly and covered with tubercles on and near this projection, as well as the scutum with five longitudinal vittae. The female of *S. kawamurae* differs from that of this new species by the first flagellar segment of antenna about 1.3 times as long as the second one, the sensory vesicle about 0.35 times as long as the third maxillary palpal segment, mid and hind basitarsi whitish on basal 1/2 and on basal 2/5, respectively, and the cercus about 1.6 times as wide as long. This new species is similar to *S. digrammicum* Edwards, 1928, originally described from female specimens collected in peninsular Malaysia and Thailand (Edwards, 1928; Takaoka and Davies, 1995) and *S. griseifrons* Brunetti, 1911, from India (Puri, 1932b), but is distinguished by the bare basal portion of the radial vein (cf. fully haired in *S. digrammicum* and haired or bare in *S. griseifrons*), a pair of submedial sternal plates (Fig. 5) (cf. one medial sternal plate in the two known species), and the presence of tubercles near the base of the medial projection of the cibarium (Fig. 3). The female of *S. suchariti* is also similar to that of *S. maenoi* Takaoka and Choochote, 2002, found in northern Thailand (Takaoka and Choochote, 2002) in that it has the bare basal portion of radial vein, but differs by the presence of many tubercles near the base of the medial projection of the cibarium (Fig. 3).

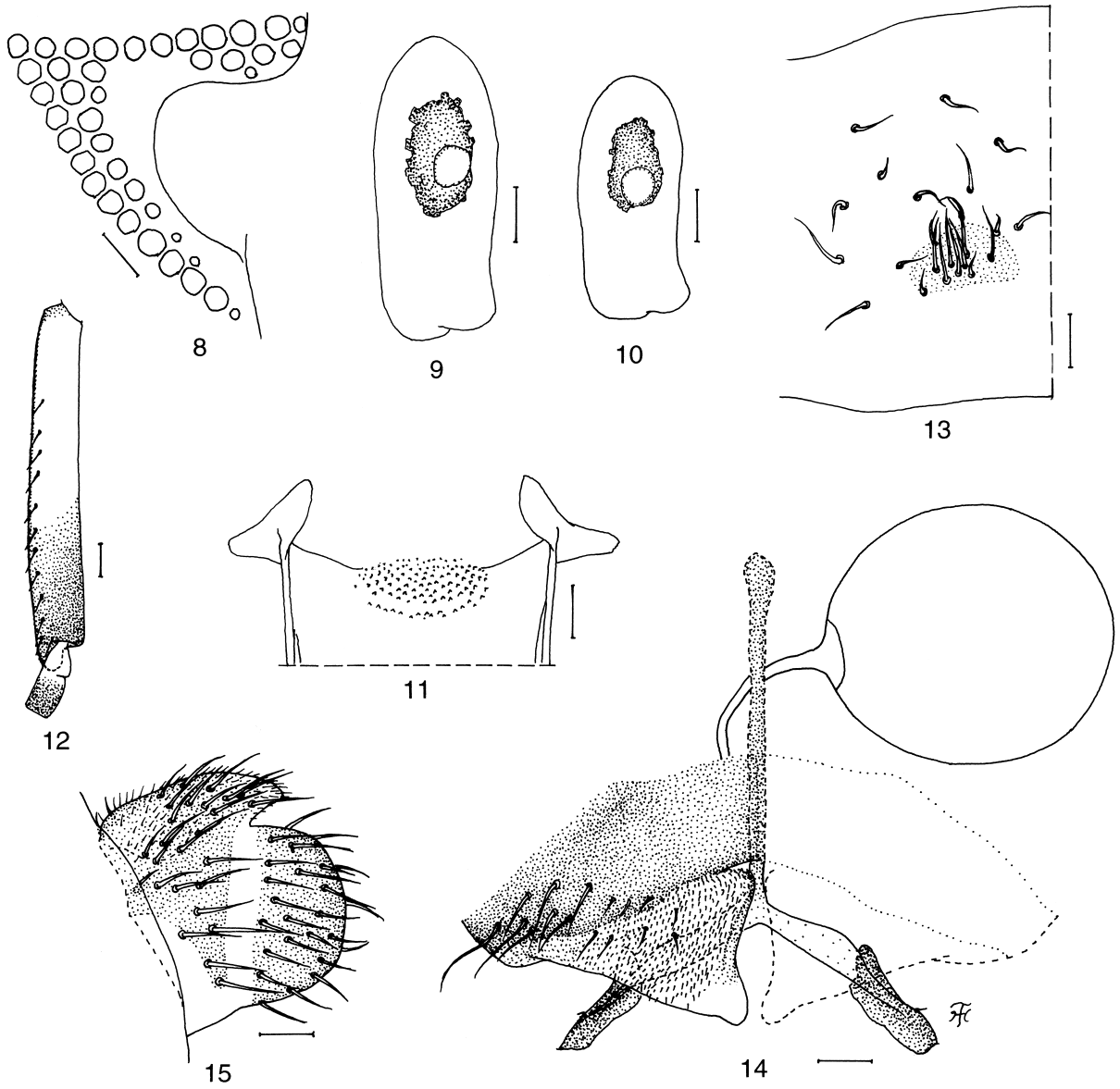
The male, pupa and larva of this new species are unknown yet.

Simulium (*Simulium*) *setsukoae* sp. nov.

Simulium (*Simulium*) sp. D: Takaoka and Suzuki, 1984 (female)

DESCRIPTION. **Female.** Body length 2.2—3.1 mm. ***Head.*** Narrower than width of thorax. Frons slaty black, shiny, with several dark stout hairs along lateral margins; frontal ratio 1.3—1.4:1.0:1.1; frons-head ratio 1.0:3.5—3.7. Fronto-ocular area (Fig. 8) moderately developed, short and rounded apically. Clypeus slaty black, shiny, with scattered dark stout hairs marginally. Labrum 0.61—0.64 times as long as clypeus. Antenna composed of 2+9 segments, dark brown except base of 1st flagellar segment narrowly yellow; ventral surface of 1st flagellar segment dark yellow in some

females; 1st flagellar segment about 1.5 times as long as 2nd one. Maxillary palp brownish black, composed of 5 segments with proportional lengths of 3rd, 4th and 5th segments 1.0:1.0:2.1; 3rd segment (Figs. 9 and 10) of moderate size; sensory vesicle long, 0.39—0.49 times length of 3rd segment, with medium-sized opening medially or apically. Maxillary lacinia with 14—18 inner and 17—19 outer teeth. Mandible with about 34 inner and 13—15 outer teeth. Cibarium (Fig. 11) with numerous minute tubercles near the anterior margin. ***Thorax.*** Scutum slaty black, shiny, not patterned, moderately covered with copper-colored recumbent hairs (appearing shiny yellow at certain angle of light), interspersed with dark long upstanding hairs on prescutellar area; scutum thinly grey pruinose when illuminated at a certain angle of light. Scutellum dark brown, with dark long hairs. Postnotum dark brown, shiny, without hairs. Pleural membrane bare. Katepisternum longer than deep, and bare. ***Legs.*** Foreleg: coxa dark yellow or light yellowish-brown;



Figures 8-15. Morphological characters of female *Simulium setsukoae* sp. nov. 8, fronto-ocular area; 9 and 10, 3rd segments of maxillary palp with sensory vesicle; 11, cibarium; 12, basitarsus and 2nd tarsal segment of hind leg (left side and outside view); 13, right half of medial portion of ventral surface of the abdominal segment 7 showing small sternal plate and clustered hairs on it; 14, sternite 8, ovipositor valves, genital fork and spermatheca *in situ* (ventral view); 15, right paraproct and cercus (lateral view). Scale bars. 0.05 mm for all figures.

trochanter and femur dark brown; tibia dark brown with outer median portion largely yellowish white, and extensive white sheen on outer margin when illuminated; basitarsus entirely dark brown, slightly dilated, 6.4 times as long as its greatest width, with short dorsal hair crest; rest tarsal segments dark brown. Midleg: dark brown except basal 1/4 to 2/5 of tibia and a little less than basal 1/2 of basitarsus whitish yellow; tibia with extensive white sheen on posterior surface when illuminated. Hind leg: dark brown with basal 1/3 of tibia, a little more than basal 1/2 of basitarsus and basal 1/2 of 2nd tarsal segment yellowish white; tibia with extensive white sheen on posterior surface when illuminated; basitarsus (Fig. 12) parallel-sided, 6.6 times as long as wide, 0.62 and 0.56 times as wide as the greatest width of hind tibia and femur, respectively; calcipala short, 1.1 times as wide as long, and 0.57 times as wide as basitarsal tip; pedisulcus distinct. All tarsal claws simple, without basal or subbasal tooth. ***Wing.*** Length 2.5—2.8 mm; costa with spinules and hairs; subcosta haired except apical tip bare; basal section of vein R bare; R_1 with spinules and hairs; R_2 with hairs only; hair tuft at base of stem vein dark brown; basal cell absent. ***Abdomen.*** Basal scale dark brown with fringe of dull long hairs; dorsal surface of abdomen medium to dark brown, with dark hairs; 2nd segment with a pair of silvery iridescent spots dorsolaterally, broadly connected in middle to each other; tergites 3, 4 and 5 small and dull, but tergites 6—8 large and shiny. Ventral surface of abdominal segment 7 (Fig. 13) with a pair of small submedial sternal plates, and with a cluster of 11—15 stout hairs on each sternal plate (hairs on sternal plates subequal in length to those on the surrounding area of the same segment). ***Genitalia*** (Figs. 14 and 15). Sternite 8 well sclerotized, bare medially but with 8—11 long stout hairs as well as a few short slender hairs laterally on each side; ovipositor valve triangular in general shape having a small flap-like posteromedial corner with rounded margin, membranous, covered with 5—8 short setae as well as numerous microsetae except narrow portion along inner margin and rather wide portion near posteromedial corner bare; inner margins slightly to widely curved, and moderately sclerotized. Genital fork inverted-Y-shaped, with well-sclerotized stem; arms slender, each with strongly sclerotized projection directed anterodorsally. Paraproct much longer than cercus, covered with 26—30 short stout hairs on lateral and ventral surfaces; anteromedial surface strongly sclerotized. Cercus rounded posteriorly, about 0.5 times as long as wide, covered with about 20 short stout hairs on outer surface. Spermatheca nearly globular, well sclerotized (though duct and small area around base of duct unsclerotized); no definite reticulate pattern; minute internal setae present; accessary ducts of moderate size, subequal to that of the main one.

TYPE SPECIMENS. Holotype female, collected with a hand net while approaching a human, near the mountain summit of Ang Ka, altitude 2,465 m, Doi Inthanon National Park, Chiang Mai Province, northern Thailand, 18. IX. 2003, by W. Choochote. Paratypes 3 females, same data as holotype, 1 female, same data as holotype except date, 21. IX. 2003, and 4 females, same data except date, 25. XII. 2001.

OTHER SPECIMENS EXAMINED. 6 females (labelled *Simulium* sp. D) collected with a hand net while biting a human, altitude ca. 2,400 m, Doi Inthanon National Park, 20. II. 1978, by H. Suzuki.

ETYMOLOGY. The species *setsukoae* is named after the wife of Dr. Hiroshi Suzuki, Nagasaki University, who collected female specimens of this new species for the first time in 1978 (Takaoka and Suzuki, 1984).

REMARKS. *Simulium setsukoae* sp. nov. is very similar to the female of *S. rufibasis* in many features including the leg color, but is distinguished from the latter by the short size of the clustered hairs on the seventh abdominal segment which are subequal to those on the surrounding area (Fig. 13), as already mentioned by Takaoka and Suzuki (1984). In addition to this difference, this study clarified that the two species differ from each other in the ovipositor valve, i.e., its posteromedial corner widely bare in *S. setsukoae* (Fig. 14) but moderately setose in *S. rufibasis*. This new species is also similar to *S. weji*, found in northern Thailand (Takaoka, 2001), which has also a pair of clustered hairs on the seventh abdominal segment, but the latter species has many different characteristics including the smaller sensory vesicle, the cibarium with a reduced number of tubercles, the hind femur not entirely dark, and the clustered hairs much longer than those of *S. rufibasis* (Takaoka, 2001; Takaoka and Suzuki, 1984).

The male, pupa and larva of this new species remain unknown.

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