

SHORT COMMUNICATION

Black Flies (Diptera: Simuliidae) of French Guiana: Cytotaxonomy and a Preliminary List of SpeciesNeusa Hamada/⁺, Florence Fouque*

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The objectives of the present study were to broaden the survey of simuliid species in French Guiana and to cytologically analyze the species in the Simulium perflavum species group. Twelve species of Simulium were collected from which S. goeldii, S. quadrifidum, S. trombetense, S. near incrustatum, S. metallicum (s.l.) sp1, S. metallicum (s.l.) sp2 and S. ochraceum (s.l.) are reported for the first time for this region. The only species collected in the S. perflavum group was S. rorotaense; 34 larvae of this species were cytologically analyzed, all of which had the standard sequence. S. metallicum (s.l.), S. ochraceum (s.l.), S. guianense (s.l.) and S. oyapockense (s.l.) are involved with transmission of onchocerciasis in Central and South America, however, in French Guiana these species were not found biting humans during the sampling period. With the few collections made during this study, we increase the number of simuliid species known in French Guiana from 6 to 13. It is clear that more simuliid species can be expected to be found when more sampling is done, including collections in other ecoregions in French Guiana.

Key words: aquatic insects - polytene chromosomes - *Simulium* - French Guiana

Black flies have received little attention in French Guiana, where the last studies on these insects were those of Floch and Abonnenc in the 40s. These authors reported *Simulium cauchense* Floch & Abonnenc, *Simulium rorotaense* Floch & Abonnenc, *Simulium maroniense* Floch & Abonnenc, *Simulium iracouboense* Floch & Abonnenc, *Simulium oyapockense* Floch & Abonnenc and *Simulium guianense* Wise (Floch & Abonnenc 1946a,b). *S. maroniense* was made synonymous with *S. rorotaense* by Shelley et al. (1984, 1997); however, Hamada and Adler (1998, 1999) studying specimens collected in Brazil found morphological and chromosomal evidence demonstrating that they are really two distinct species.

The objectives of the present study were to broaden the survey of simuliid species in French Guiana and, since polytene chromosomes of *S. rorotaense* and *S. maroniense* had previously not been examined from their type localities, to deter-

mine if the chromosome patterns of these species from the type locality correspond to the defined standards.

Larvae and pupae were collected in June 1999 around Cayenne, Saül, Vovony community (Approuage River), Maroni River (on the border with Surinam) and along the highway that connects Cayenne to Iracoubo (Fig. 1, Table). Specimens were hand collected and preserved in Carnoy (1 part absolute ethanol: 3 parts glacial acetic acid). Pupae with pharate adults were, whenever possible, reared in plastic vials with wet filter paper to confirm larval and pupal identifications; adults emerged from reared pupae were mounted on triangles or preserved in 80% ethanol. Specimens for chromosome analyses were dissected and stained with the Feulgen technique (Rothfels & Dunbar 1953). Cytological comparisons were made using the standard maps established by Hamada and Adler (1999).

Sixteen samples were collected in French Guiana (Table). Twelve species of *Simulium* were collected: *S. cauchense*, *S. guianense*; *S. iracouboense*, *S. oyapockense*, *S. rorotaense*; the following species are first reported for this country: *S. goeldii* Cerqueira & Nunes de Mello, *S. quadrifidum* Lutz, *S. trombetense* Hamada, Py-Daniel & Adler, *S. near incrustatum* (Figs 12-14),

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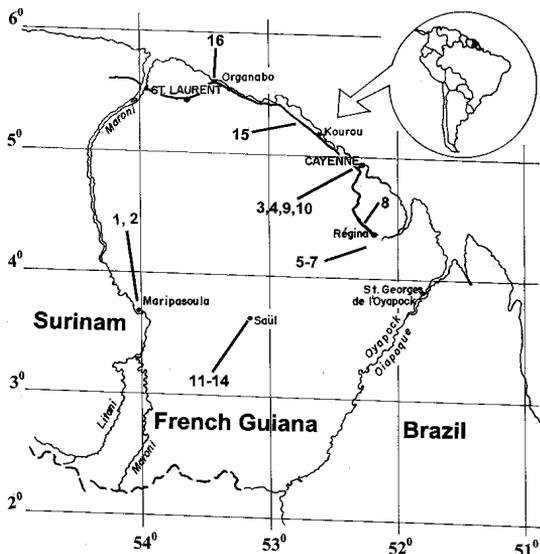


Fig. 1: map of French Guiana indicating sampling sites, in June 1999.

S. metallicum (s.l.) sp1 (Figs 2-4, 8), *S. metallicum* (s.l.) sp2 (Figs 5-7) and *S. ochraceum* (s.l.) (Figs 9-11). Voucher specimens were deposited at Invertebrate Collection, INPA, Manaus, Brazil and Medical Entomology Laboratory, Institut Pasteur, Cayenne, French Guiana.

Of the species previously reported for French Guiana only *S. maroniense* was not collected dur-

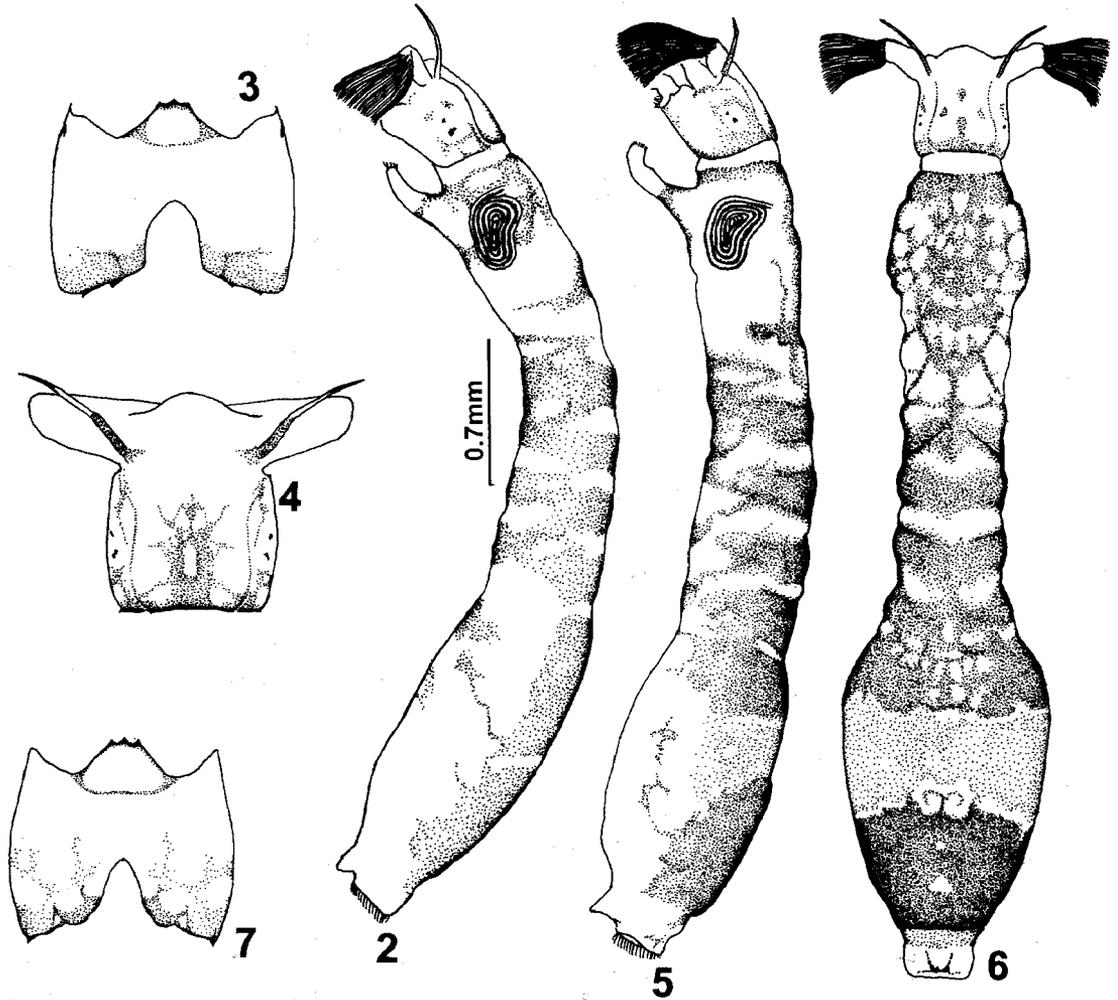
ing the sampling period; we were unable to locate its type locality (Coeur Maroni stream-Sinnamary). Apparently this stream was located in an area that now is inundated due to the construction of a hydroelectric dam (Barrage de Petit-Saut). Therefore, only *S. rorotaense* was examined at the cytological level. Larvae of *S. rorotaense* from its type locality (Rorota, Montagne du Mahury, Table) were examined; 67 last-instar larvae were stained (27 males and 40 females), of which 50.7% were completely analyzed (n = 34). All completely analyzed specimens had the standard sequence; the only polymorphism observed was the Heteroband 1 (Hb1), also found in populations of *S. rorotaense*, *S. maroniense* and *S. trombetense* in the Brazilian Amazon region (Hamada & Adler 1999).

In the two large rivers sampled (Maroni and Approuague) the most abundant species was *S. iracouboense*; this species also occurred in smaller streams (Table). *S. guianense* (s.l.) and *S. oyapockense* (s.l.) were restricted to these two large rivers, but in very low density. Although *S. guianense* (s.l.) and *S. oyapockense* (s.l.) are involved with transmission of onchocerciasis in Brazil and Venezuela (Shelley et al. 1997, Grillet et al. 2000), in French Guiana these species appear not to be anthropophilic, since the indigenous people who live along these water courses did not complain about their biting. *S. metallicum* cytotype E is involved in onchocerciasis transmission in

TABLE
Simulium spp. (Diptera: Simuliidae) collection data in French Guiana

Collection number	Collection place	Date	Collectors	Collected species
1	Maroni River	17.06.99	NH, FF	1, 2, 3
2	Maroni tributary, below fall in collection number 1	17.06.99	NH, FF	1, 2
3	Montagne du Mahury, Rorota, afer first water reservoir	21.06.99	NH; FF	4
4	Montagne du Mahury, Rorota, between the first and larger reservoir	21.06.99	NH; FF	4, 5
5	Approuague River	23.06.99	NH; FF	1, 2, 3, 6
6	Vovony community, first headwater	23.06.99	NH; FF	9
7	Vovony community, second headwater	24.06.99	NH; FF	9
8	Felipe bridge, between Cayenne and Régina County	24.06.99	NH; FF	5, 6, 7, 8
9	Mont Grand Matoury	25.06.99	NH; FF	4, 7, 9
10	Mont Gr. Matoury, trail # 9	25.06.99	NH; FF	4, 11
11	Saül	26.06.99	NH; SL	6, 7, 9, 10
12	Saül	26.06.99	NH; SL	6, 7, 11
13	Saül	27.06.99	NH; SL	4, 9, 11, 12
14	Saül	27.06.99	NH; SL	7, 10
15	Malmanoury stream	28.06.99	NH; RC	5, 6, 7
16	Organabo stream	28.06.99	NH; RC	1, 6

Date: day.month.year; collector: FF = Florence Fouque; NH = Neusa Hamada; RC = Romuald Carinci; SL = Stéphane Laventure. Collected species: 1 = *S. iracouboense*; 2 = *S. guianense* (s.l.); 3 = *S. oyapockense* (s.l.); 4 = *S. rorotaense*; 5 = *S. goeldii*; 6 = *S. quadrifidum*; 7 = *S. cauchense*; 8 = *S. trombetense*; 9 = *S. ochraceum* (s.l.); 10 = *S. near incrustatum*; 11 = *S. metallicum* (s.l.) sp1; 12 = *S. metallicum* (s.l.) sp2



Simulium metallicum (*s.l.*) larva. Fig. 2: *S. metallicum* sp1 lateral view. Fig. 3: head capsule ventral view - post genal cleft. Fig. 4: head capsule dorsal view. Fig. 5: *S. metallicum* sp2 lateral view. Fig. 6: dorsal view. Fig. 7: head capsule ventral view - post genal cleft

mountainous areas of Venezuela, near the Caribbean coast (Grillet et al. 1995). This nominal species includes at least 12 cytotypes (Conn et al. 1989, Arteaga & Muñoz de Hoyos 1999). We collected two morphotypes that by larvae and gill filament morphology (Figs 4-9) can be placed in the *S. metallicum* species complex; one of these (*S. metallicum* sp2) may be *Simulium horacioi* Okazawa & Onishi, which corresponds to Conn et al. (1989) cytospecies H. Pupae of this morphotype were not collected, but dissected gill histoblasts of last-instar larvae indicate that it has typical *S. metallicum* (*s.l.*) gill morphology. Both morphotypes were collected in small (first-order) mountain streams at less than 300 m altitude; they were collected syntopically in one stream (Table). These morphotypes also seem not to be anthropo-

philic because, when asked, people living along the river do not complain about anthropophilic black flies in the area. Other researchers have reported *S. metallicum* (*s.l.*) at higher altitudes and, in Venezuela and Colombia they were reported as anthropophilic (Grillet et al. 1995, Arteaga & Muñoz de Hoyos 1999).

The *S. ochraceum* species complex is known to include at least two cytospecies and one cytotype; cytospecies A is highly anthropophilic and is involved with onchocerciasis transmission in Guatemala and Mexico (Millest 1992, Hirai et al. 1994). In Venezuela, *S. ochraceum* (*s.l.*) co-occurs with *S. metallicum* cytotype E and is not involved with onchocerciasis transmission (Grillet & Barrera 1997). *S. ochraceum* (*s.l.*) was not found biting humans at the breeding sites, and it occupied a dif-

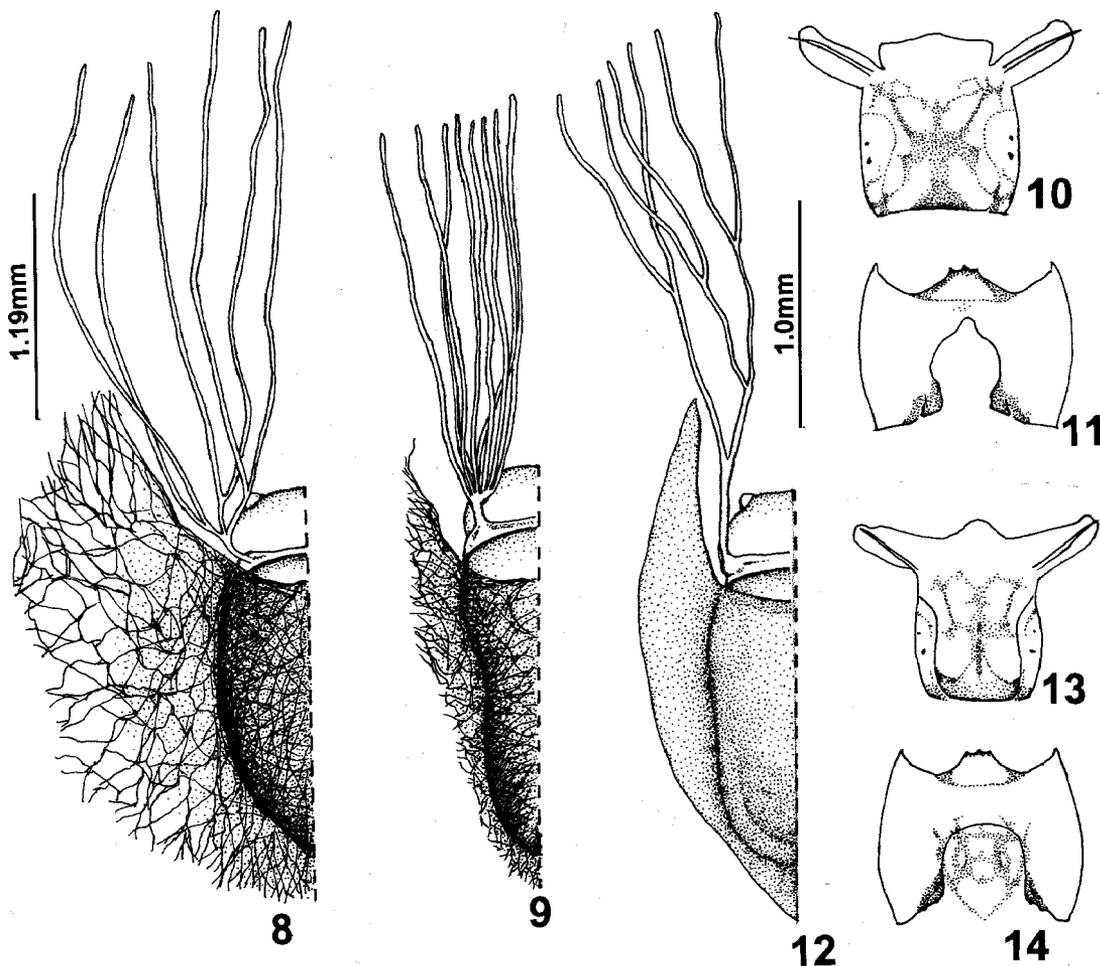


Fig. 8: *Simulium metallicum* (s.l.) sp1 pupa. Fig. 9: *S. ochraceum* (s.l.) pupa. Fig. 10: *S. ochraceum* (s.l.) larval head capsule dorsal view. Fig. 11: ventral view - post genal cleft. Fig. 12: *Simulium* near *incrustatum* pupa. Fig. 13: *Simulium* near *incrustatum* larval head capsule dorsal view. Fig. 14 ventral view - post genal cleft

ferent habitat from the populations studied by Hirai et al. (1994) and Grillet and Barrera (1997), who reported this species above 600 m altitude. The five sites (Table) with this species were small, pristine, first-order streams, located in forested areas at less than 300 m altitude, and temperatures of 24-25°C.

Simulium near *incrustatum* (Fig. 2) was collected in the larval and pupal stages in two small streams. Confirmation of this identification may only be made after rearing pupae to obtain the adults.

With the few collections made during this study, we increase the number of simuliid species known in French Guiana from 6 to 13. It is clear that more simuliid species can be expected to be found when more sampling is done, including collections in other ecoregions in French Guiana. Cytological and biological studies are also needed, especially

on *S. metallicum* (s.l.), *S. ochraceum* (s.l.), *S. guianense* (s.l.) and *S. oyapockense* (s.l.), since some of the cytotypes or cytospecies in these nominal species are involved in onchocerciasis transmission in Central and South America.

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