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Smittia zealandiana sp. n. a new semi-aquatic species occurring in the moss carpet of riparian habitat in Mont Panié, New Caledonia [Diptera, Chironomidae]

by Joel MOUBAYED-BREIL* & Nathalie MARY**

*Freshwater & Marine biology, 10 rue des Fenouils, F - 34070 Montpellier, France
joelmb34@free.fr
**Ethyco, B. P. 13 821, 98803 Nouméa Cedex, Nouvelle-Calédonie
ethyco2005@gmail.com

Keywords: *Smittia zealandiana* sp. n., Diptera Chironomidae, New Caledonia, Mont Panié, conservation.

Male adult of *Smittia zealandiana* sp. n. is diagnosed and described based on material collected in the upper stream of the River We Caot (Mont Panié, north east of New Caledonia, altitude 1390 m). A combination of some atypical characters found in the male adult (eyes bare, membrane of wing hairy, unusual shape of arculus, anal point, virga, gonocoxite, inferior volsella and gonostylus) allowed us to consider this new species as a member of a separate *Smittia*-group: the *zealandiana*-group. On the basis of some common characters, *S. scutellosetosa* Caspers, 1988 represents the closest species to *S. zealandiana* sp. n. Larval instars are confined in the emerged moss carpet of riparian habitats bordering the bed of the We Caot upper river stream. The new Australasian species is only known from its type-locality.

Smittia zealandiana sp. n., une nouvelle espèce semi-aquatique connue d'habitats ripicoles du Mont Panié en Nouvelle-Calédonie [Diptera, Chironomidae]

Mots-Clés: *Smittia zealandiana* sp. n., Diptera Chironomidae, Nouvelle-Calédonie, Mont Panié, conservation.

L'adulte mâle de *Smittia zealandiana* sp. n. est décrit à partir d'un matériel collecté dans le cours supérieur de la rivière We Caot (Mont Panié, nord est de la Nouvelle-Calédonie, altitude 1390 m). Une combinaison de certains caractères atypiques de l'adulte mâle (yeux glabres, membrane de l'aile pubescente, forme inhabituelle de l'arculus, pointe anale, virga, gonocoxite, volselle inférieure et gonostyle) a permis de considérer cette espèce nouvelle comme membre d'un groupe de *Smittia* distinct : le groupe *zealandiana*. Sur la base de certains caractères communs, *S. scutellosetosa* Caspers, 1988 représente l'espèce la plus proche de *S. zealandiana* sp. n. Les populations larvaires de *S. zealandiana* sp. n. sont confinées dans le tapis de mousse émergé, en bordure des habitats ripicoles que couvre le lit du cours supérieur de la rivière We Caot. La nouvelle espèce australasienne est uniquement connue de sa localité type.

1. Introduction

Larval instars of the genus *Smittia* Holmgren, 1869 belong, in general, to terrestrial and semi-aquatic forms, which are commonly encountered in wetlands and riparian habitats (wet bryophytes

and grasses, temporary pools, peat bogs, ponds, lakes, estuaries) located in mountain and lower geographical areas. Based on knowledge provided on the taxonomy and geographical distribution of the known *Smittia* species from the Australasian and neighbouring biogeographical Regions (GOETGHEBUER 1940-1950), BRUNDIN 1947, 1956, FREEMAN 1956, 1959, ASHE et al. 1987, CASPERS 1988, CRANSTON 1991, 1996, 2019, CRANSTON & MARTIN 1989, CRANSTON et al. 1989, MOUBAYED 1989, BOOTHROYD & CRANSTON 1995, ROSSARO & LENCIONI 2000, SÆTHER & EKREM 2003, ASHE & O'CONNOR 2012a, 2012b, ANDERSEN et al. 2013, LANGTON & PINDER 2007, MOLLER PILLOT 2008, SÆTHER & SPIES 2013, MOUBAYED-BREIL & TISSOT 2019), there are about 85 species worldwide, including: 60 in the Palaearctic Region, and respectively 8, 7, and 3 in the Afrotropical, Oriental and Australasian Regions. Consequently, the description here of the new species increases the total number in the genus *Smittia* to 4 valid species from the Australasian Region.

In this paper, the male adult of *Smittia zealandiana* sp. n. is diagnosed and described based on material collected in the emerged moss carpet of riparian habitats bordering the upper stream of the River We Caot (Mont Panié, north-eastern area of New Caledonia, altitude 1390 m; Map 1). This description consists of a first taxonomic result on the chironomid fauna of New Caledonia (MOUBAYED-BREIL & MARY, in prep.). On the basis of some atypical characters found in the male adult, the new Australasian species appears to key into a separate group of species: the *zealandiana*-group.

Material and methods: see MOUBAYED-BREIL & GARRIGUE (2021) or page 2 of this revue.

Remark: the proximal part of the abdomen and the halteres were preserved in 80-85% ethanol for an eventual DNA analysis.

2. Description

Smittia zealandiana sp. n.

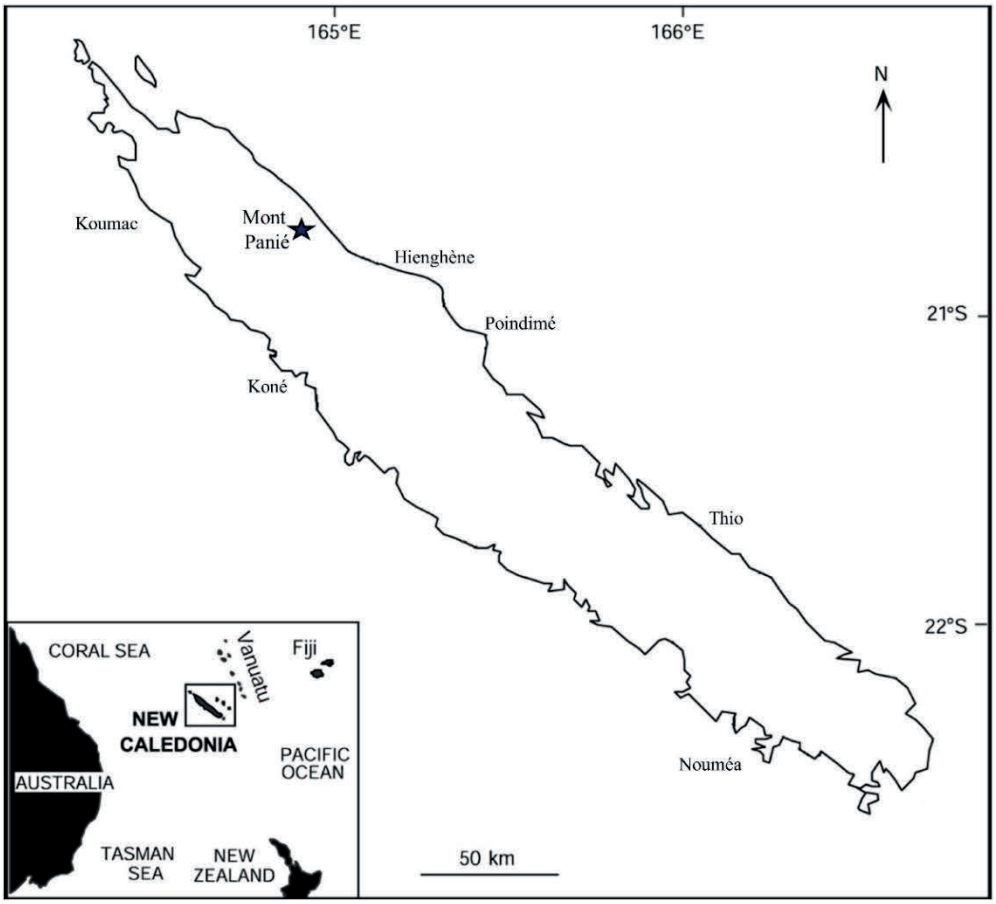
Material examined

Holotype: 1 male adult, leg. N. Mary; submerged moss carpet of riparian habitats bordering the upper stream of the River We Caot (Photo 1), at Mont Panié (X WGS 84: 164° 45' 52.99" E; Y WGS 84: 20° 34' 54.01" S); altitude 1390 m (Map 1), New Caledonia. Environmental data are: crystalline water, conductivity 23-28 µS/cm, pH 6.2-6.5; temperature 13-19 °C; 03.XI.1997.

Paratype: 1 male adult, leg K.A. Johanson (Museum of Stockholm, Sweden), preserved in 80% ethanol, which is measured but not mounted, same date and locality as for holotype.

Holotype (mounted on one slide) is deposited in the collections of the MUSE-Museo delle Scienze, Corso del Lavoro e della Scienza 3, 38122 Trento, Italy. The paratype is deposited in the collection of the senior author.

Etymology: the species name *"zealandiana"* belongs to the known emerged old continent, Zealandia, which includes New Caledonia and New Zealand.



Map 1. Geographical location of the studied site at Mont Panié in New Caledonia.
Carte 1. Localisation géographique du site étudié au Mont Panié en Nouvelle-Calédonie.

Diagnostic characters

Based on some unusual characters found in the male adult (membrane of wing hairy; shape of anal point, virga, inferior volsella and gonostylus), *S. zealandiana* sp. n. appears to belong to a separate group of *Smittia* species: the *zealandiana*-group. However, the new species is easily distinguished by a combination of characters. Head. Eyes naked, frontal tubercle distinctly semi-circular, coronals absent; clypeus semi-circular; palpomere 3 with 3 sensilla chaetica and one needle-like sensilla coeloconica. Thorax. Lobes of antepronotum narrowly separated, not gaping; humeral pit absent. Wing. Membrane with setae on cells: r_{4+5} and m_{1+2}; squama bare. Anal segment. Tergite IX broadly semi-circular, posterior area with 8 setae located close to base of anal point (4 on each side), posterior margin bi-lobed; anal point very long, basal and median parts distinctly larger, distal half parallel-sided, basal area with dense microtrichia, median area bare, apex rounded; sternapodeme semicircular, without lateral projections; phallapodeme larger medially;

gonocoxite markedly swollen at base and median parts; inferior volsella digitiform with crotchet-like apical part, apex mostly hyaline and bare, short dorsal setae present on distal half; virga semi-circular to wide bell-shaped with 3 spines (2 located laterally and one medially); gonostylus linearly elongate, swollen medially and narrowing posteriorly; crista dorsalis absent; megaseta well-developed, thin and curved outwards.

Male imago

(n = 2; Figs 1-7, 8-14)

Small sized *Smittia* species. Total length 2.10 mm. Wing length 1.10 mm. TL/WL = 1.91. General colouration brownish with contrasting brown to dark brown head, mesonotal strips and anal segment. Head brownish with dark brown eyes and pedicels; antenna brown; thorax contrasting dark brown to pale brown; wing pale brown; legs and abdomen brownish; anal segment contrasting brown to dark brown with a whitish posterior area on tergite IX.

Head. Vertex and coronal area as in Fig. 1, frontal tubercle semi-circular, coronals absent, suture regularly thin; eyes bare, hairs on inner lateral margin of eye absent; temporals consist of 8 setae including 6 inner 2 outer verticals. Antenna 13-segmented, 588 µm long, linearly elongated; last flagellomere (Fig. 2) 165 µm long, parallel-sided and weakly clubbed apically, with numerous apical sensillae chaetica, presence of one apical stout seta; antennal groove clearly visible, beginning on segment 2 and reaching ultimate flagellomere; AR 1.40. Palp 5-segmented, segments 1-2 fused; length (in µm) of segments: 15, 22, 53, 61, 95; palpomere 3 (Fig. 3) with 3 sensilla clavata and one needle-like sensilla coeloconica. Clypeus (Fig. 4) about 50 µm long and 80 µm maximum width, nearly sub-circular and bearing 13 setae in 3 rows.

Thorax. Lobes of antepronotum (Fig. 5) narrowly separated and not gaping, antepronotals 5; acrostichals 9-10, uniserial, arising about 11 µm long from antepronotum; dorsocentrals 8-9 in one row; prealars 5 uniserial; humeral pit indistinct; preepisternum bare; scutellum with 6 setae in one row. Wing. Brachiolum with 1 seta, arculus (Fig. 6) markedly forked at a right angle. Number of setae on veins: R, 11-12; R_{1+2}, 9-10; R_{2+3}, 7-8; R_{4+5}, about 30; M_{1+2}, 23-25; remaining veins bare; squama bare. Membrane atypically hairy (Fig. 7), covered with short setae on cells: r_{4+5}, about 50; m_{1+2}, 25-30. Legs. Tibial spurs present on PI-PIII, about 25 µm long; sensilla chaetica present on tibia and tarsomeres ta_1-ta_4 of PI-PIII; pseudospurs absent on tarsomeres of PI-PIII; length (µm) and proportions of prothoracic (PI), mesothoracic (PII) and metathoracic (PIII) legs as in following table:

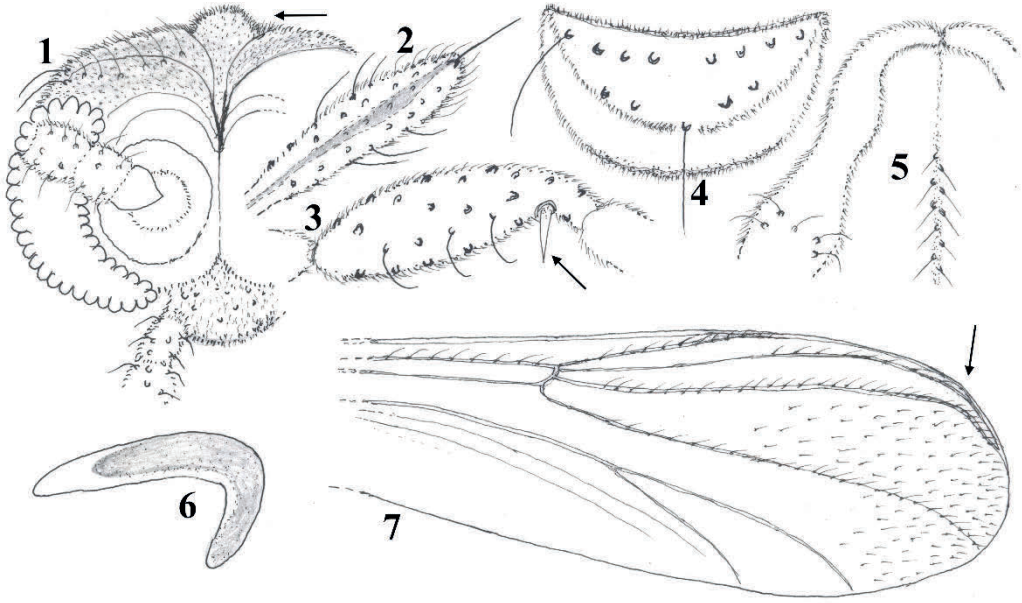
	fe	ti	ta_1	ta_2	ta_3	ta_4	ta_5	LR	BV	SV	BR
PI	515	455	420	265	240	140	95	0.76	1.78	2.81	1.35
PII	945	885	510	260	185	125	100	0.58	3.49	3.59	1.40
PIII	1020	1010	635	345	165	120	85	0.63	3.73	3.20	1.60

" 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."

Abdomen. Hypopygium in dorsal and ventral views (Figs 8-9), ventral view (Fig. 9) with tergite IX and anal point removed. Tergite IX 57 µm long; 75 µm maximum width at base and about 30 µm at distal part; broadly semi-circular and distinctly narrowing posteriorly, dorsal margin without hump, posterior margin distinctly bi-lobed; caudal area with 8 setae located near the base of anal point (4 on each side). Anal point (Figs 8, dorsal; 12, lateral) very long, reaching tip of inferior volsella, 67-70 µm long; maximum width 35 µm at base, about 20 µm in proximal half

and about 7 µm in its distal part; basal and proximal half cup-like shaped, distal half parallel-sided; apex rounded to spatulate in dorsal view (Fig. 8), triangular and pointed when viewed laterally (Fig. 12); basal area densely covered with microtrichia, dorsomedian area hyaline and bare. Laterosternite IX with 12-14 lateral setae (6-7 on each side). Sternapodeme and phallapodeme (Fig. 9), transverse sternapodeme semi-circular, markedly projecting orally and lacking lateral projections. Gonocoxite 110 µm long, about 40 µm maximum width at base of inferior volsella; dorsal side (Fig. 8) distinctly swollen at base and median part, presence of a cluster of strong setae located above inferior volsella; ventral side (Fig. 9) with 10 stout setae on inner margin. Inferior volsella (Figs. 8, 11) about 65 µm long, 15-20 µm maximum width at base; distal part 20 µm long and 5-7 µm wide; nearly digitiform to long lobe-like shaped, apical part crotchet-like and projecting upwards; basal and median parts covered with medium to short sized setae, apical part hyaline and bare. Virga (Figs 8, 10) 5-7 µm long, about 15 µm maximum width, semi-circular to wide bell-shaped, with 3 spines (2 located laterally and 1 medially). Gonostylus (Figs 13, dorsal; 14, ventral) about 60 µm long, 15-17 µm maximum width in its median part; linearly elongate, gradually narrowing posteriorly and projecting apically; anterior side markedly swollen in its proximal half, bearing 1 long seta pre-apical to megaseta, remaining part covered with short setae; median and posterior areas with 6-7 long setae clearly visible on both dorsal (Fig. 13) and ventral views (Fig. 14); crista dorsalis absent; megaseta about 6 µm long, located pre-apically, well-developed, finely elongate and curved outwards. HV = 3.5; HR = 1.83.

Female, pupa and larva: unknown.



Figures 1-7. Male imago of *Smittia zealandiana* sp. n.: head (dorsal, left side), vertex, coronal area and temporals (1); apex of last flagellomere of antenna (2); palpomere 3 (3); clypeus (4); lobes of antepronotum (5); arculus of wing (6); veins and membrane of wing (7).

Figures 1-7. Imago mâle de *Smittia zealandiana* sp. n.: tête (côté dorsal droit), vertex, aire coronale et soies temporales (1); extrémité du dernier segment antennaire (2); palpomère 3 (3); clypeus (4); lobes de l'antépronotum (5); arculus de l'aile (6); nervures et membrane de l'aile (7).

3. Differential diagnosis

The European *Smittia scutellosetosa* Caspers, 1988 represents the closest species to *S. zealandiana* sp. n., based on the following common characters: shape of anal point, inferior volsella and gonostylus. These two species appear to key into a separate group of *Smittia* species: the *zealandiana*-group. However, the new species can be distinguished from its known congeners from local insular areas and some neighbouring biogeographical regions by a combination of differentiating morphological characters:

- Eyes naked (Fig. 1) as in *S. leucopogon* (Meigen, 1804), *S. pratorum* (Goetghebuer, 1927), *S. remoraya* Moubayed-Breil & Tissot, 2019 and *S. rostrata* Goetghebuer in Schmölzer, 1962, while are finely pubescent in *S. retracta* Freeman, 1961 (in FREEMAN 1961) and *S. scutellosetosa* (Fig. 3 in CASPERS 1988);

- Frontal tubercle semi-circular (Fig. 1), is triangular in *S. scutellosetosa* (Fig. 3 in CASPERS 1988) and absent in *S. remoraya (*Fig. 1 in MOUBAYED-BREIL & TISSOT);

- Acrostichals present as in *S. alpilonga* Rossaro & Lencioni, 2000, *S. aterrima* (Meigen, 1818), *S. nudipennis* (Goetghebuer, 1913), *S. paranudipennis* Brundin, 1947 and *S. rupicola* (Kieffer, 1923), are absent in *S. retracta* (in FREEMAN 1961), *S. durandae* Moubayed, 1989 (in MOUBAYED 1989), *S. leucopogon* and *S. rostrata* (in MOUBAYED-BREIL & TISSOT 2019);

- Lobes of antepronotum not gaping (Fig. 5), are distinctly gaping in *S. alpilonga* Rossaro & Lencioni, 2000, *S. aterrima* and both *S. remoraya* and *S. superata* Goetghebuer, 1939 (Figs 5-6 in MOUBAYED-BREIL & TISSOT 2019);

- Arculus right angle-like and unequally forked (Fig. 6), is differently shaped in *S. remoraya*, *S. pratorum* and *S. superata* (Figs 7-9 in MOUBAYED-BREIL & TISSOT 2019);

- Membrane of wing atypically hairy (Fig. 7), with setae on cells r_{4+5} and m_{1+2}, while is bare in all members of the genus *Smittia*, including *S. scutellosetosa* (Fig. 1 in CASPERS 1988);

- Dorsal part of tergite IX linear (Figs 8, 12), is eventually bearing hump in some *Smittia* species as in *S. remoraya* (Fig. 13 in MOUBAYED-BREIL & TISSOT 2019);

- Anal point very long (about 70 µm) and bare in its distal half (Figs 8, 12), is similarly long but more or less covered with macrotrichia in *S. hirtella* Freeman, 1953 (Fig. 14j in FREEMAN 1956), *S. pratorum* (Fig. 192A in LANGTON & PINDER 2007) and *S. scutellosetosa* (Fig. 2 in CASPERS 1988); in *S. scutellosetosa*, the anal point is about 90 µm long;

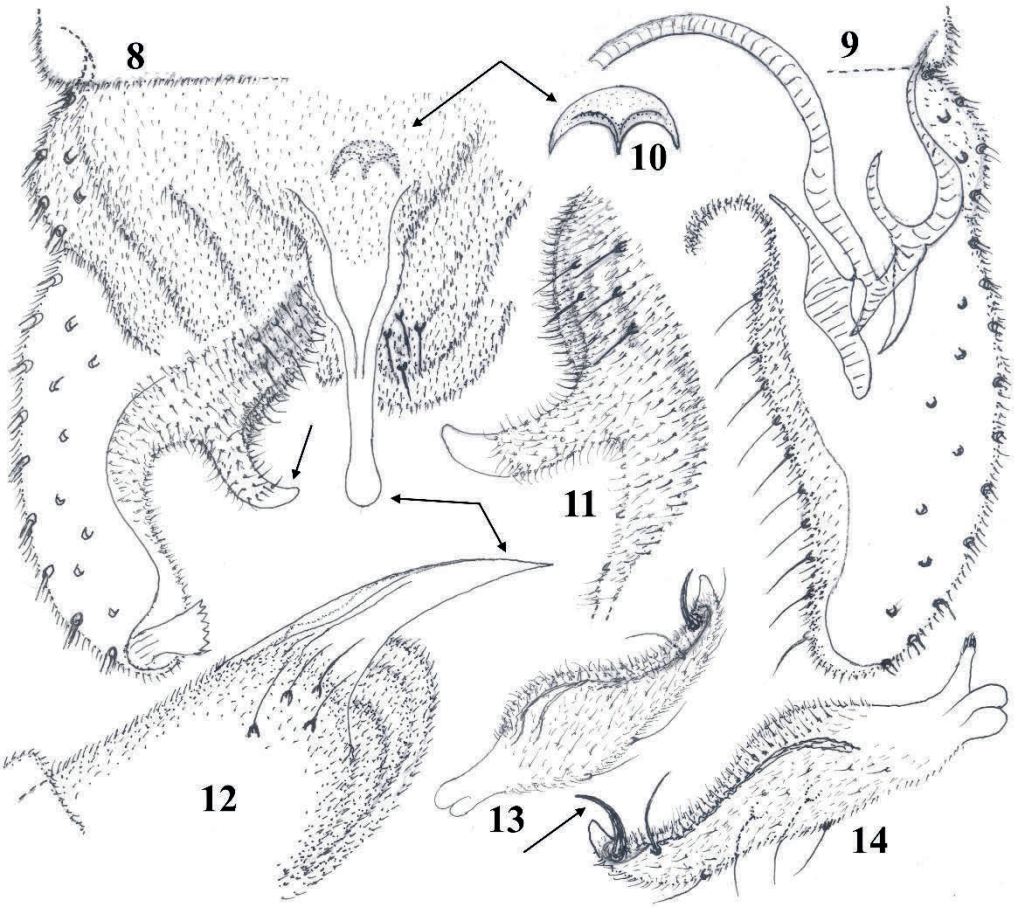
- Virga atypically semi-circular to bell-shaped (Figs 8, 10), is differently figured in all other members of the genus;

- Inferior volsella (Figs 8, 11) nearly digitiform with crotchet-like apical part, mostly hyaline and bare, is differently figured in *S. capicola* Freeman, 1953 (Fig. 14n in FREEMAN 1956), *S. scutellosetosa* (Fig. 2 in CASPERS 1988);

- Gonostylus elongate, upwardly projecting apically and distinctly swollen in its proximal part (Figs 13-14), is differently shaped in *S. retracta* (Fig. 15e in FREEMAN 1961) and *S. scutellosetosa* (Fig. 2 in CASPERS 1988);

- Megaseta markedly curved outwards (Figs 13-14), is usually straight in all other members of *Smittia* genus;

- Crista dorsalis absent (Figs 13-14), is mostly present in the genus *Smittia*.



Figures 8-14. Male imago of *Smittia zealandiana* sp. n.: hypopygium in dorsal (8) and ventral view (9); virga (10); inferior volsella, right side (11); tergite IX and anal point in lateral view (12); gonostylus at acute angle, dorsal view (13); gonostylus at obtuse angle, ventral view (14).

Figures 8-14. Imago mâle de *Smittia zealandiana* sp. n.: hypopyge en vue dorsale (8) et ventrale (9); virga (10); volselle inférieure, côté droit (11); tergite IX et pointe anale en vue latérale (12); gonostylus, sous un angle aigu (13); gonostylus, sous un angle obtus (14).

Moreover, *S. zealandiana* sp. n. can be separated from its known worldwide congeners (including those from the Palaearctic, Oriental, Afrotropical and Australasian Regions) on the basis of some distinguishing morphological characters, which are summarized in the following key.

Key to male adults of known *Smittia* species of the *zealandiana*-group

1. Inferior volsella digitiform and inwardly projecting apically (Figs 8, 11; Fig. 2 in CASPERS 1988)..... 2. *Smittia* spp., related to *zealandiana*-group

- Inferior volsella otherwise shaped, not digitiform and not inwardly projecting apically…….....Other *Smittia* spp., *zealandiana*-group excluded

2. Wing membrane not hairy, all cells are naked; eyes pubescent; inferior volsella downwardly projecting apically, bearing 2 short setae on apex (CASPERS 1988, Fig. 2); gonostylus swollen in its distal half; anal point about 90 µm long..... *S. scutellosetosa* (Palaearctic)

- Wing membrane hairy, setae present on cells r_{4+5} and m_{1+2} (Fig. 7); eyes not pubescent; inferior volsella upwardly projecting apically, lacking apical setae (Figs 8, 11); gonostylus swollen in its proximal half; anal point about 70 µm long..... *S. zealandiana* sp. n. (Australasian)

4. Ecology and geographical distribution

Larval stages of *S. zealandiana* sp. n. are typically semi-aquatic occurring among the emerged moss carpet of riparian habitats bordering the bed of the We Caot River (Mont Panié, alt. 1390 m). The type-locality (Photo 1) of the new species consists of shaded pristine mountain rhithral, where hygropetric and lotic habitats enriched with rocks and stones densely covered by submerged and emerged bryophytes and microalgae represent the most common and favourite microhabitats for larval populations. Environmental data of water recorded along the upper rhithral of the River We Caot are: siliceous water, low conductivity (23-28 µS/cm); pH 6.2-6.5; temperature 13-19 °C; further additional data on both ecological and biological quality of aquatic habitats in New Caledonia are provided in MARY & ARCHAIMBAULT (2011). Emergence is observed in early spring period but apparently extends to late summer and autumn. Environmental data of water recorded along the upper rhithral of the River We Caot are: siliceous water, low conductivity (23-28 µS/cm); pH 6.2-6.5; temperature 13-19 °C. This highlights the importance of some insular mountain ranges in the Australasian Region where constructive plans for conservation and preservation of autochthonous and endemic species must be implemented. *S. zealandiana* sp. n. is considered as an Australasian biogeographic representative and a pertinent biological indicator of global warming and local climate change.

Associated aquatic and subaquatic species encountered in the same locality with *S. zealandiana* sp. n. include: *Parochlus* sp.; *Podonomopsis* sp.; *Nilotanypus* sp.; *Paramerina* sp. 1 (cf. *levidensis* Skuse, 1889); *P.* sp. 2 (cf. *parva* Freeman, 1961); *Aphrotenia* sp.; *Aphroteniella* sp.; *Bryophaenocladius* sp.; *Corynoneura* sp.; *Cricotopus zealandicus* Freeman, 1959; *C.* sp. (cf. *conicornis* Dayson, Cranston & Krosh, 2015); *Metriocnemus* spp.; *Nanocladius* sp.; *Parakiefferiella* sp.; *Paratrichocladius pluriserialis* (Freeman, 1959); *P.* sp. (cf. *bifenestratus* Cranston, 2015; *Pseudosmittia* sp. 1; *Smittia* sp. 2; *Polypedilum* (*Polypedilum*) *nubifer* (Skuse, 1889); *P.* sp. 1 (cf. *aferum* Lehmann, 1981); *P.* sp. 2 (cf. *johanseni* Sublette & Sublette, 1973); *Cladotanytarsus stylifer* Gilka, 2015; *Rheotanytarsus* (cf. *juliae* Glover, 1973); *Tanytarsus fuscithorax* (Skuse, 1889); *Tanytarsus* spp.

Other associated species belonging to Trichoptera are: *Hydrobiosella uncinata* Kimmins, 1953; *Polycentropus nathalae* Johanson & Ward, 2009; *Helicopsyche trispina* Johanson & Mary, 2000; *Triplectides sasali* Mary & Ward, 2001; *Xanthochorema paniensis* Ward & Mary, 2000; *Oxyethira caledoniensis* Kelley, 1989.

Geographical distribution of the new described species is currently restricted to its type-locality.

Photo 1. Type-locality of *Smittia zealandiana* sp. n. Upper stream of the River We Caot (Mont Panié, 1390 m): arrows show the wet moss carpet where larvae of *Smittia* spp. were sampled. Photo J-F. Butaud.

Photo 1. Localité type de *Smittia zealandiana* sp. n. Cours supérieur de la rivière We Caot (Mont Panié, 1390 m): les flèches indiquent le tapis de mousses où des larves de *Smittia* spp. ont été collectées. Cliché J-F. Butaud.

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