

## ***Simulium (Chirostilbia) jefersoni*, a new species of black fly (Diptera: Simuliidae) from the state of Bahia, Brazil**

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### **Abstract**

*Simulium jefersoni* n. sp. is described based on adults, pupae, and larvae collected in Chapada Diamantina National Park and the surrounding area, in the state of Bahia, Brazil. Its affinities with other species, distribution, and biology in Brazil are presented. The immature stages of *S. jefersoni* n. sp. were found in 44% of the 68 streams sampled in the study area. Females did not bite humans in the field.

**Key words:** *Chirostilbia*, black fly, aquatic insects, Neotropical Region, taxonomy, Parque Nacional Chapada Diamantina

### **Introduction**

The subgenus *Chirostilbia* Enderlein includes 14 species, most of which are found in South America (Crosskey & Howard 1997, 2004; Hamada & Pepinelli 2004). Some species in this subgenus, such as *Simulium pertinax* Kollar, bite humans voraciously in parts of Brazil, causing adverse effects on tourism in the southern coastal region of the country (Araújo-Coutinho *et al.* 1988).

Coscarón (1982) first proposed the *S. subpallidum* species group in *Chirostilbia*; he later recognized two species groups: the *subpallidum* and *pertinax* species groups, containing 3 and 11 species, respectively (Coscarón 1987, 1991). In addition, Py-Daniel &

Moreira (1988) and Py-Daniel *et al.* (1988) grouped three other species (*S. empascae* Py-Daniel, Souza & Caldas, *S. distinctum* Lutz, and *S. riograndense* Py-Daniel) in the *distinctum* species group. However, Coscarón (1991) and Crosskey & Howard (2004) did not recognize the *distinctum* species group and maintained only the *subpallidum* and *pertinax* species groups. Ecological surveys of aquatic ecosystems in Brazil have resulted in the description of *S. bifenestratum* (Hamada & Pepinelli 2004) and the description of the female of *S. friedlanderi* Py-Daniel (Pepinelli *et al.* 2003). Further collections in the state of Bahia have revealed a new species of black fly in the subgenus *Chirostilbia*, which is described in this paper.

### Material and methods

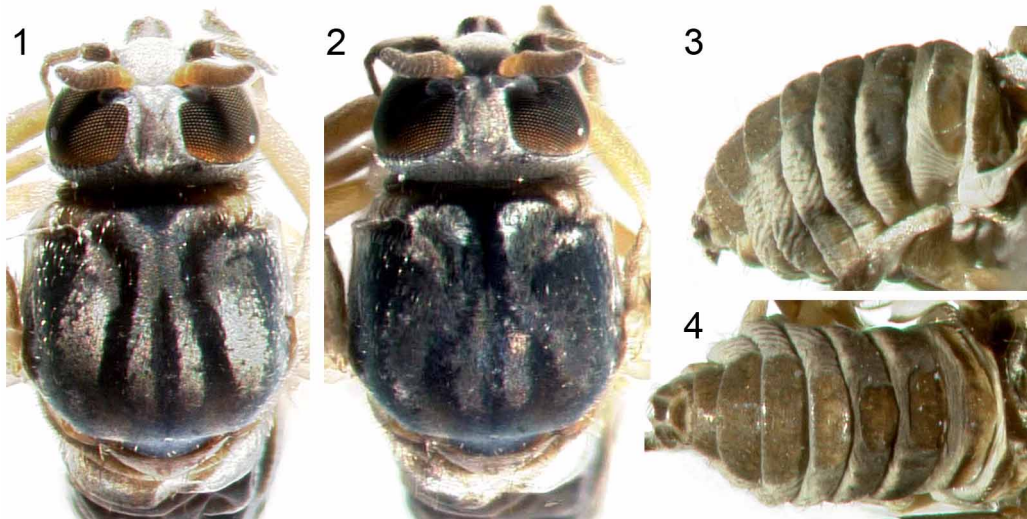
Most of the sampled streams are in Chapada Diamantina National Park (PNCD) in the central region of Bahia State between 12°24'23"S and 13°11'57"S; 41°35'38"W and 41°05'45"W, including Lençóis, Mucugê, Palmeiras, Itaitê and Ibicoara counties. The PNCD was created in 1985 and is administered by the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA—Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis), from its office in Palmeiras County. The PNCD region is located in the Paraguaçu River hydrographic basin, which drains a total area of 56,300 km<sup>2</sup>. The climate is typically tropical, with annual precipitation between 750 and 1000 mm and 4 to 6 months without rain. The mean altitude is about 1000 m, but can reach 1600 m. Vegetation types are campos rupestres (grassland in rocky areas in the hills), campos gerais (grassland in areas without stony soils), cerrados (savanna), matas (Atlantic forest), and capões (small fragments of Atlantic forest in the deep valleys) (IBAMA 2005).

The techniques for collection and rearing of specimens are those detailed by Hamada & Pepinelli (2004) and Pepinelli *et al.* (2003). Dissection of the specimens was carried out using a modified technique routinely used at The Natural History Museum (BMNH) (Hernández & Shelley 2005, Hernández *et al.* 2005). Measurements of specimens and terminology used in the species description are detailed by Shelley *et al.* (1997, 2000) and Hamada & Pepinelli (2004). Description of the thoracic pattern was based on specimens recovered from alcohol, using the technique of Sabrosky (1966). Description of the hypostomal teeth follows that of Adler *et al.* (2004). Images of structures were obtained directly from specimens, using a Synoptics composite system at the BMNH (Hernández & Shelley 2005, Hernández *et al.* 2005) or using an Olympus digital camera attached to a dissecting or compound microscope (Hamada & Pepinelli 2004). Type specimens are deposited in the Invertebrate Collection of the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Amazonas, Brazil, and in the Entomology Department of the BMNH, London, United Kingdom.

**Female** (Figs. 1–17). General body color dark brown to black (specimens recovered from alcohol) (Figs. 1–4). Body length (specimens in alcohol) 2.6–3.0 mm ( $n = 3$ ); thorax lateral length 0.9 mm ( $n = 3$ ). Wing length 1.3–1.8 mm ( $n = 3$ ); wing width 0.7–0.8 mm ( $n = 3$ ).

Head dichoptic with dark red eyes and fronto-ocular triangle well developed (Fig. 8). Frons, clypeus, and occiput black, with silver pruinosity; clypeus and frons covered with dark, erect setae. Antennae with silver pubescence, 0.40–0.44 mm in length; scape and pedicel pale brown, remaining segments dark brown (Fig. 6). Maxillary palpus dark brown; sensory vesicle elongated occupying more than 1/3 length of palpomere III; palpomere V twice length of palpomere III and IV (Fig. 5). Mandible with 12 external serrations and 34–38 internal teeth. Lacinia with 25 or 26 retrorse teeth. Cibarium with well-developed, sclerotized cornuae, without teeth (Fig. 7). Thorax with scutum black covered by evenly arranged, recumbent, whitish setae; posterior margin with short, recumbent, whitish setae. Scutal pattern varying with illumination. With anterior illumination, thorax black with 1+1 median and 1+1 sublateral, silver pruinose vittae extending from anterior to posterior margin of thorax and black lyre-shaped pattern; humeri pale brown with faint gray pruinosity; lateral and posterior margins black (Fig. 1). With posterior illumination, lyre-shaped pattern silver pruinose on black scutum; humeri weakly pale brown and lateral margins weakly silver pruinose; posterior margin black (Fig. 2). Anepisternum dark brown; katapisternum light brown. Scutellum dark brown with recumbent whitish setae interspersed with long, black bristles. Postnotum dark brown with silver pruinosity. Pleura dark brown with silver pruinosity. Costa of wing with sparse distribution of spines and setae. Subcosta with line of few setae up to half length of vein (Fig. 9). Radius with line of setae intermixed with spines apically; basal section bare. Basal tuft of long, dark setae (Fig. 9). Leg coloration and proportions as in Figs. 10–12. Fore leg with coxa, trochanter, femur, and tibiae yellow; apex of tibia weakly pale brown; basitarsus and tarsomeres I–IV dark brown (Fig. 10). Middle leg pale yellow except apical two-thirds of basitarsus and tarsomeres I–IV dark brown to black and one-third of basitarsus whitish (Fig. 11). Hind leg with coxa, apex of femur, half of tibiae, apical one-third of basitarsus, and tarsomeres I–IV dark brown, remainder of hind leg pale yellow (Fig. 12). Claws curved with basal tooth (Fig. 13). Halteres cream with brown base. Abdomen with tergites I–IX dark brown to black (Figs. 3, 4); tergite II silver pruinose on anterolateral margins. Basal fringe with thin, long, golden hairs. Tergal plates developed; sternal plates undeveloped. Sternites grayish black; genitalia dark brown. Eighth sternite weakly sclerotized with irregularly distributed setae on posterior margin; hypogynial valves (= gonapophyses) nearly same length as eighth sternite at its midpoint, subtriangular, membranous except weakly sclerotized on internal margins (Fig. 14). Cercus subquadrangular, covered with long, brown setae; anal lobe (= paraproct)

subtriangular, nearly one and one-half times longer than cercus, sclerotized and covered by long setae basally and small hairs on distal region of posterior margin (Fig. 15). Genital fork stout, sclerotized with apical termination of stem expanded; termination of lateral arm almost straight; anterior process developed, rounded apically; posterior processes poorly developed (Fig. 16). Spermatheca globular, with internal spicules in groups of 2–4 (Fig. 17); spermathecal duct and area of attachment unpigmented.

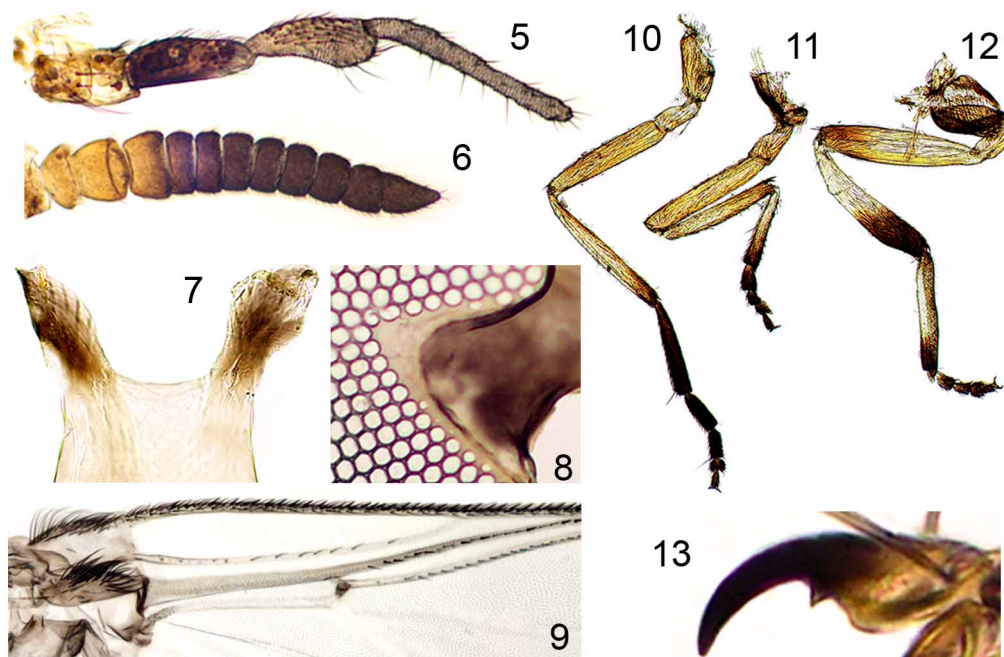


**FIGURES 1–4.** *Simulium jefersoni* n. sp. (Diptera: Simuliidae) female. **1, 2.** Scutum (dorsal length = 0.92 mm). **1.** Dorsal view, anterior illumination. **2.** Dorsal view, posterior illumination. **3, 4.** Abdomen (lateral dorsal length = 1.17 mm). **3.** Lateral view. **4.** Dorsal view.

**Male** (Figs. 18–28). General body color dark brown (specimen recovered from alcohol) (Figs. 18, 19, 23, 24). Body length (specimens in alcohol) 2.2–3.0 mm ( $n = 3$ ); thorax lateral length 0.72–0.78 mm ( $n = 3$ ). Wing length 1.6–2.5 mm ( $n = 3$ ); wing width 0.9 mm ( $n = 3$ ).

Head holoptic with dark red eyes. Antenna with whitish pubescence, 0.50 mm in length; scape, pedicel, and first flagellomere light brown, remaining flagellomeres dark brown (Fig. 20). Palpus dark brown, sensory vesicle small, occupying less than 1/5 of palpomere III; palpomere V about 1.6 times as long as palpomeres III and IV (Fig. 21). Thorax with scutum black covered with recumbent golden hairs. Scutal pattern varies slightly with light incidence: with anterior light source thorax black with 1+1 submedian, silver pruinose cunae on anterior one-third (Fig. 18). With light source posterior to specimen, thorax black (Fig. 19). Humeri pale brown; lateral and posterior margins of scutum pruinose [best seen when specimen viewed laterally]. Scutellum dark brown with recumbent whitish hairs interspersed with long, erect black hairs on posterior margin. Postnotum dark brown to black with silvery gray pruinosity. Anepisternum and

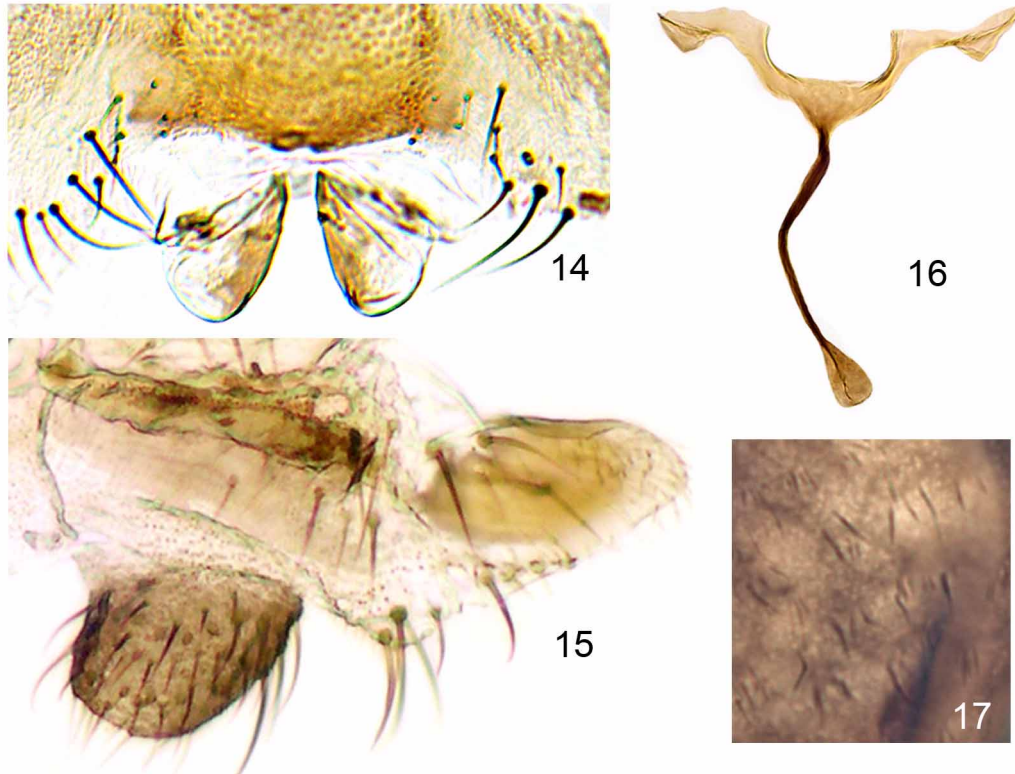
katepisternum dark brown. Wing setation and leg coloration as in female, except claws without basal tooth (Fig. 22). Abdomen (Figs. 23, 24) with tergite I black with posterior margin silver pruinose; basal fringe with long, thin, golden hairs; tergite II black in median region and pale brown laterally; tergites III–IV black; tergites V–IX black mesally and grayish in lateral margins; tergites II (anteriorly), IV–VII with silver pruinosity on ventrolateral margin; in some specimens, silver pruinosity also on tergites VIII and IX [best seen on specimens in lateral view]. Sternal plates undeveloped. Genitalia black; gonocoxite subquadrangular (Fig. 28); gonostyle conical (finger-like) (Fig. 28), nearly as long as gonocoxite at midpoint, with ridge in median region and 2 spiniform setae apically [visible only at high magnification]; gonocoxite and gonostyle covered with long setae. Ventral plate sclerotized, with ventral margin almost straight, without keel and covered by small hairs; basal arms short and deeply sclerotized (Fig. 27). Median sclerite Y shaped with distinct incision in apical one-third (Fig. 26). Paramere with developed and sclerotized basal process and numerous stout teeth centrally (Fig. 25).



**FIGURES 5–13.** *Simulium jeffersoni* n. sp. (Diptera: Simuliidae) female. **5.** Maxillary palp (fifth palpomere length = 0.21 mm). **6.** Antenna (length = 0.42 mm). **7.** Cibarium (internal distance between cornuae = 0.07 mm). **8.** Fronto-ocular triangle. **9.** Wing base. **10.** Foreleg (femur length = 0.40 mm). **11.** Middle leg (femur length = 0.43 mm). **12.** Hindleg (femur length = 0.51 mm). **13.** Foreleg tarsal claw.

**Pupa** (Figs. 29–38). Cocoon length dorsally 2.8–3.8 mm (mean = 3.2 mm, SD = 0.28,  $n = 10$ ), ventrally 3.8–5.4 mm (mean = 4.5 mm, SD = 0.39,  $n = 10$ ); pupa length 2.6–3.9

mm (mean = 3.1 mm; SD = 0.43,  $n = 10$ ); gill length 1.5–2.5 mm (mean = 1.9 mm, SD = 0.38,  $n = 8$ ).



**FIGURES 14–17.** *Simulium jeffersoni* n. sp. (Diptera: Simuliidae) female. **14.** Hypogynial lobes, ventral view. **15.** Cercus and anal lobe (cercus basal length = 0.07 mm), lateral view. **16.** Genital fork (stem length = 0.16 mm). **17.** Groups of internal spicules in the spermatheca.

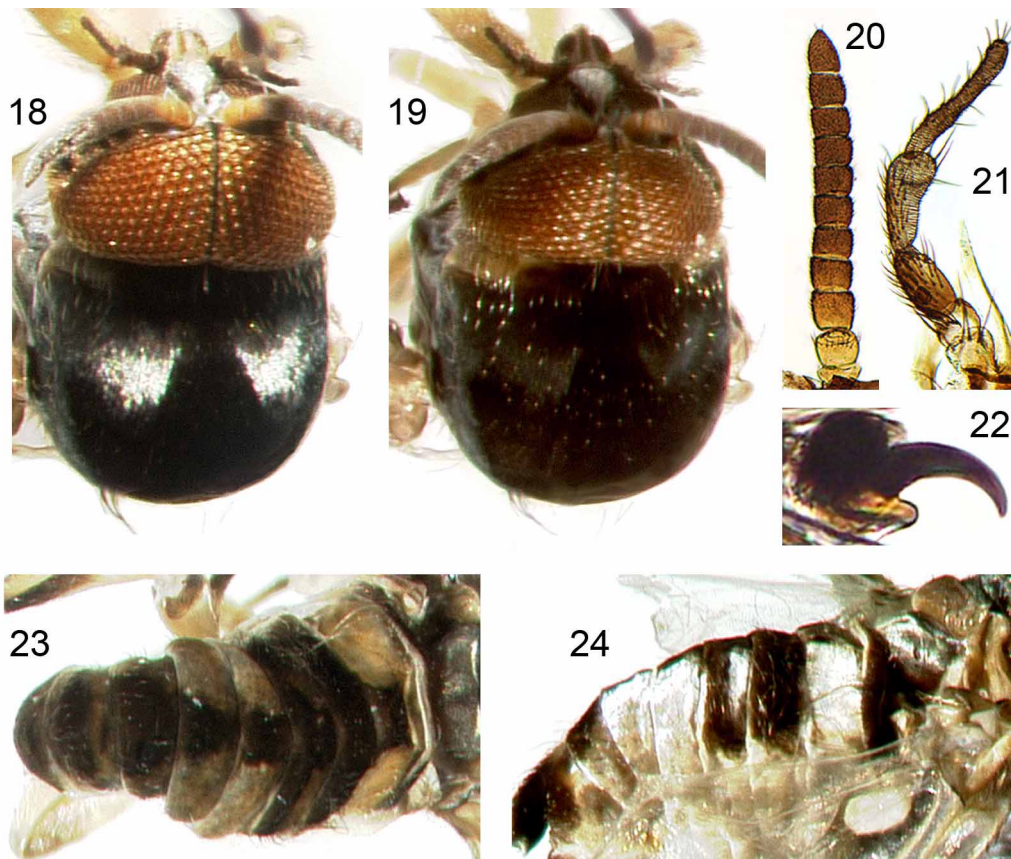
Cocoon shoe shaped, dark brown composed of thick coalesced fibres posteriorly and distinct, loop-like fenestrations anteriorly (Figs. 29, 30). Frontoclypeus with 3+3 long, multiramous frontal and 1+1 long, multiramous, dorsal trichomes (Fig. 34); frontoclypeus with distinct groups of platelets mesally, 1+1 dorsolaterally and 2 or 3 platelets in 2 groups laterally in frontal region, respectively (Fig. 33); tubercles rounded, densely distributed (Fig. 36) over entire frontal and dorsal region. Thorax with 5 pairs of long, multiramous (Fig. 32) trichomes near margin of dorsal cleft, 2+2 multiramous and 1 simple trichomes at gill base, one small, bifid or simple trichome on ventral margin, and 1 bifid or trifid trichome in median region of thorax; tubercles rounded, densely distributed over entire surface. Antennal sheath with transversal punctuations (Fig. 35). Gill filaments pale yellowish with 8 forwardly directed filaments, arranged in 3 dimensions, curving at midpoint and directed inward apically. Gill configuration with main trunk short, giving rise to 3 sets of primary branches, dorsal and ventral (internal) primary branches each

consisting of 3 secondary branches; external set consists of 2 secondary branches; all filaments bifurcate at different heights near base of gill. Filaments stout basally and becoming narrower toward apex, rounded distally, without spicules on surface; edges weakly crenate. All gill filaments approximately same length (Fig. 31). Abdominal tergite I (Figs. 37a–e) with 1+1 submedian, simple trichomes. Tergite II with 4+4 submedian, spiniform setae in longitudinal row, 2+2 small, simple trichomes anterior to most external spiniform setae and 1+1 simple trichome on lateral margin (Fig. 37a). Tergites III and IV with 4+4 submedian, simple hooks in longitudinal row (Figs. 37b, 37c), 1+1 small, simple trichomes anterior to most lateral hooks, and 1+1 small, simple trichomes on lateral margin. Tergite V with 1+1 sublateral, small, simple trichomes, and 1+1 small, simple trichomes on anterior margin; tergite VI with 1+1 submedian and 1+1 sublateral, small trichomes. Tergite VII with 1+1 submedian and 1+1 sublateral, small, simple trichomes. Tergite VIII with 1+1 submedian, simple or bifid, and 1+1 sublateral, simple trichomes, and spine combs distinctly resembling teeth on anterior margin (Fig. 37e). Tergite IX weakly sclerotized, with 1+1 small spines. Spine combs on anterior margin of tergites II, VI–IX (Fig. 37d). Abdominal sternite III (Figs. 38a–d) with 1+1 submedian and 2+2 sublateral, small, simple trichomes; sternite IV with 1+1 submedian and 2+2 sublateral, small, simple trichomes; sternite V with 2+2 close, bifid or trifid hooks in row and 2+2 simple trichomes anterior to most lateral hooks (Fig. 38b); sternites VI and VII with 2+2 well separated, simple, bifid or trifid hooks (Figs. 38c, 38d), sternite VII with 1+1 simple trichomes on lateral margin; sternite VIII without hooks; sternite IX weakly sclerotized. Abdominal sternites III–IX with spine combs on anteromedian margin (Fig. 38a).

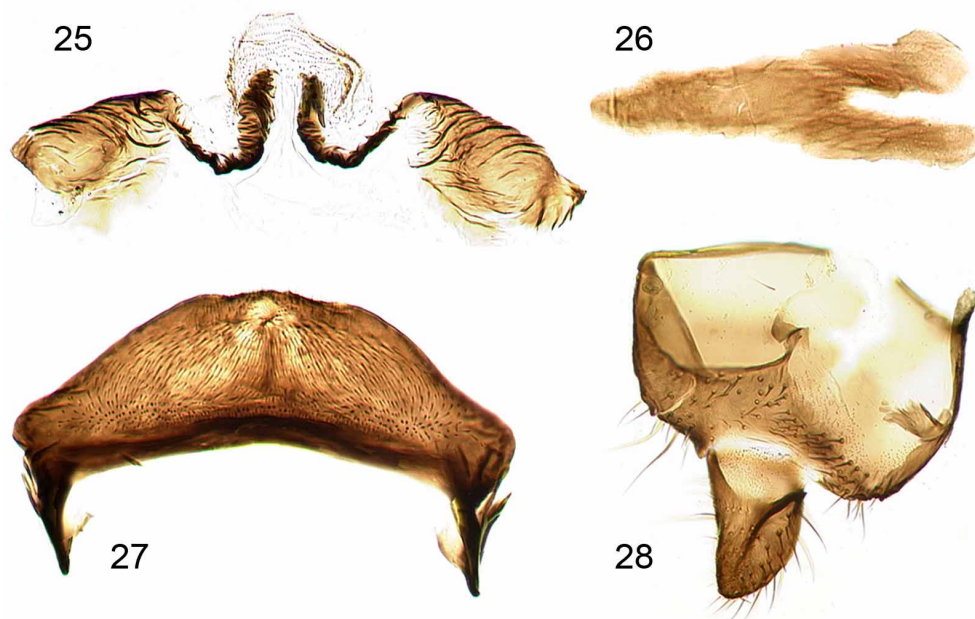
**Larva** (last instar) (Figs. 39–45). Body length: 5.8–6.6 mm (mean = 6.2 mm, SD = 0.2,  $n = 10$ ); head capsule lateral length: 0.6–0.8 mm (mean = 0.7 mm, SD = 0.06,  $n = 10$ ); dorsal width of head capsule: 0.5–0.7 mm (mean = 0.6 mm, SD = 0.05,  $n = 10$ ).

General body coloration pale gray (in Carnoy's solution); form as in Fig. 39. Head mainly pale brown, numerous small setae present on all surfaces and head capsule slightly wrinkled. Head pattern positive (Fig. 43). Cervical sclerites small, elliptical, free in membrane. Postgenal cleft subtriangular, wider basally (Figs. 41, 44). Postgenal bridge 0.7 times as long as hypostoma (Fig. 41). Hypostoma with strongly pigmented anterior margin and 9 apical teeth (Fig. 40): median tooth simple and more prominent than sublateral teeth, 3+3 rows of sublateral teeth, middle tooth smaller than remaining teeth, 1+1 lateral teeth nearly same height as median tooth, 2 poorly developed paralateral teeth, and 3 small lateral serrations; hypostoma with 1+1 line of 6 or 7 lateral setae parallel to lateral margin and 1+1 long and 1+1 or 2+2 short setae in posterior region of hypostoma near hypostomal groove. Subesophageal ganglion not pigmented. Antennae (Fig. 42) as long as labral fan stalk; antennal segments brown, except whitish apical one-third of median and basal region of distal segment; segments proportions (proximal, medial and distal) approximately 0.7–0.9: 0.4–0.6: 1.2–1.3 ( $n = 3$ ). Mandible with 3 apical teeth, basal tooth more prominent than remaining teeth, second comblike teeth with first tooth longer than

second and third, mandible with 9 internal teeth, and mandibular serration with anterior teeth longer than posterior; mandibular brushes well developed; mandible with small, simple setae near external margin and 2 prominent, simple trichomes at base of apical mandibular brush. Lateral mandibular process simple and thick. Maxillary palp heavily pigmented, nearly 3 times as long as wide at base. Cephalic fan with 43–47 rays. Thorax pale dorsally and grey ventrally. Proleg with plate heavily sclerotized with band of more than 40 processes of nearly 13 hooks ( $n = 1$ ). Pupal gill histoblast dark brown with 8 filaments. Abdomen usually completely gray dorsally, progressively paler ventrally, last segments white; faint segmental banding visible dorsally (Fig. 39). Cuticle mainly lacking setae. Ventral nerve cord pale gray. Ventral posterior tubercles absent. Anterodorsal arms of anal sclerite shorter in length than posteroventral arms (Fig. 45). Posterior proleg bearing approximately 100 rows of up to 13 or 14 hooks ( $n = 2$ ). Anal papillae with 3 branches, each with approximately 7 or 8 finger-shaped lobes of same length ( $n = 1$ ).



**FIGURES 18–24.** *Simulium jefersoni* n. sp. (Diptera: Simuliidae) male. **18, 19.** Scutum (median dorsal length = 0.77 mm). **18.** Dorsal view, anterior illumination. **19.** Dorsal view, posterior illumination. **20.** Antenna (length = 0.50 mm). **21.** Maxillary palp (fifth palpomere length = 0.14 mm). **22.** Tarsal claw. **23, 24.** Abdomen (lateral dorsal length = 1.15 mm). **23.** Lateral view. **24.** Dorsal view.



**FIGURES 25–28.** *Simulium jefersoni* n. sp. (Diptera: Simuliidae) male. **25.** Paramere. **26.** Median sclerite (length = 0.12 mm). **27.** Ventral plate (widest width = 0.17 mm). **28.** Gonocoxite and gonostyle (gonostyle length = 0.08 mm).

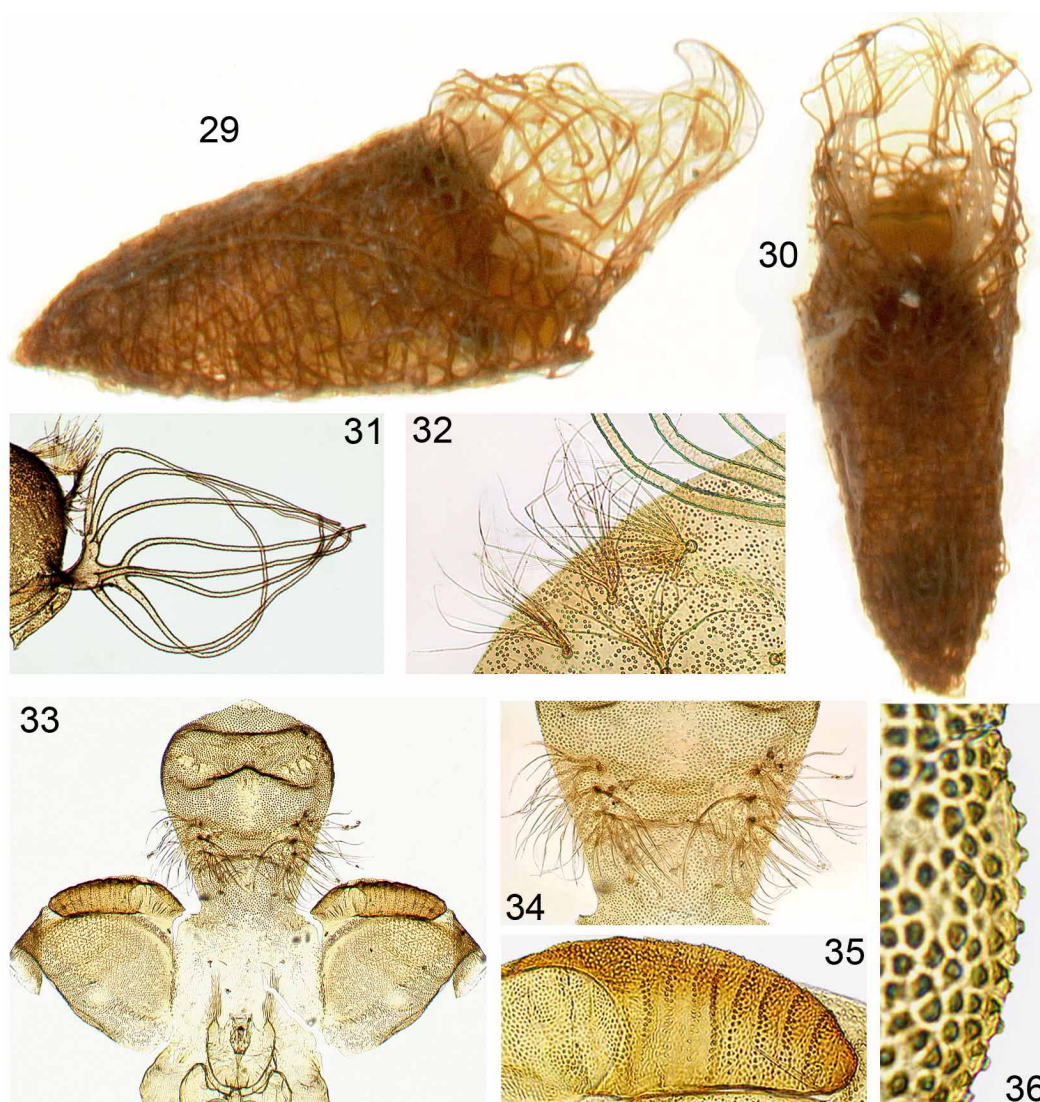
#### Type Material

**Holotype** (INPA): Brazil, Bahia State, Palmeiras County. Parque Nacional Chapada Diamantina: Cachoeira da Fumaça stream (#32), 12°36'S 41°27'W, 31.vii.2005 (N. Hamada, M. Pepinelli and V.L. Landeiro) - female (pinned), with pupal exuviae in glycerine.

**Paratypes:** Brazil, Bahia State, **Palmeiras County.** Parque Nacional Chapada Diamantina: Cachoeira da Fumaça stream (#32), 12°36'S 41°27'W, 31.vii.2005 (N. Hamada, M. Pepinelli & V.L. Landeiro) - 2 pupae (P), 2 larvae (L) in ethanol, 1 male (M) pinned, with pupal exuviae in glycerine (INPA); small tributary of Mucujezinho stream (#26), 12°28'S 41°27'W, 07.vii.2003 (N. Hamada & J. Silva) - 2P, 2L in ethanol (INPA); Galinha stream (#29), Bomba village (Vale do Capão), Gerais do Vieira, 12°40'S 41°29'W, 08.vii.2003 (N. Hamada & J. Silva) - 3L in ethanol (INPA); Batista River (#30), Pousada do Capão, 12°37'S 41°29'W, 08.vii.2003 (N. Hamada & J. Silva) - 2L in ethanol (INPA); Sobradinho stream (#34), Lençóis-Capão trail, Gerais do Morrão, 12°32'S 41°28'W, 10.vii.2003 (N. Hamada & J. Silva) - 1L, 1P in ethanol, 1F pinned with pupal exuviae in glycerine (INPA); Águas Claras stream, Gerais do Morrão, Lençóis-Capão trail, 12°31'S 41°28'W, 10.vii.2003 (#35) (N. Hamada & J. Silva) - 1L, 2P in ethanol (INPA), 26.vii.2005 (#14) (N. Hamada & M. Pepinelli) - 2P ethanol (INPA); Morrão stream (#13),

Morrão trail, 12°31'S 41°28'W, 26.vii.2005 (N. Hamada & M. Pepinelli) - 1L, 2P in ethanol (INPA); headwater of Conceição dos Gatos stream (#15), Morrão trail, 12°32'S 41°28'W, 26.vii.2005 (N. Hamada & M. Pepinelli) - 1P in ethanol (INPA); Mucujezinho stream (#17), 12°28'S 41°27'W, 27.vii.2005 (N. Hamada & M. Pepinelli) - 2L, 3P in ethanol (INPA). **Lençóis County**, Parque Nacional Chapada Diamantina: Cachoeirinha stream (#32), 12°33'S 41°24'W, 09.vii.2003 (N. Hamada & J. Silva) - 2P in ethanol (INPA), 25.vii.2005 (N. Hamada & M. Pepinelli) - 1P in ethanol (INPA). **Andaraí County**, Parque Nacional Chapada Diamantina: Piabas River (below erosion area) (#39), 12°51'S 41°18'W, 11.vii.2003 (N. Hamada & J. Silva) - 1L, 2P in ethanol (INPA); Piabas River (#43), 12°57'S 41°16'W, 04.viii.2005 (N. Hamada, M. Pepinelli & V.L. Landeiro) - 2L, 2P in ethanol (INPA); Coisa Boa River (#40), 12°51'S 41°18'W, 11.vii.2003 (N. Hamada & J. Silva) - 1P in ethanol (INPA); Roncador River (#41), "off road" track between Andaraí and Lençóis, 12°41'S 41°21'W, 11.vii.2003 (N. Hamada & J. Silva) - 2L, 3P in ethanol, 1F pinned (INPA); Serrano River (#9), 12°33'S 41°23'W, 25.vii.2005 (N. Hamada, M. Pepinelli) - 2L, 1P in ethanol (INPA); Pombos waterfall (#38), Igatu, 12°54'S 41°19'W, 03.viii.2005 (N. Hamada, M. Pepinelli & V.L. Landeiro) - 2P in ethanol (INPA). **Mucugê County**, Parque Nacional Chapada Diamantina: Cumbuca River (#42), 12°59'S 41°21'W, 12.vii.2003 (N. Hamada & J. Silva) - 3P in ethanol, 1M pinned (INPA); 1F, 1M pinned (genitalia on slide), 2F, 2M, 7P, 4L in slides, several P in ethanol, several L in Carnoys (BMNH); stream in the access road to Sibéria waterfall (#45), 12°56'S 41°21'W, 15.vii.2003 (N. Hamada & J. Silva) - 3P in ethanol (INPA); Pimenteiras stream (#46), in the access road to Sibéria waterfall, 12°57'S 41°21'W, 15.vii.2003 (N. Hamada & J. Silva) - 1L, 4P in ethanol (INPA); first stream on the access road to Sibéria waterfall (#41), 12°58'S 41°21'W, 04.viii.2005 (N. Hamada, M. Pepinelli & V.L. Landeiro) - 2L, 2P in ethanol (INPA). **Itaitê County**, Urubu River (#24), Chapadinha, Rumo village, 13°11'S 41°10'W, 29.vii.2005 (N. Hamada, M. Pepinelli) - 2P in ethanol, 1F pinned (INPA); Barrigudinha River (#26), Rumo village, 13°13'S 41°08'W, 29.vii.2005 (N. Hamada, M. Pepinelli) - 2L, 2P in ethanol, 2F, 2M pinned (INPA). **Ibicoara County**, Parque Municipal Natural do Espalhado, Espalhado River (# 52), 13°19'S 41°09'W, 08.viii.2005 (N. Hamada, M. Pepinelli & V.L. Landeiro) - 4P in ethanol, 1F, 1M pinned (INPA). **Rio de Contas County**, Mocotó River (#57), Mato Grosso village, 13°25'S 41°50'W, 10.viii.2005 (N. Hamada, M. Pepinelli & V.L. Landeiro) - 2L, 3P in ethanol (INPA).

**Etymology:** This species is named in honor of Jeferson Oliveira da Silva (INPA/CPEN), an ethical and dedicated professional and a good friend, who has been working tirelessly with N. Hamada in the field and laboratory.

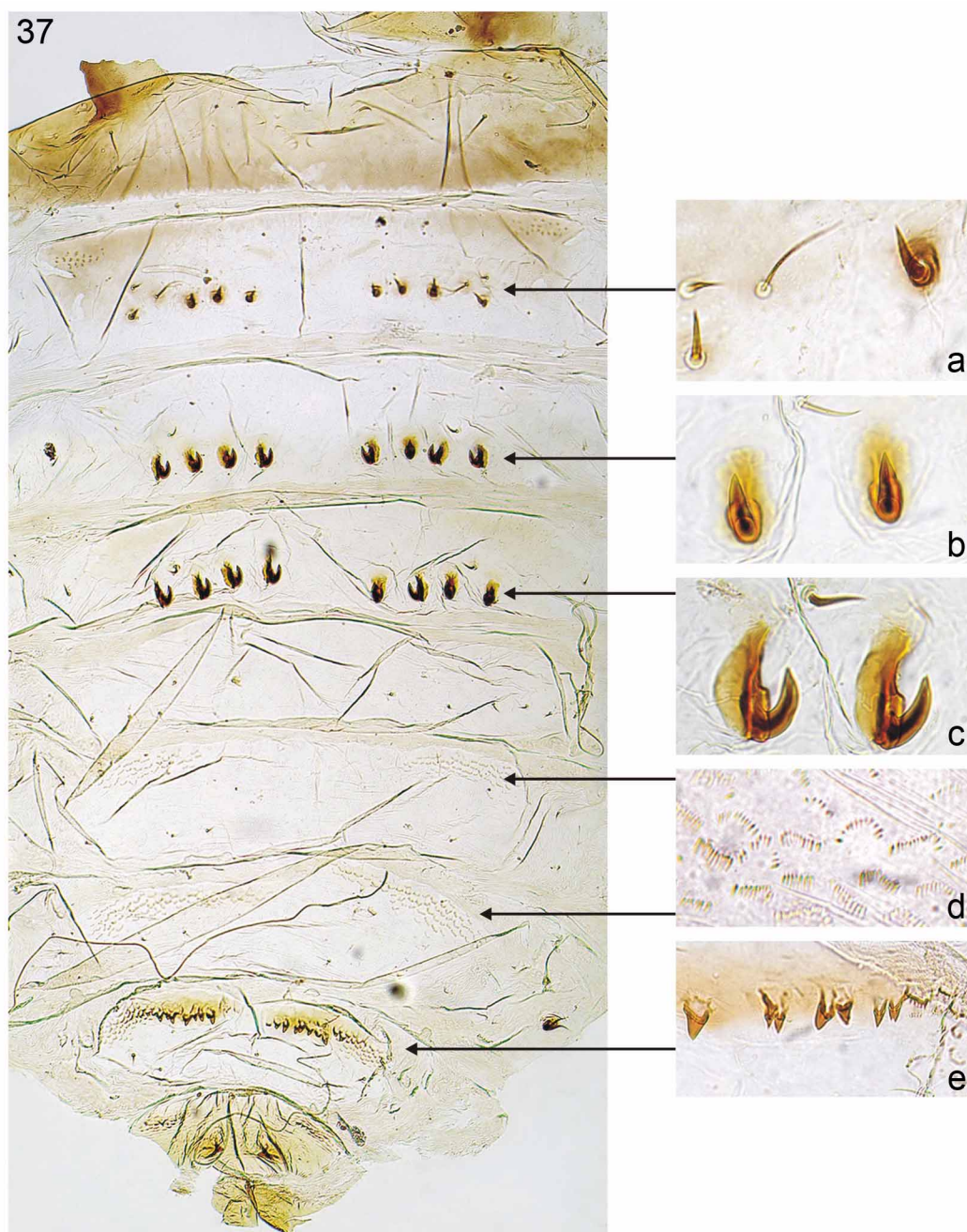


**FIGURES 29–36.** *Simulium jefersoni* n. sp. (Diptera: Simuliidae) pupa. **29, 30.** Habitus. **29.** Lateral view (length = 3.40 mm). **30.** Dorsal view. **31.** Gill filaments (length = 1.90 mm). **32.** Thoracic trichomes (trichomes length = 0.28 mm). **33.** Frontoclypeus (antennal sheath length = 0.38 mm). **34.** Frontoclypeus trichomes (trichome length = 0.27 mm). **35.** Antenal sheath. **36.** Cephalic tubercles.

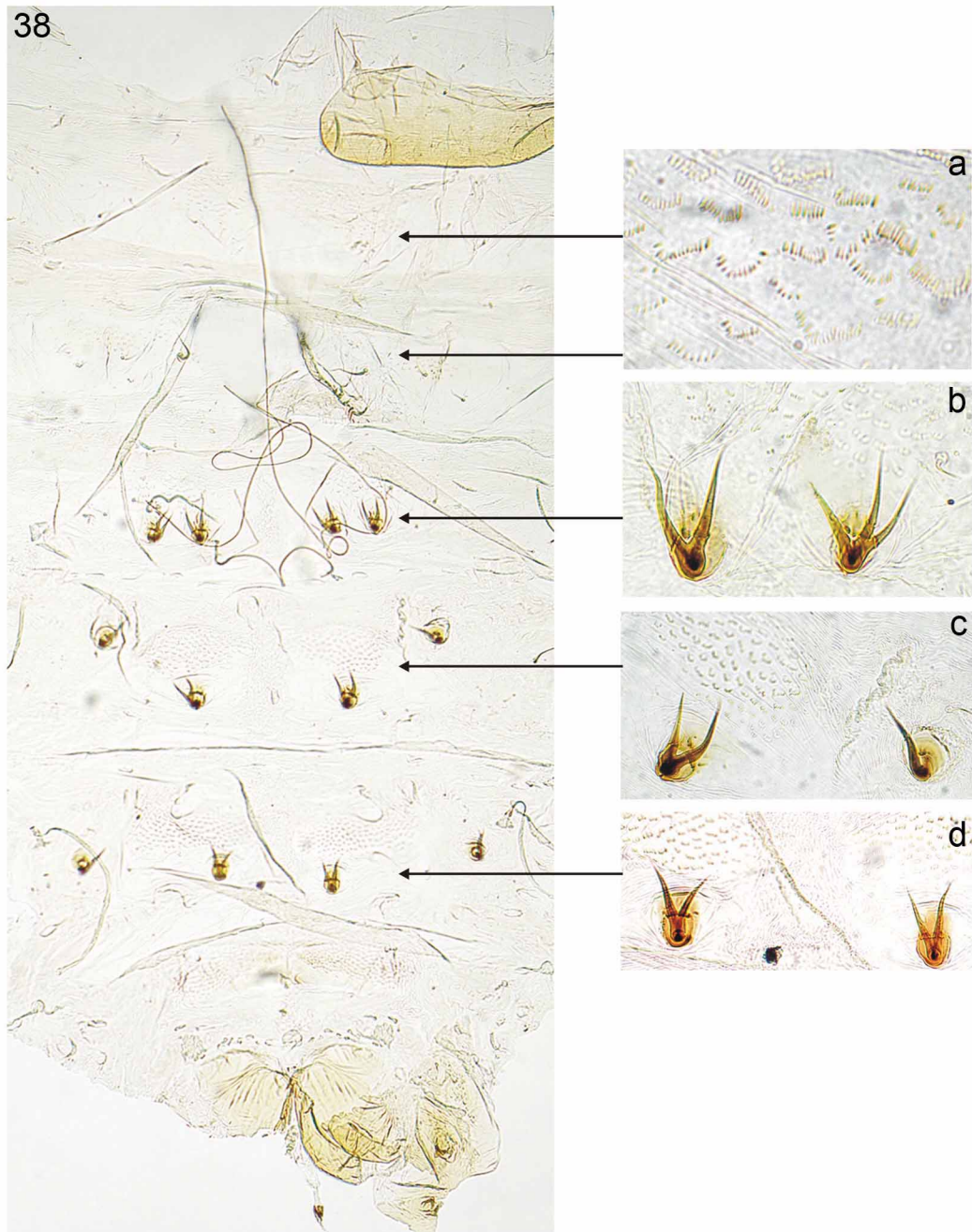
**Taxonomic discussion and diagnosis:** *Simulium jefersoni* n. sp. is placed in the subgenus *Chirostilbia* based on the combination of characters given by Coscarón (1987, 1991). Within *Chirostilbia*, this species might be included in the *S. pertinax* species group by having females with a black thorax and tarsal claws with a basal tooth (Coscarón 1987). However, the males have a ridge on the median region of the gonostyle, as in the species of the *S. subpallidum* group. The adults in the subgenus *Chirostilbia* are difficult to separate,

especially those species in the *S. pertinax* group, without examination of the pupal gill configuration. Comparisons, especially with species in image archives in the BMNH, identified black fly specimens at INPA and BMNH, and published illustrations of known species of *Chirostilbia*, indicate that *S. jefersoni* n. sp. is morphologically similar to several species. The females are externally similar to females of *S. acarayense* Coscarón & Wygodzinsky, *S. laneportoi* Vargas, *S. papaveroi* Coscarón, *S. serranum* Coscarón, *S. spinibranchium* Lutz, the black form of *S. subpallidum* Lutz, and *S. striginotum* Enderlein by having the scutum black with 1+1 median and 1+1 sublateral silver pruinose vittae and a black lyre-shaped pattern. However, the new species can be distinguished by the structure of the anal lobe (Fig. 15) and its length, which is nearly 1.5 times longer than the cercus. In the other species, the anal lobe is approximately 2.5 to 3 times longer than the cercus. The male thoracic pattern of *S. jefersoni* n. sp. is also similar to that of species in the *S. pertinax* species group, from which this species can be distinguished by the structure of the gonostyle and the ventral plate. In *S. jefersoni* n. sp., the gonostyle is conical and finger-like with a ridge (Fig. 28), and the ventral plate is distinctly rectangular, with the ventral margin nearly straight (Fig. 27), similar to that of *S. acarayense* (Coscarón 1991). The most reliable character for identifying *S. jefersoni* n. sp. is the structure of the cocoon and the number and configuration of the pupal gill filaments. The pupa of the new species has eight gill filaments (Fig. 31), which group this species with *S. acarayense*, *S. empascae*, *S. laneportoi*, *S. papaveroi*, *S. pertinax*, *S. serranum*, *S. spinibranchium* and *S. subpallidum*. However, *S. jefersoni* n. sp. can be separated by the shoe-shaped cocoon with prominent anterior fenestrations (Figs. 29, 30). In this respect, *S. jefersoni* n. sp. is similar to *S. distinctum*, *S. friedlanderi*, *S. obesum* Vulcano and *S. riograndense*, but the number of its gill filaments distinguishes it from these species, which have 10, 11, >100, and 10 filaments, respectively. The cocoon in *S. empascae* is also shoe-shaped, but the pupal gill filaments and the cocoon have different configurations. The pupa of *S. jefersoni* n. sp. also can be recognized by the set of three primary branches giving rise to three sets of secondary branches that curve at their midpoints and diverge inward apically (Fig. 31), and the thorax and frontoclypeus with prominent, multiramous trichomes (Figs. 32, 34). The pupae of the known eight-filamented species of *Chirostilbia* in the Neotropical Region have a different gill and trichome configuration pattern. The postgenal cleft of the last-instar larva of *S. jefersoni* n. sp. is similar to that of *S. serranum* (Coscarón 1981), but both species can be distinguished by the different structure of the filaments of the gill histoblast.

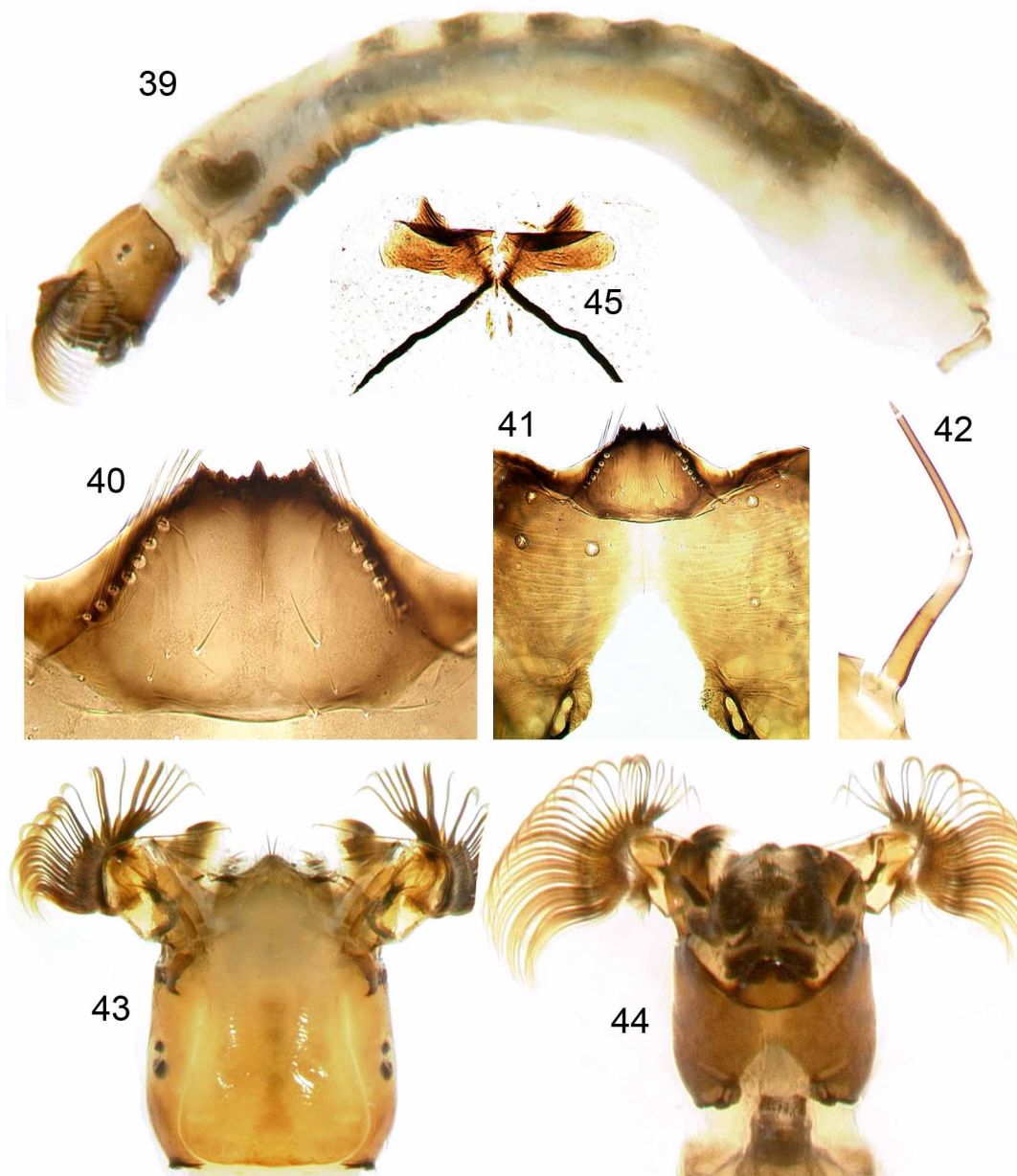
**Bionomics:** *Simulium jefersoni* n. sp. has been collected only in the state of Bahia, Brazil, in Chapada Diamantina National Park and the surrounding area. The immature stages were collected from trailing vegetation, deciduous leaves, and rocks in areas with faster flow in 30 rock-bottomed streams, with width varying from 1 to 50 m. The streams had black water, mean water temperature of 21°C (SD = 2.0), median electrical conductivity below 20µS/cm, and mean pH of 4.5 (SD = 0.45). These streams were located at altitudes of 468 to 1345 m. Females were not collected biting humans.



**FIGURE 37.** *Simulium jefersoni* n. sp. (Diptera: Simuliidae) pupa. Abdomen, dorsal view, a: lateral setae on tergite II; b: setae and hooks on tergite III; c: hooks on tergite IV; d: microspine combs on tergites II, VI–IX; e: spine comb resembling teeth on tergite VIII.



**FIGURE 38.** *Simulium jefersoni* n. sp. (Diptera: Simuliidae) pupae. Abdomen, ventral view (distance between second and third hooks of sternite VII = 0.20 mm), a: group of microspines on sternites III–V; b: hooks on sternite VI; c: hooks on sternite VII; d: hooks on sternite VIII.



**FIGURES 39–45.** *Simulium jefersoni* n. sp. (Diptera: Simuliidae) larvae. **39.** Larval habitus, lateral view (length = 6.2 mm). **40.** Hypostoma (widest width = 0.18 mm). **41.** Ventral view of postgenal cleft. **42.** Antenna (length = 0.19 mm). **43, 44.** Head capsule (length = 0.87 mm). **43.** Dorsal view. **44.** Ventral view. **45.** Anal sclerite (short arms length = 0.20 mm).

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