Original Article

A new species and a newly recorded species of the *Simulium* (*Simulium*) *striatum* species-group (Diptera: Simuliidae) from Nepal

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Abstract: A new species of black fly, *Simulium dadagaunense*, is described based on a female reared from a pupa from Nepal. This species is assigned to the *Simulium* (*Simulium*) *striatum* species-group, and is characterized in the female by the relatively narrow frons, weakly developed fronto-ocular area, and cibarium with four tiny processes. In addition, *S. grisescens* Brunetti originally described from India is newly recorded from Nepal.

Key words: Taxonomy, fauna, biodiversity, Oriental Region

INTRODUCTION

Simulium bagmaticum Maskey was the only species of the *S. striatum* species-group previously known from Nepal (Maskey, 1987). However, we recently recorded five species of black flies of this species-group from Nepal, including three new species (Takaoka et al., 2020). More recently, we collected two more species belonging to the *S. striatum* species-group, of which one is described here as a new species and the other, *S. grisescens* Brunetti, is newly recorded from Nepal.

Methods of morphological observation, terms of features, descriptions, and illustrations, followed Takaoka (2003) and partially followed Adler et al. (2004).

The holotype of the new species is deposited in the Entomology Section of the Queen Sirikit Botanic Garden, Chiang Mai, Thailand.

Simulium (*Simulium*) *dadagaunense* Takaoka & Shrestha sp. nov.

Female ($n=1$). Body length 2.5 mm. **Head.** Slightly narrower than thorax. Frons (Fig. 1A) brownish black, shiny, with several dark stout hairs submedially and along lateral margin on each side; frontal ratio 1.6:1.0:1.9; frons:head ratio 1.0:4.4. Fronto-ocular area not well developed (Fig. 1A). Clypeus brownish black, shiny, moderately covered with dark brown medium-long hairs. Labrum 0.7 times length of clypeus. Antenna composed of scape, pedicel and

nine flagellomeres, and yellowish except five or six apical flagellomeres light brown. Maxillary palp with five palpomeres, light brown except third palpomere medium brown; proportional lengths of third, fourth, and fifth palpomeres 1.0:1.2:2.4; sensory vesicle (Fig. 1B) medium-sized, ellipsoidal (0.34–0.37 times length of third palpomere), having moderate-sized opening. Maxillary lacinia with 11 inner and 12 outer teeth. Mandible with 23 inner and 11 outer teeth. Cibarium (Fig. 1C) with four tiny processes near posterodorsal margin; each cornua slender. **Thorax.** Scutum dark brown, shiny, densely covered with whitish yellow, fine recumbent short hairs intermixed with light brown similar fine short hairs near anterior margin, and interspersed with few dark brown long upright hairs on prescutellar area; scutum gray pruinose with five non-pruinose longitudinal vittae (one medial, two submedial, and two lateral), all vittae united with transverse non-pruinose band on prescutellar area, when illuminated in front and viewed dorsally; scutum gray pruinose except four non-pruinose longitudinal vittae, when illuminated posteriorly and viewed dorsally. Scutellum medium brown, covered with dark brown upright long hairs and yellow short hairs. Postnotum dark brown, shiny, gray pruinose when illuminated at certain angles, and bare. Pleural membrane bare. Katepisternum dark brown, longer than deep, shiny, gray pruinose when illuminated at certain angles, and bare. **Legs.** Foreleg: coxa and trochanter yellowish white; femur yellow with apical

Fig. 1. Female of *Simulium dadagaunense* sp. nov. A, frons and fronto-ocular areas of head; B, sensory vesicle (right side; front view); C, cibarium; D, basitarsus and second tarsomere of hind leg (left side; outer view); E, sternite 8 and ovipositor valves (ventral view); F, ovipositor valve (left side; lateral view); G, genital fork (ventral view); H and I, paraprocts and cerci (H, right side and ventral view; I, left side and lateral view); J, spermatheca. Scale bars: 0.1 mm for D; 0.05 mm for A; 0.02 mm for B, C and E-J.

tip light brown, tibia medium brown except basal tip yellow and median portion of outer surface largely light brown; tarsus dark brown, with moderate dorsal hair crest; basitarsus moderately dilated, 4.8 times as long as its greatest width. Midleg: coxa medium brown though posterolateral surface dark brown; trochanter whitish yellow; femur yellow with apical cap light brown; tibia ochreous except basal tip yellow and apical cap medium brown; basitarsus yellowish white except apical tip light brown, second tarsomere yellowish white except apical two-thirds light brown, and rest of tarsus light brown. Hind leg: coxa medium brown; trochanter yellowish white; femur ochreous except base yellowish white and

apical cap dark brown; tibia light to dark brown except basal one-fifth yellowish white; tarsus medium brown except basal two-thirds of basitarsus and basal half of second tarsomere whitish yellow; basitarsus (Fig. 1D) nearly parallel-sided, 5.85 times as long as wide, and 0.62 and 0.55 times as wide as greatest widths of hind tibia and femur, respectively; calcipala (Fig. 1D) moderately developed, nearly as long as wide, and 0.4 times as wide as greatest width of basitarsus; pedisulcus (Fig. 1D) well developed. Tarsal claw simple, without tooth. **Wing.** Length 1.9 mm. Costa with dark spinules and hairs; subcosta haired except near apex bare; basal section of radial vein bare; R_1 with dark brown spinules and hairs; R_2 with dark

brown hairs; hair tuft on stem vein dark brown; basal cell absent. **Halter.** White except base darkened. **Abdomen.** Basal scale light brown, with fringe of whitish yellow fine hairs. Dorsal surface of abdomen medium to dark brown except tergal plate of segment 2 light brown, and with light to dark brown short hairs; tergite 2 shiny and silvery iridescent when illuminated

at certain angles and tergites 6–9 shiny. Ventral surface of seventh segment with pair of weakly sclerotized submedian sternal plates. **Terminalia.** Sternite 8 (Fig. 1E) with posterior margin concave medially in form of inverted-U shape, bare medially, with 26–28 medium-long hairs and 10 or 11 short hairs on each lateral surface. Ovipositor valves (Fig. 1E, F) rounded

Fig. 2. Pupa of *Simulium dadagaunense* sp. nov. A, frontal trichomes; B, facial trichome; C–F, thoracic trichomes (C, dorsomedial; D, anterolateral; E, mediolateral; F, ventrolateral); G, gill (left side; outer view); H, seta on dorsum of abdominal segment 1; I, hair-like seta and minute sitae on dorsum of abdominal segment 2; J, terminal hook (caudal view); K, cocoon (lateral view). Scale bars: 1.0 mm for K; 0.1 mm for G; 0.01 mm for A–F and H–J.

posteriorly, with ventrally produced lobe near inner margin, membranous except narrow area along inner margin slightly sclerotized, covered with 26 or 27 short hairs and numerous microsetae; inner margins sinuous, close to each other. Genital fork (Fig. 1G) of inverted-Y form, with narrow well sclerotized stem; arms of moderate width, each with short and broad projection directed anterodorsally. Paraproct in ventral view (Fig. 1H) rounded, somewhat longer than greatest width, strongly pigmented on anterior surface, with *ca.* 40 short to medium-long hairs on lateral and ventral surfaces; paraproct in lateral view (Fig. 1I) 0.4 times as long as wide, and much protruding ventrally beyond ventral margin of cercus. Cercus in lateral view (Fig. 1I) short, 0.6 times as long as wide, with posterior margin somewhat rounded or nearly straight, and with numerous short to medium-long hairs. Spermatheca (Fig. 1J) nearly globular, well sclerotized and pigmented except portion of junction with duct somewhat widely unpigmented, without definite reticulate patterns on its surface; internal setae present; accessory ducts subequal in thickness to each other, and to major duct.

Pupa ($n=1$). Body length 2.6 mm. **Head.** Integument dark yellow to ochreous, moderately covered with round tubercles; frons with two unbranched short trichomes with straight apices on each side (Fig. 2A); face with one medium-long trichome with straight apex on each side (Fig. 2B). **Thorax.** Integument dark yellow to ochreous, moderately covered with round tubercles except conical tubercles on posterodorsal surface; thorax on each side with three trichomes (anterior two trichomes long and bifid or trifid, posterior one short and unbranched) dorsomedially (Fig. 2C), two medium-long trichomes (anterior one unbranched, posterior one bifid) anterolaterally (Fig. 2D), one medium-long trichome with bifid apex mediolaterally (Fig. 2E), and three trichomes (two long and unbranched or bifid, one medium-long and unbranched) ventrolaterally (Fig. 2F). Gill (Fig. 2G) with 10 thread-like filaments arranged as $2 + [(1+2)+3] + 2$ from dorsal to ventral; all filaments 1.0–1.4 mm long; two filaments of dorsal pair and dorsal filament of upper medial triplet much shorter; relative thickness of filaments from dorsal to ventral when measured basally 1.4:1.6–1.7:1.0:0.7–1.0:1.0–1.1:1.2–1.4:1.1–1.4:1.1–1.2:1.2–1.3:1.0; all filaments pale ochreous, covered with annular ridges and furrows except basal portion of ventral paired filaments without such ridges and furrows, and densely covered with minute tubercles. **Abdomen.** Dorsally, nearly transparent except segment 1 ochreous; segment 1 without tubercles, with one medium-long slender seta (Fig. 2H) on each side; segment 2 with one medium-long slender seta and five minute spinous setae, of which three are stouter than two others (Fig. 2I) on each side; segments 3 and 4 each with 4 distinct

hooks and one short seta on each side; all setae and hooks unbranched; segments 5, 6, 7 and 9 lacking spine-combs; segment 8 with distinct spine-combs in transverse row; segments 6–9 each with comb-like groups of microspines on each side; segment 9 with pair of cone-like terminal hooks (Fig. 2J). Ventrally, segments 4–8 transparent, each with comb-like groups of microspine; segment 5 with pair of bifid stout hooklets submedially and few unbranched short setae on each side; segments 6 and 7 each with pair of bifid inner and unbranched outer stout hooklets somewhat separated from each other and few unbranched short setae on each side. **Cocoon** (Fig. 2K). Light ochreous, shoe-shaped, with several small open spaces anterolaterally on each side, strongly woven; posterior half with floor; individual threads on anterior portion visible; 2.7 mm long, 1.0 mm wide and 0.5 mm high (at anterior tip).

Male and Mature larva. Unknown

Type specimen. Holotype. Female (with its associated pupal exuviae and cocoon, in 80% ethanol), collected from a stream (elevation 1,080 m, 28°25.770'N, 082°10.852'E), Dadagaun, Salyan, Nepal, 8-V-2011, by S. Shrestha.

Etymology. The species name *dadagaunense* refers to the locality name, Dadagaun, where this new species was collected.

Remarks. This species is assigned to the *S. striatum* species-group by having the striated scutum, claw without a tooth, sternite 8 with an inverted U-shaped depression posteromedially (Fig. 1E), ovipositor valve with a ventrally produced process near the inner margin (Fig. 1E), paraproct much produced ventrally (Fig. 1I), and pupal gill with 10 thread-like filaments (Fig. 2G).

The female of this new species is characterized by the relatively narrow frons (Fig. 1A), weakly developed fronto-ocular area (Fig. 1A), cibarium with four tiny processes (Fig. 1C), all femora yellowish or ochreous with the apical caps darkened, and basal portion of the radius bare.

No other species of the *S. striatum* species-group have such a weakly developed fronto-ocular area.

The pupa of this new species is similar to that of *S. beniense* Takaoka & Shrestha from Nepal (Takaoka et al., 2020) in having the 10 pupal gill filaments, of which several filaments are somewhat thinner than the others, but is distinguished from the latter species by the arrangement of the gill filaments $2 + [(1+2)+3] + 2$ from dorsal to ventral ($2 + [(1+2)+2+1] + 2$ in *S. beniense*).

The pupa of this species is distinguished from that of *S. bagmaticum* (Maskey, 1987) by having a pair of terminal hooks (Fig. 2J) (terminal hooks absent in *S. bagmaticum*).

Fig. 3. Female of *Simulium grisescens*. A, frons and fronto-ocular areas of head; B, sensory vesicle (right side; front view); C, cibarium; D, fore tibia (left side; outer view); E, hind tibia (left side; outer view); F, basitarsus and second tarsomere of hind leg (left side; outer view); G, genital fork (ventral view); H, spermatheca. Scale bars: 0.1 mm for D–F; 0.05 mm for A; 0.02 mm for B, C, G and H.

***Simulium (Simulium) grisescens* Brunetti, 1911**

Simulium grisescens Brunetti, 1911: 282–288 (Male).

Simulium (Simulium) grisescens: Puri, 1932: 523–526 (Female, male and pupa); Datta, 1974: 18–19 (Larva).

This species was described from India by Brunetti (1911) and redescribed by Puri (1932) and by Datta (1974). The female, male, pupa and mature larva are here redescribed.

Female ($n=1$). Body length 2.3 mm. **Head**. Slightly narrower than thorax. Frons (Fig. 3A) brownish black, shiny, with several dark stout hairs along lateral margin on each side and near antennal base; frontal ratio 1.25:1.00:1.24; frons:head ratio 1.0:4.1. Fronto-ocular area short, rounded apically (Fig. 3A). Clypeus brownish black, shiny, moderately covered with dark brown medium-long hairs except upper one-third almost bare medially. Labrum 0.66 times length of clypeus. Antenna composed of

scape, pedicel and nine flagellomeres, and light to medium brown except scape, pedicel and base of first flagellomere yellow, and anterior surface of two to three basal flagellomeres yellow. Maxillary palp with five palpomeres, light brown except third palpomere medium brown; proportional lengths of third, fourth, and fifth palpomeres 1.0:1.3:2.6; sensory vesicle (Fig. 3B) medium-sized, ellipsoidal (0.36–0.38 times length of third palpomere) having large opening. Maxillary lacinia with 10 or 11 inner and 11 or 12 outer teeth. Mandible with 22–24 inner and 11 or 12 outer teeth. Cibarium (Fig. 3C) with 10 tiny processes near posterodorsal margin; each cornua triangular. **Thorax**. As in *S. dadagaunense* sp. nov. **Legs**. Foreleg: coxa and trochanter yellowish white; femur yellow with apical tip light brown, tibia (Fig. 3D) medium to dark brown except base yellow; tarsus dark brown, with moderate dorsal hair crest; basitarsus moderately dilated, 5.0 times as long as its greatest width. Midleg: coxa

medium brown though posterolateral surface dark brown; trochanter whitish yellow; femur medium to dark brown; tibia medium to dark brown except basal tip yellow; basitarsus yellowish white except apical tip light brown, second tarsomere yellowish white except apical two-thirds light brown, and rest of tarsus light brown. Hind leg: coxa medium brown; trochanter yellowish white; femur dark brown except base yellowish white; tibia (Fig. 3E) medium to dark brown except base yellowish white; tarsus medium brown except basal two-thirds of basitarsus and basal half of second tarsomere whitish yellow; basitarsus (Fig. 3F) nearly parallel-sided, 6.0 times as long as wide, and 0.7 and 0.6 times as wide as greatest widths of hind tibia and femur, respectively; calcipala (Fig. 3F) moderately developed, nearly as long as wide, and 0.4 times as wide as greatest width of basitarsus; pedisulcus (Fig. 3F) well developed. Tarsal claw simple, without tooth. **Wing.** Length 2.0 mm. Costa with dark spinules and hairs; subcosta haired except near apex bare; basal section of radial vein haired; R_1 with dark brown spinules and hairs; R_2 with dark brown hairs; hair tuft on stem vein dark brown; basal cell absent. **Halter** and **Abdomen.** As in *S. dadagaunense* sp. nov. **Terminalia.** As in *S. dadagaunense* sp. nov. except following characters. Sternite 8 with 24 or 25 medium-long hairs and 12 or 13 short hairs on each lateral surface. Ovipositor valves each covered with 29 or 30 short hairs and numerous microsetae. Genital fork (Fig. 3G) of inverted-Y form, with narrow well-sclerotized stem; arms of moderate width, each with short and broad projection directed anterodorsally. Paraproct with 46 or 47 short to medium-long hairs on lateral and ventral surfaces; paraproct in lateral view 0.5 times as long as wide. Cercus in lateral view short, 0.7 times as long as wide, and rounded posteriorly. Spermatheca (Fig. 3H) ovoid, 1.2 times as long as wide.

Male ($n=2$). Body length 2.4 mm. **Head.** Slightly wider than thorax. Upper-eye (large) facets in 16 or 17 vertical columns and 17 horizontal rows. Clypeus black, thickly white pruinose and iridescent when illuminated at certain angles, with dark brown hairs along and near lateral margins (most of central portion bare). Antenna composed of scape, pedicel and nine flagellomeres, medium to dark brown except scape and pedicel light brown and base of first flagellomere yellow; first flagellomere elongate, 1.75 times length of second. Maxillary palp with five palpomeres, medium-brown except first and second palpomeres ochreous; proportional lengths of third, fourth, and fifth palpomeres 1.0:1.3:2.8; third palpomere (Fig. 4A) widened apically; sensory vesicle (Fig. 4A) ellipsoidal, 0.24 times length of third palpomere, and with small opening. **Thorax.** Scutum black, with whitish-pruinose pattern, *i.e.*, anterior pair of large spots on shoulders extended posteriorly along lateral margins and connected to large transverse spot entirely

covering prescutellar area, anterior pair of large spots divided into anterior half and posterior half, either of which disappears depending on direction of lighting; all spots brilliantly iridescent when illuminated at certain angles; scutum uniformly and moderately covered with brassy recumbent short hairs intermixed with dark brown short hairs near anterior margin and with several dark brown long upright hairs on prescutellar area. Scutellum medium brown, with dark brown long upright hairs and brassy short hairs. Postnotum brownish black, shiny and whitish pruinose when illuminated at certain angles and bare. Pleural membrane bare. Katepisternum longer than deep, brownish black, and bare. **Legs.** Foreleg: coxa whitish yellow; trochanter whitish yellow with anterior surface partially dark yellow to light brown; femur light brown with base dark yellow and apical tip medium brown; tibia dark brown; tarsus dark brown to brownish black, with moderate dorsal hair crest; basitarsus greatly dilated, 5.5 times as long as its greatest width. Midleg: coxa dark brown except posterolateral surface brownish black; trochanter medium brown except base yellowish white; femur medium brown with apical cap dark brown; tibia medium to dark brown except basal tip yellow; basitarsus yellowish white except apical one-fifth medium brown, and rest of tarsus medium brown except base of second tarsomere yellowish white. Hind leg: coxa dark brown; trochanter yellowish white; femur medium to dark brown except base whitish yellow and apical cap brownish black; tibia dark brown to brownish black except base yellowish white; tarsus medium brown except little more than basal half of basitarsus and basal half of second tarsomere yellowish white (Fig. 4B); basitarsus (Fig. 4B) slightly widened from base to apical two-fifths, 4.2 times as long as wide, and 0.8 times as wide as greatest widths of hind tibia and femur; calcipala (Fig. 4B) small, nearly as long as its basal width, and 0.3 times as wide as greatest width of basitarsus; pedisulcus (Fig. 4B) well developed. **Wing.** Length 2.0 mm. Other characters as in female except subcosta and basal portion of radial vein without hairs. **Halter.** White except base darkened. **Abdomen.** Basal scale brownish black, with fringe of dark brown long hairs. Dorsal surface of abdomen dark brown to brownish black, moderately covered with dark brown short to medium-long hairs; segments 2, 5, 6 and 7 each with pair of whitish pruinose spots (brilliantly iridescent when illuminated at certain angles) dorsolaterally, those on segment 2 broadly connected in middle to each other. **Genitalia.** Coxites, styles and ventral plate in ventral view as in Fig. 4C; style in ventrolateral view (Fig. 4D) 1.8 times length of coxite, 3.1 times as long as greatest width at basal one-fourth, somewhat narrowed to little more than basal half, then nearly parallel-sided, with subapical spine; style in medial view (Fig. 4E) somewhat flattened dorsoventrally, with short

Fig. 4. Male of *Simulium griseocens*. A, sensory vesicle (left side; front view); B, basitarsus and second tarsomere of hind leg (left side; outer view); C, coxites, styles and ventral plate (ventral view); D–F, styles (D, right side; ventrolateral view; E, right side; medial view; F, left side; dorsal view); G, ventral plate and medial sclerite (lateral view); H, ventral plate (caudal view). Scale bars: 0.1 mm for B; 0.02 mm for A and C–H.

triangular basal protuberance directed dorsomedially; style in dorsal view (Fig. 4F) with basal protuberance with saw-like anterior margin. Ventral plate in ventral view (Fig. 4C) with body broad, lateral margins slightly convex, anterior margin nearly straight; body bearing prominent median process sharply narrowed to round tip and moderately covered with minute setae medially on anteroventral surface; arms short, stout, divergent from base; ventral plate in lateral view (Fig. 4G) with median process abruptly bent ventrally at nearly right angle, and with stout arms; ventral plate in caudal view (Fig. 4H) in form of equilateral triangle, and bare. Median sclerite in lateral view (Fig. 4G) arising anterior to anteromedian portion of ventral plate, and in middle curved dorsally; median sclerite in caudal view wide, plate-like. Paramere enlarged basally, with several hooks apically. Aedeagal membrane sparsely covered with minute setae; dorsal plate weakly sclerotized, in form of narrow transverse bar. Abdominal segment 10 with four or five hairs on

each posterolateral surface; cercus small, with 12 or 13 distinct hairs.

Pupa ($n=3$). Body length 2.6–2.8 mm. **Head.** Integument dark yellow to ochreous, moderately covered with relatively large tubercles having tiny secondary projections (Fig. 5A); frons with three trichomes (one medium-long or long, unbranched, and two short, unbranched or bifid) (Fig. 5B) in female, though frons with two medium-long unbranched trichomes in two males, on each side; face with long trichome on each side (Fig. 5C). **Thorax.** Integument dark yellow to ochreous, moderately covered with relatively large tubercles similar to those on frons, except conical tubercles on posterodorsal surface; thorax on each side with three medium-long or long trichomes, each with three or four branches dorsomedially (Fig. 5D), two trichomes (anterior one unbranched, medium-long, and posterior one trifid, long) anterolaterally (Fig. 5E), one medium-long trichome with bifid apex mediolaterally (Fig. 5F), and

Fig. 5. Pupa of *Simulium grisescens*. A, tubercles on frons; B, frontal trichomes; C, facial trichome; D–G, thoracic trichomes (D, dorsomedial; E, anterolateral; F, mediolateral; G, ventrolateral); H, gill (left side; outer view); I, hair-like seta on dorsum of abdominal segment 1; J, hair-like seta and minute setae on dorsum of abdominal segment 2; K, terminal hook (caudal view); L, cocoon (lateral view). Scale bars: 1.0 mm for L; 0.1 mm for H; 0.01 mm for A–G, and I–K.

three unbranched trichomes (one long, one medium-long, and one short) ventrolaterally (Fig. 5G). Gill (Fig. 5H) with 10 thread-like filaments arranged as $2+(2+1)+(2+1)+2$ from dorsal to ventral, though two middle triplets overlapped when viewed laterally; all filaments 0.6–1.1 mm long, with two filaments of dorsal pair shortest; relative thickness of filaments

from dorsal to ventral when measured basally $1.0:1.0:0.8-0.9:0.9:1.1:1.0:1.0:1.0-1.1:1.1:1.2$; lower filament of ventral pair slightly thicker than other filaments; all filaments pale ochreous, covered with annular ridges and furrows and densely covered with minute tubercles. **Abdomen.** Dorsally, nearly transparent except segment 1 ochreous; segment 1

Fig. 6. Mature larva of *Simulium grisescens*. A, mandible; B, hypostoma; C, head capsule (ventral view); D, protuberance and minute setae on dorsum of abdominal segment 6 (lateral view). Scale bars: 0.1 mm for C; 0.05 mm for D; 0.04 mm for B; 0.01 mm for A.

without tubercles, with one short slender seta (Fig. 5I) on each side; segment 2 with one short slender seta and five minute spinous setae, of which three are stouter than two others (Fig. 5J) on each side; segments 3 and 4 each with 4 distinct hooks and one short seta on each side; all setae and hooks unbranched; segments 5, 6, 7 and 9 lacking spine-combs; segment 8 with distinct spine-combs in transverse row; segments 6–9 each with comb-like groups of microspines on each side; segment 9 with pair of cone-like terminal hooks (Fig. 5K). Other characters as in *S. dadagaunense* sp. nov. **Cocoon** (Fig. 5L). Light ochreous, shoe-shaped, with several small to medium-sized open spaces anterolaterally on each side, strongly woven; posterior half with floor; individual threads on anterior portion visible; 2.6 mm long, 1.0 mm wide and 0.7 mm high (at anterior tip).

Mature larva ($n=1$). Body length 4.5 mm. Body dark gray. Abdomen in lateral view gradually widened from segment 1 to segment 7, then narrowed to segment 9. **Head**. Medium brown except eye-spot region on each lateral surface and clypeus yellowish white with longitudinal band along each lateral margin and narrow horizontal band along posterior margin medium brown; head spots indistinct except mediolateral spots medium brown, though almost merged into longitudinal band on each side of clypeus,

and single round spot medium brown below eye-spot region on each side. Antenna composed of three articles and apical sensillum, slightly longer than stem of labral fan; length ratio of three articles (from base to tip) 1.00:1.36:0.96. Labral fan with 35 primary rays. Mandible (Fig. 6A) with mandibular serration composed of two teeth (one medium-sized, one small); main tooth at right angle against mandible on apical side; comb-teeth gradually reduced in length from first to third; supernumerary serrations absent. Hypostoma (Fig. 6B) with nine anterior teeth, of which median and corner teeth subequal in length to each other, followed by three intermediate teeth on each side; lateral margins weakly serrate apically; four hypostomal bristles divergent posteriorly from lateral border on each side. Postgenal cleft (Fig. 6C) large, mitre-shaped; sheath of subesophageal ganglion moderately pigmented). Cervical sclerites on each side composed of light brown elliptical piece, not fused to occiput. **Thorax and Abdomen**. Histoblast of pharate pupal gill with 10 thread-like slender filaments. Thoracic segment 3 with pair of small round dorsolateral protuberances; cuticle sparsely covered with minute colorless setae. Abdominal segments 1–8 each with pair of cone-like dorsolateral protuberances (Fig. 6D). Abdominal cuticle sparsely covered with minute colorless setae (Fig. 6D), and moderately

covered with short colorless setae on each side of anal sclerite. Rectal scales present. Rectal organ of three lobes, each with six to eight finger-like secondary lobules. Anal sclerite X-shaped, with short broad anterior arms about half length of posterior arms and with forked apices. Last abdominal segment not bulged laterally and lacking ventral papillae. Posterior circlet with 88 rows of hooklets with up to 17 or 18 hooklets per row.

Specimens examined. One female and two males (with associated pupal exuviae and cocoons), reared from pupae, and one mature larva collected from the same stream as noted for *S. dadagaunense* sp. nov.

Remarks. The female and males with their pupal exuviae from Nepal are tentatively identified as *S. grisescens* from India (Brunetti, 1911; Puri, 1932) by sharing many characters including the dark colored female and male legs (Fig. 3D, E), haired basal portion of the radial vein of the female wing, male scutum covered with brassy short hairs, male hind basitarsus moderately enlarged (Fig. 4B), and 10 pupal gill filaments subequal in thickness to one another and arranged vertically as $2+(2+1)+(2+1)+2$, though two middle triplets are overlapped when viewed laterally (Fig. 5H).

There are differences in the color of some parts of the legs between the present specimens and the original description of *S. grisescens* by Puri (1932) as follows (characters in the original description in parentheses): female mid trochanter medium brown (brownish yellow); female mid femur entirely dark brown (black with the base pale yellow); male fore femur light brown with the base yellow and apical cap medium brown (grayish yellow though dark gray distally); male hind trochanter yellow (black with the base yellow); male mid basitarsus yellow on the basal two-thirds (yellow on the basal half); male hind basitarsus dark brown with a little more than the basal half whitish yellow (black with the basal half yellow).

The arrangement of the pupal gill filaments is almost the same as those of *S. chainpurense* Takaoka & Shrestha from Nepal (Takaoka et al., 2020) and *S. perakense* Takaoka & Ya'cob from Peninsular Malaysia (Takaoka et al., 2018). However, this species is distinguished from both species by the relatively large tubercles on the frons and the thorax having tiny secondary projections (Fig. 5A), and from *S. chainpurense* by the male upper-eye (large) facets in 16 or 17 vertical columns and 17 horizontal rows (21 vertical columns and 21 horizontal rows in *S. chainpurense*).

This species is similar in the arrangement of the

pupal gill filaments to *S. xuandai* Takaoka & Sofian-Azirun from Vietnam (Takaoka et al., 2014) but is distinguished from the latter species by the male upper-eye facets in 16 or 17 vertical columns and 17 horizontal rows (20 vertical columns and 20 horizontal rows in *S. xuandai*), male scutum with brassy short hairs (whitish yellow short hairs in *S. xuandai*), and three unbranched ventrolateral trichomes (all three trichomes branched in *S. xuandai*).

The larva of this species was described by Datta (1974). However, no detailed information was given on the presence or absence of paired dorsal protuberances, the number of the rows of hooklets of the posterior circlet, relative ratio of the three articles of the antenna, and the number of the secondary lobules of the rectal organ.

We confirmed for the first time the presence of paired dorsal protuberances (Fig. 6D) on the larval body of *S. grisescens*.

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