

Simulium (Trichodagmia) guianense Wise (complex)

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This is a common and widespread species in Brazil. It is the primary vector of human onchocerciasis in highland areas of the Amazônia focus and consequently has been the most investigated species of the subgenus.

Simulium guianense Wise, 1911: 252. LECTOTYPE f#, GUYANA: Essequibo River, 1908 (*Melville*) (BMNH) [Lectotype designation by Smart, 1940: 5.]. [Examined.]

Simulium pintoï d'Andretta & d'Andretta, 1945: 101. HOLOTYPE f#, BRAZIL: São Paulo State, Salto de Piraçicaba, Piraçicaba, 28.vii.1944 (*Vulcano Andretta & Andretta Jr.*) (Depository unknown). [Synonymy with *S. guianense* by Shelley *et al.* 1997: 40.]

Simulium ortizi Ramírez Pérez, 1971: 336. HOLOTYPE [sex unspecified, but f#], VENEZUELA: Bolivar State, San Felix, Rio Caroni, (no collection date) (*J. Ramírez Pérez*)(DERM). [Synonymy with *S. pintoï* by Ramírez Pérez *et al.*, 1982: 55]. [Synonymy with *S. guianense* by Shelley *et al.* (1997: 40).]

FEMALE. General body colour black. Body length 1.9-3.3 mm (mean=2.7 mm, s.d. = 0.3, n = 59); wing length 1.7-2.7 mm (mean = 2.2, s.d. = 0.2, n = 56), wing width 0.7-1.5 mm (mean = 1.0, s.d. = 0.1, n = 51).

Head — dichoptic with dark red eyes; nudiocular area slightly developed (Fig. X). Frons, clypeus and occiput black with grey pruinosity; frons and clypeus with dense vestiture of recumbent brass-coloured setae. Mouthparts brown. Antennae dark brown with scape, pedicel and first flagellomere light brown. Cibarium not armed with teeth (Fig.X), but small denticles and coloured bumps resembling tubercles present in central trough in a population from Mucajai only seen at high magnification as shown in Shelley *et al.* (1989b, Fig. 4); cornuae undeveloped and sclerotised.

Thorax — scutum, including paranotal folds, scutellum and humeri dark grey with feint silvery grey pruinosity. Scutum and scutellum with numerous, short, broad, brass-coloured, fine or scale-like setae arranged irregularly in small groups. Scutal pattern varying only slightly with illumination. With anterior illumination, thorax dark grey to black (Fig. X). With posterior illumination thorax dark grey to black with feint silver grey pruinosity on anterior third (Fig. X); in freshly emerged specimens fine median line runs two thirds length of the scutum from the anterior border occurs where no scales present. Pleural region dark grey and brown with silvery grey pruinosity. Postnotum dark grey with light silvery grey pruinosity. Costa of wing with sparse distribution of hairs and spines. Subcosta either bare or with up to six fine setae in distal half. Basal

sector of radius with single row of hair-like setae on basal two thirds, a single row of spine-like setae interspersed with hair-like setae on distal third; basal tuft of dark hairs. Leg proportions and coloration as in Fig. X. Legs brown and white banded as follows: fore leg with coxa, trochanter and femur light brown, tibia light brown with anterior surface white and upper border dark brown, and tarsus black; mid leg coxa dark grey pruinose, trochanter and femur light brown, tibia grey, basitarsus white with black distal articulation and rest of tarsi black; hind leg coxa dark grey pruinose, trochanter light brown, femur black except proximal articulation, tibia black with distal articulation and outer distal half of margin white, basitarsus with basal three quarters white and distal quarter black, rest of tarsi black. Scale-like hairs on femora and tibiae of mid and hind legs as in *S. exiguum*. Claw curved and slender without basal tooth. Haltere light yellow with dark brown stem.

Abdomen — Abdominal tergites I-IV velvet black with silver pruinosity covering tergite II, tergites V-IX shiny black. Tergal plates well developed. Sternites and genitalia black. Eighth sternite highly sclerotised in posterior two-thirds with 1+1 groups of 13-24 well developed setae; gonopophyses large, membranous, not meeting centrally and densely covered in fine setae (Fig. X). Cerci hemispherical; paraprocts broadly quadrangular with dorsally exposed part sclerotised and more ventral part membranous with small tail-like projection pointing internally close to gonopophyses; whole paraproct densely covered in setae (Fig. X). Genital fork short, with highly developed terminations to lateral arms and sclerotised anterior processes (Fig. X). Spermatheca oval, highly sclerotised, with internal sculpturing and few small spicules; width of membranous area of insertion of spermathecal duct large, about half maximum width of spermatheca (Fig. X).

MALE. General body colour black. Body length 1.9-3.1 mm (mean= 2.5 mm, s.d. = 0.3, n = 31); wing length 1.5-2.3 mm (mean = 1.9, s.d. = 0.2, n = 29); wing width 0.6-1.1 mm (mean = 0.8 mm, s.d. = 0.1, n = 21).

Head — holoptic with dark red eyes. Clypeus black with silvery grey pruinosity and many, long, dark, upright setae. Mouthparts black, antennae black with scape, pedicel and first flagellomere orange-brown.

Thorax — scutum velvet black with varying degrees of silvery grey pruinosity and covered by evenly distributed recumbent golden hairs. Scutal pattern varies slightly with light incidence, the clearer pattern being seen with posterior lighting (Fig. X). The same pattern is seen X). In all cases the silver ornamentation covers most of the scutum except for a broad, median vitta that runs from anterior border posteriorly for about three quarters of scutal length and 1+1 lateral oval areas in the central part of the scutum. The median vitta varies from sub-rectangular (Figs. X) to sub-triangular (Figs.) and in the form of a capital T (Fig. X). The lateral areas vary from large and oval (Figs. X)

to a small, indistinct area (Fig. X). Humeri and paranotal folds black with silvery grey pruinosity. Scutellum velvet black on anterior half and black with silvery grey pruinosity on posterior half, postnotum black with silvery grey pruinosity. Pleural region black with silvery grey pruinosity. Scutum and postnotum covered in short, recumbent golden hairs and posterior margin of scutellum with strong, brown bristles curved anteriorly. Wing venation as in female except basal sector of Radius and Subcosta bare. Leg coloration as in female except light brown and grey areas black in fully coloured specimens. Haltere lemon yellow with orange-brown base.

Abdomen — abdominal tergites velvet black, basal fringe light brown. Silver ornamentation as follows: tergite II all silver except for posterior edge and median area of posterior half of segment, most of lateral area of tergites V- VII and lower margin of tergite VIII. Sternites yellowish brown with well developed black sternal plates on segments III-VIII. Genitalia dark brown. Gonocoxite sub-rectangular, gonostyle elongate, pyriform with large blunt distal spine (Fig. X) and sometimes smaller accessory spine. Ventral plate sclerotised, rectangular with shallow, apical (posterior) depression, well developed, parallel basal (anterior) arms and setose, ventral, pyriform, median prolongation not reaching apical level of well developed lateral shoulders (Fig. X). Median sclerite rectangular with deep incision at narrower apex (Fig. X). Paramere poorly developed with no spines and little sclerotisation (Fig. X).

PUPA. Cocoon length dorsally 2.0-3.1 mm (mean = 2.5 mm, s.d. = 0.3, n = 35); ventrally 2.2-3.6 mm (mean = 2.8 mm, s.d. = 0.3, n = 37); pupa length 1.9-3.1 mm (mean = 2.4 mm, s.d. = 0.3, n = 37); gill length 0.5-0.9 mm (mean = 0.7 mm, s.d. = 0.1, n = 36).

Cocoon — shoe-shaped, light to dark brown; rim of aperture not reinforced and without central protuberance. Cocoon of smooth and gelatinous appearance with no obvious fibres.

Gill — light brown with twelve filaments arranged in form of antlers (Fig. T162), main trunk giving rise to three primary branches, dorsal with six filaments, median with four filaments and ventral with two filaments. Branching of filaments in basal two thirds of gill. Filaments short with distal dark pointed ends, their more distal surfaces with spicules in annular arrangement.

Head — with 2+2 small, unbranched frontal trichomes, and 1+1 small, unbranched, facial trichomes; surface of head with scattered platelets on periphery and base of frontal region and rounded tubercles on facial and frontal region. Thorax with up to 4+4 simple or sometimes bifid, poorly developed, antero-dorsal trichomes. Surface of thorax with sparsely developed platelets mainly on dorsal and ventral margins and rounded and pointed tubercles around base of gill, dorsal cleft and alar region. Abdominal tergite II with 4+4 fine hooks in line on posterior border of segment; tergites III-V with 4+4 well developed simple hooks; tergites VI-IX with patches of poorly developed spine combs on antero-lateral margins; tergite IX with no obvious terminal spines.

Abdominal sternite IV with 1+1 simple, short, unsclerotised spines; sternite V with 2+2 bifid or sometimes trifid hooks; sternites VI and VII with 2+2 bifid or trifid hooks; 1+1 patches of spine combs on postero-lateral borders of sternites IV-VIII.

TAXONOMIC DISCUSSION.

Wise (1911) first described *S. guianense s.l.* from eleven females collected by Melville while biting man on the Essequibo River and tributaries of its upper reaches in Guyana. Details of the taxonomy of this species are fully reviewed in Shelley *et al.* (1997). Since then, more paralectotypes have been discovered in the NHM and these are discussed in Shelley *et al.* (2004). Further taxonomic descriptions of this species can be found in Coscarón (1991) [as *S. pintoï*], d'Andretta & d'Andretta (1945) [as *S. pintoï*], Ramírez Pérez (1971) [as *S. ortizi*] & Shelley *et al.* (2000).

Coscarón (1987) placed *S. guianense* in the *orbitale* subgroup of the subgenus *Thyrsopelma* and this position was later maintained by Miranda-Esquivel & Coscarón (2001) in their cladistic analysis of the subgenera *Thyrsopelma* and *Trichodagmia*. However, Crosskey and Howard (1997) had placed *S. guianense* in the subgenus *Trichodagmia*, an action followed in this work for the reasons given in the section entitled “ The supraspecific classification of the Simuliidae in relation to Brazil”. Coscarón & Coscarón-Arias (2007) placed *S. guianense* in the subgenus *Thyrsopelma* and accepted all the synonyms listed in Shelley *et al.* (1997).

Simulium guianense s.l. is a relatively well studied species in Brazil because of its rôle as a primary vector of human onchocerciasis in the highland areas of the Amazônia focus of the disease in Brazil and Venezuela (*e.g.*, Basáñez *et al.* 1988; Shelley, 1988; Shelley *et al.*, 1987, 1997, 2001a) and it was suspected of being a complex of sibling species largely because of variations in biting behaviour. Charalambous *et al.* (1996) then showed the presence of four distinct cytotypes in Brazil collected in different localities: cytotype A from Goiás State (Rio Tocantins and Rio Mucambão), B from Amapá State (Rio Oyapoque), C from Maranhão State (Rio Tocantins) and D from Pará State (Rio Xingu). Further evidence that more cytotypes of *S. guianense* might be found has been given by Shelley *et al.* (2002a), who observed morphological differences in the larvae and wing venation of adults in two populations of this species from Goiás State (Rio Verdão and Rio Doce). The variation in the scutal pattern in the males of *S. guianense s.l.* and any link that it may have to cytotype needs further study. In the *S. damnosum* complex in Africa male scutal pattern variation is useful in some cases as a character for cytotype identification, but considerable variation has been noted in the *soubrense /sanctipauli* subgroup suggesting that variation within cytotype probably also occurs (Cheke *et al.*, 1987; Dang & Peterson, 1980; Meredith *et al.*, 1983).

Simulium guianense s.l. is similar to *S. duodenicornium*, *S. itaunense*, *S. orbitale* and *S. perplexum* (see “**TAXONOMIC DISCUSSION**” under *S. orbitale* for full details).

DISTRIBUTION.

Simulium guianense has a widespread distribution in Brazil being found in the states of Amapá, Amazonas, Espírito Santo, Goiás, Maranhão, Mato Grosso, Minas Gerais, Pará, Rio de Janeiro, Roraima, Santa Catarina, São Paulo and Tocantins (Crosskey & Howard, 1997; Material examined. Elsewhere, it has been recorded in Guyana, Suriname and Venezuela (Crosskey & Howard, 1997 and French Guiana (Hamada & Fouque, 2001).

BIOLOGY AND MEDICAL IMPORTANCE.

Simulium guianense s.l. has a wide distribution in Brazil where it can be found in large (300 m), fast flowing, sunlit rivers, but less common anthropophilic populations appear to have a more discrete distribution and in some cases are collected breeding in smaller rivers (Shelley, 2002). Immature stages can be collected on submerged plants, especially species of the family Podostemaceae. In Guyana, Shelley *et al.* (2004) collected *S. guianense s.l.* on submerged vegetation in a 50m wide river with rocky beds. Coscarón (1991) recorded this species from Argentina in small, deep, fast flowing and clear water rivers with rocky beds. This species is the primary vector of human onchocerciasis in highland areas of the Amazonian focus, where it bites man more predominantly in Auaris and Serra dos Surucucus, being present in only small numbers at Toototobi. Zoophilic populations were recorded at Catrimani and Mucajai (Shelley *et al.*, 1997) and in French Guiana (Hamada & Fouque, 2001). In the Venezuelan part of the focus *S. guianense* is anthropophilic in highland areas and zoophilic at lowland sites.