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Article

On the genus *Stenochironomus* Kieffer from French Guiana. I. New records with description of *S. hallei* sp. n. from the primary rainforest (Diptera, Chironomidae, Chironominae)

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ABSTRACT

Recent material composed of adults, collected in the primary rainforest in French Guiana, revealed the presence of five species of the genus *Stenochironomus*. In this paper, *S. hallei* sp. n. is described as male adult based on material captured over the canopy and the undergrowth aquatic habitats of the primary rainforest of Petit-Saut. On the basis of some atypical distinctive characters (posterior margin of frontal area widely bilobed; wing with 2 median dark spots; femur and tibia of PI-PIII with typical dark pigmentation; tergites II-VI with transverse caudal dark spots, tergite VII with 2 circular postero-lateral spots; postero-ventral part of tergite IX with 8 characteristic groups of tripled curved stout setae (4 on each side); anal point slender, spatulate apically; superior volsella with 4 inner setae and 1 typical outer seta; gonocoxite with long setae, apical ones overreaching tip of gonostylus), *S. hallei* sp. n. appears to belong to a separate group of species and probably can be considered as a biogeographic representative local element of the primary rainforest of French Guiana. Remarks on the taxonomic position of the new species are given.

Keywords: Diptera Chironomidae, *Stenochironomus hallei* sp. n., French Guiana, primary forest, conservation measures.

Sur le genre *Stenochironomus* de Guyane française. I. Nouvelles citations et description de *S. hallei* sp. n. de la forêt primaire (Diptera, Chironomidae, Chironominae)

RESUMÉ

L'adulte mâle de *Stenochironomus hallei* sp. n. est décrit à partir d'un matériel collecté au-dessus de la canopée et des habitats aquatiques du sous-bois de la forêt tropicale primaire de Petit-Saut en Guyane française. Certains caractères atypiques distinctifs (marge postérieure de l'aire frontale largement bifide; aile avec 2 taches médianes; fémur et tibia de PI-PIII avec des pigmentations typiques foncées; partie caudale des tergites II-VI avec des taches sombres caudales, tergite VII avec 2 taches circulaires postéro-latérales; partie postéro-ventrale du tergite IX avec 8 groupes caractéristiques de triples soies rigides (4 de chaque côté) ; pointe anale effilée, partie apicale spatulée ; volselle supérieure munie de 4 soies internes et d'une soie externe typique ; gonocoxite avec de longues soies, les apicales dépassent le gonostyle), permettent de placer la nouvelle espèce dans un nouveau

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groupe et probablement de la considérer comme un élément indicateur biogéographique à l'échelle locale de la forêt équatoriale primaire guyanaise. Des remarques sur la position taxonomique de *S. hallei* sp. n. sont fournies.

Mots-clés : Diptera Chironomidae, *Stenochironomus hallei* sp. n., Guyane française, forêt primaire, mesures de conservation.

1. Introduction

A large material composed of Diptera was collected using entomological net and Malaise traps over the canopy and aquatic habitats delimited by the undergrowth of the primary rainforest in French Guiana. Exploration of the primary forest all over the world was implemented by the project named Canopy Raft ('Radeau des Cimes' = Raft of the peak), which allowed prof. F. Hallé (Montpellier university) and his collaborators (botanists, entomologists, climbers) to collect a precious and valuable patrimonial material of both terrestrial and aquatic insects. Sampling methods and other various technics of capture are detailed in ABERLENC (2017).

Parcels of Chironomidae were kindly entrusted to us for examination and taxonomical studies. The latter collection allowed us to generate a short faunal list including several genera of Chironomini, which revealed the presence of a new species belonging to the genus *Stenochironomus* Kieffer, namely *S. hallei* sp. n. In this paper, the new species is described only as male adult. Remarks with comments on the ecology of the new species are given.

As reported in both previous and recent knowledge from the literature (KIEFFER 1919, TOWNES 1945, FITTKAU & REISS 1979, SASA 1979, 1989, LEHMANN 1979, 1981, FREEMAN & CRANSTON 1980, YAMAMOTO 1981, BORKENT 1984, HASHIMOTO 1983, CRANSTON et al. 1989, WIEDERHOLM 1989, CRANSTON 1996, SPIES & REISS 1996, SASA & SUZUKI 1999, 2000a, 2000b, 2001, 2002, ZORINA 2001, 2010, PINHO et al. 2005, ANDERSEN et al. 2007, LANGTON & PINDER 2007, QI et al. 2008, VINOGRADOVA 2008, SPIES et al 2009, DANTAS 2010, GALILEU et al. 2010, 2016, REIS et al. 2013, SÆTHER & SPIES 2013, LIN et al. 2021, SWANSON & BILGER 2021), the genus *Stenochironomus* Kieffer, 1912 is well-represented in number of species from some zoogeographical regions, namely: Neotropical, Oriental, Afrotropical, Palearctic and Nearctic. Higher number of recently reported species is recorded from the Neotropical and Oriental Region in particular Brazil, Japan and China.

2. Material and methods

The examined male adults of *S. hallei* sp. n. were collected using sweeping net over the canopy of the primary rainforest and by Malaise traps set along the aquatic habitats delimited by the undergrowth. Additional details on the methodology of the sampling sites are provided in ABERLENC (2017). Preserved male adults in 80-85% ethanol, were cleared of musculature in 90% lactic acid (head, thorax, abdomen and anal segment) for about 60 to 80 minutes; this can be left overnight at room temperature without any detrimental effect or damage. When clearing was complete the specimens were washed in two changes of 50-60% ethanol to ensure that all traces of lactic acid were removed. The holotype and paratypes were mounted in polyvinyl lactophenol. Before the final slide mountings (dorsally) of the type-material, the hypopygium including tergite IX, the anal point, the gonocoxite and the gonostylus, were viewed ventrally and laterally to examine and draw from both sides all the necessary details of the species. Morphological terminology and measurements follow those of SÆTHER (1980) and LANGTON & PINDER (2007) for the imagines.

3. Description

Stenochironomus hallei sp. n.

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Material examined

Holotype. French Guiana. 1 male adult captured by sweeping net over the canopy of the primary rainforest of Petit-Saut (5° 9' 22.5504" N, 52° 53' 8.7144" W); leg. H.-P. Aberlenc and G. Del vare. 25.X.1989.

Paratypes. Two male adults (1 mounted and 1 preserved in 80% ethanol), captured by Malaise traps set around the undergrowth of the primary rainforest of Petit-Saut, same date as for holotype (leg. H.-P. Aberlenc and G. Delvare).

Holotype (mounted on one slide) is deposited in the collections of the 'Musée cantonal de Zoologie, Palais de Rumine, 6 place de la Riponne, CH-1014 Lausanne (MZL), Switzerland' (GBIFCH01217137). The paratypes are deposited in the collection of the author.

Etymology: the new species is named '*hallei*' in honour of my colleague Francis Hallé (University of Montpellier), who remains active as botanist in preserving the primary rainforest all over the world.

Diagnostic characters

The new described species shares some common characters with other related known members from neighbouring countries, where numerous *Stenochironomus* species were recently described or recorded. However, *S. hallei* sp. n. can easily be separated by having, beside the unusual lateral outer seta on superior volsella, the following additional distinctive characters. Head. Caudal margin of frontal area widely bilobed; temporals 16; antenna 1280 μm long, last flagellomere 850 μm long, AR 1.98. Thorax. Lobes of antepronotum not gaping; acrostichals 30-32; dorsocentrals 20-22; scutellum with 24 setae. Wing. Brachiolum with 3 setae, median part with dark shading, anal lobe low, squama with 8-9 setae. Legs. Femur and tibia of PI-PIII markedly ringed with dark pigmentation. Abdomen. tergites II-VI with transverse caudal spots, tergite VII with 2 circular postero-lateral spots. Tergite IX cup-shaped, distal half rounded, anal tergite bands swollen medially, interrupted at base of anal point; dorso-median area with 40-42 setae; distal margin with 8 lateral setae; postero-ventral part with 24 characteristic curved stout setae including 8 tripled groups (4 on each side, 1 median and 3 apical). Anal point elongate, parallel-sided medially, spatulate apically. Laterosternite IX with 10 setae. Superior volsella slightly overpassing half of inferior volsella, margins with 5 setae including 1 atypical outer lateral and 4 inner. Inferior volsella elongate, distal half curved outwards, with 7 fine setae and 1 spine-like apical megaseta. Gonocoxite with 9 long setae, apical ones overreaching tip of gonostylus. Gonostylus slightly curved inwards, distal half of inner margin with a row of equally needle-like setae.

Male imago

(n = 3; Figs 1A-J, 2A-C)

Medium to big sized species. Total length 4.35 mm. Wing length 1.97 mm, TL/WL = 2.21. General colouration brownish in general. Antenna brownish; thorax contrasting brown to dark brown, mesonotal stripes dark brown; wing pale brown with 2 median dark shadings; legs brown to dark brown, femur and tibia of PI-PIII with dark spots. Tergites II-VI with transverse caudal dark spots, tergite VII with 2 postero-lateral rounded spots; anal segment contrasting brown to dark brown.

Head (Fig. 1A). Eyes bare; temporals 16 including 13 inner (in 1-2 rows) and 3 outer vertical; frontal tubercles absent, frontal margin widely bilobed apically; antenna 1280 μm long, last flagellomere 850 μm long, antennal groove reaching segment 3, AR 1.98; clypeus (Fig. 1B) 100 μm long, 125 μm maximum width, sub-rectangular, distal half semi-circular, with 26 setae in 4 rows; palpomeres 1-2 fused, 3-5 missing. Thorax. Lobes of antepronotum thick, not gaping; acrostichals 30-32 typically uniserial; dorsocentrals 20-22 in 2 rows; scutellum with 24 unequally sized setae, biserial. Wing (Fig. 1C). Brachiolum with 3 setae; membrane with 2 distinct dark spots on median area; subcosta overreaching fork of radius, costal expansion absent; number of setae on

	fe	ti	ta_1	ta_2	ta_3	ta_4	ta_5	LR	BV	SV	BR
PI	1350	1280	1720	825	775	650	265	1,34	1,73	1,53	2.10
PII	1345	1260	665	520	425	265	115	0,53	2,47	3,92	1.80
PIII	1190	955	730	350	275	170	90	0,76	3,25	2,94	2.00

Table 1. ' LR = Length of tarsomere ta_1 divided by length of tibia (ti); BV = Combined length of femur (fe), tibia and ta_1 divided by combined length of tarsomeres ta_2-ta_5; SV = Ratio of femur plus tibia to tarsomere ta_1; BR = Ratio of longest seta of ta_1 divided by minimum width of ta_1, measured one third from apex'

veins: R about 60; R_1 about 30, R_{4+5} up to 60; remaining veins bare; anal lobe low, nearly right-angled, squama with 8-9 setae. Legs. Femur and tibia of PI-PIII (Figs D-F) markedly spotted with dark pigmentation (3 on PI, only 2 on PII-PIII); tibial scale of PI rounded apically; length (in μm) of tibial spurs on: PII (45, 30), PIII (subequal, 50); sensilla chaetica present on tarsomeres ta_1-ta_5; length (in μm) and proportions of legs (n = 1) as in the Table 1.

Abdomen. Tergites II-VII (Fig. 1G) with typical transverse and lateral dark spots (bilobed on II-IV; linear on V-VI; circular on postero-lateral sides on VII). Hypopygium in dorsal and ventral view as in Figs 1H-I: dorsal (Fig. 1H); ventral view (Fig. 1I) with tergite IX and anal point omitted. Tergite IX 205 μm long; maximum wide (130 μm at base, 110 μm distally), cup-like shaped, distal half roundly enlarged posteriorly; dorsal part without ridges, dorso-median area bearing 40-42 setae; anal tergite bands (ATB) vertically extended, basal part sinuous and thick, markedly concave medially, antero-median and posterior parts much thinner, interrupted before base of anal point; distal margin with 8 lateral setae (4 on each side); caudo-ventral margin (Fig. 2B) with 24 characteristic curved stout setae inserted in 8 groups of 3 tripled stout setae (3 lateral, 2 central). Anal point (Figs 1H, 2A, 2B), illustrated dorsally (Fig. 1H), laterally (Fig. 2A) and ventrally (Fig. 2B), 50 μm long, maximum width 50 μm at base and 2.5 μm apically; ending as tip of inferior volsella; linearly elongate, parallel-sided in its median part, giving appearance of long spatulate apex. Laterosternite IX with 10 short setae (5 on each side). Superior volsella (Figs 1H-J; 1H-I holotype, 1I-J paratype), 85 μm long, 2-3 μm maximum width; elongate vertically, apex rounded; distal half distinctly curved and slightly projecting inwards, wider at base, progressively narrowing distally, almost overpassing half of inferior volsella; margins with 5 short setae 20-25 μm long, outer lateral seta atypically characteristic, well visible when viewed dorsally (Figs 1H-J) and laterally (Fig. 2C). Inferior volsella (Figs 1I, 2C; 1I ventral, 2C lateral), 110 μm long, 3-4 μm maximum width; linear, nearly parallel-sided, distal half outwardly turned over towards the gonostylus, inner margin bare, outer margin with 7 fine curved setae equally sized, ending with a spine-like megaseta. Gonocoxite 120 μm long, 55 μm maximum width, with 9 very long setae, those inserted apically are slightly overpassing tip of gonostylus as illustrated in Figs 1H, 2C. Gonostylus 180 μm long, 7 μm maximum width, nearly parallel-sided except in its apical part, strongly curved inwards, distal half of inner margin with 1 row of 9-10 curved setae, apex with 2-3 fine curved setae. HR 0.67; HV 2.42.

Female adult, pupa and larva: unknown.

4. Remarks and differential diagnosis

The closest *Stenochironomus* species to *S. hallei* sp. n. are: *S. aestivalis* Townes, 1945; *S. bare* Galileu et al, 2016; *S. cinctus* Townes, 1945, *S. liviae* Galileu et al, 2016; *S. manauara* Galileu et al, 2016; *S. triannulatus* Borkent, 1984. The six cited species were reported from some neighbouring countries (primary rainforest of Brazil in particular), where numerous other new local ele-

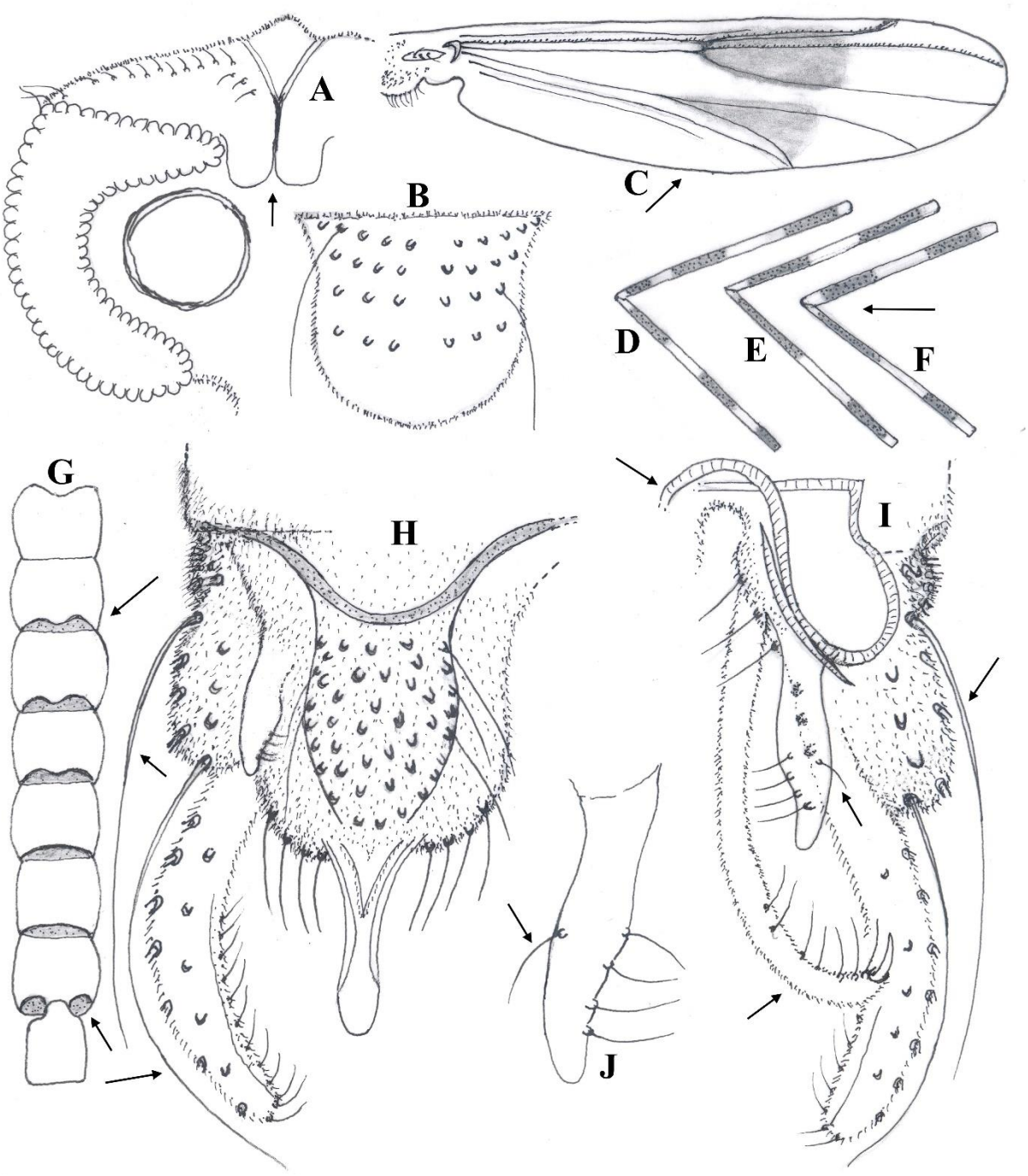

Figure 1. Male imago of Stenochironomus hallei *sp. n. Head* (*left side, dorsal*)*, frontal area, vertex and temporal setae* (*A*)*; clypeus* (*B*)*; wing* (*C*)*; femur and tibia of PI-PIII* (*D-F*)*; tergites I-VIII* (*G*)*; hypopygium, holotype, in dorsal* (*H*) *and ventral view* (*I*)*; superior volsella, paratype* (*J*)*. The arrows indicate some distinctive characters.*

Figure 1. Imago mâle de Stenochironomus hallei *sp. n. Tête* (*côté gauche, vue dorsale*)*, aire frontale, vertex, et soies temporales* (*A*) *; clypéus* (*B*) *; aile* (*C*) *; fémur et tibia de PI-PIII* (*D-F*) *; tergites I-VIII* (*G*) *; hypopyge, holotype, en vue dorsale* (*H*) *et ventrale* (*I*) *; volselle supérieure, paratype* (*J*)*. Les flèches indiquent quelques caractères distinctifs.*

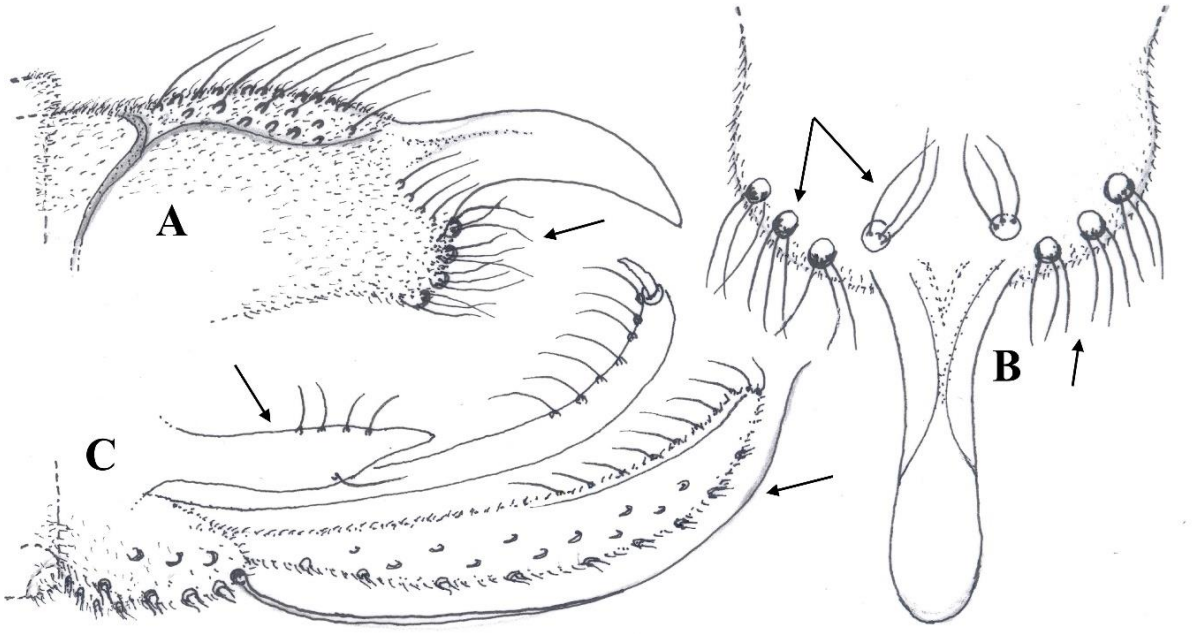

Figure 2. Male imago of Stenochironomus hallei *sp. n. Tergite IX and anal point, lateral* (*A*)*; distal part of tergite IX with anal point in ventral view* (*B*)*; superior and inferior volsella, gonocoxite and gonostylus, lateral* (*C*)*. The arrows indicate some distinctive characters.*

Figure 2. Imago mâle de Stenochironomus hallei *sp. n. Tergite IX et pointe anale, vue latérale* (*A*) *; partie distale du tergite IX et pointe anale, vue ventrale* (*B*) *; volselle supérieure et inférieure, gonocoxite et gonostyle, vue latérale* (*C*)*. Les flèches indiquent quelques caractères distinctifs.*

ments were described or reported (TOWNES 1945, BORKENT 1984, PINHO et al. 2005, ANDERSEN et al. 2007, DANTAS 2010, GALILEU et al. 2010, 2016, REIS et al. 2013).

Though some common morphological characters (distribution pattern of dorsal setae on

tergite IX, shape of anal point, superior and inferior volsella) are observed between the new species and other known members from the Nearctic and Neotropical Regions, the unusual outer seta on superior volsella combined with the following distinctive characters, will easily separate the new species from all other congeners.

Accordingly, a combination of some distinguishing relevant features are highlighted in the following differential diagnosis:

- Frontal margin of head widely and distinctly bilobed (Fig. 1A), differently figured in *S. bare*, *S. liviae* and *S. manauara* (GALILEU et al. 2016, Figs 6A, 20A, 24A);

- Wing (Fig. 1C) with 2 distinct large dark shading on median part, is otherwise shaped in other members of the genus (BORKENT 1984, PINHO et al. 2005, ANDERSEN et al. 2007, DANTAS 2010, GALILEU et al. 2010, 2016, REIS et al. 2013);

- Legs. Femur and tibia of PI-PIII (Figs 1D-F) ringed with dark pigmentation, are differently pigmented in all other congeners as illustrated by BORKENT (1984, Figs 17-21);

- Tergites II-VI and VII with dark spots (Fig. 1G), are otherwise shaped in other related members of the genus (BORKENT 1984, Figs 26-28);

- Hypopygium including tergite IX, anal point, superior and inferior volsella, gonocoxite and gonostylus in dorsal, ventral and lateral view (Figs 1H-J, 2A-C), are not similarly shaped in the six previously cited species (BORKENT 1984, Figs

26-28, 30-38, 39-42, 43-45; GALILEU et al. 2016, Figs 7A-B, 20C, 21A-C, 25A-C).

5. Ecology and distribution

Members of the genus *Stenochironomus* Kieffer occur mostly in all standing water and can be found in bordering riparian both lentic and lotic habitats of streams and large rivers. Larvae mostly feed on decaying organic matter and plant litter, as they are miners of dead wood and leaves.

Adults of *S. hallei* sp. n. was exclusively collected in the primary rainforest of French Guiana (Petit-Saut area). The type-material was captured in two different habitats: the first, over the canopy; the second, along aquatic habitats delimited by the undergrowth. Emergence of adults is recorded during the dry season of 1989 (October-November).

Although the new described species is currently known only from its type locality, it seams to be more widely distributed in similar primary rainforest located in French Guiana or in other neighbouring geographical countries, namely Brazil and Suriname.

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