



## Article

# *Polypedilum (Pol.) guianensis* sp. n., a new species occurring in the primary rainforest of French Guiana (Diptera, Chironomidae, Chironominae)

Joel Moubayed

Freshwater & Marine Biology, 10 rue des Fenouils, 34070 Montpellier, France ; [chirojmb@gmail.fr](mailto:chirojmb@gmail.fr)

Reçu le 12 juin 2024 - Accepté le 20 septembre 2024 - Publié le 16 janvier 2025

## ABSTRACT

Male adult of *Polypedilum (Pol.) guianensis* sp. n. is described based on material composed of adults captured over the canopy of the primary rainforest of Petit-Saut in French Guiana. On the basis of the specific distinguishing characters (inner verticals in 2 rows, caudal margin of frontal area low, widely bilobed; antenna 1250  $\mu\text{m}$  long, terminal segment 730  $\mu\text{m}$  long, tapering distally, AR 1.74; palpomere 3 longer than 4 and 5; tergites I-III and VIII with distinct circular pigmentation on postero-lateral corner; tergite IX with 3 characteristic ridges; superior volsella ending with one atypical short curved seta, outer seta located on distal half; gonocoxite with very long setae), *P. guianensis* sp. n. belongs to a separate group of the subgenus *Polypedilum*: the *guianensis*-gr. Therefore, the new species can be considered as a local biogeographic representative element of the primary rainforest of French Guiana. Remarks with short comments on the ecology of the new species are given.

Keywords: Diptera Chironomidae, *Polypedilum (Pol.) guianensis* sp. n., French Guiana, primary forest.

## *Polypedilum (Pol.) guianensis* sp. n., une nouvelle espèce connue de la forêt primaire en Guyane française (Diptera, Chironomidae, Chironominae)

## RESUMÉ

L'adulte mâle de *Polypedilum (Pol.) guianensis* sp. n. est décrit à partir d'un matériel composé d'adultes capturés au-dessus de la canopée de la forêt primaire de Petit-Saut en Guyane française. Sur la base des caractères distinctifs spécifiques (soies verticales intérieures en 2 rangées, partie caudale de la marge frontale largement bilobée ; antenne de 1250  $\mu\text{m}$  de long et à segment terminal de 730  $\mu\text{m}$ , partie distale effilée, AR 1.74; palpomère 3 plus long que les 4<sup>ème</sup> et 5<sup>ème</sup> réunis ; angle postéro-latéral des tergites I-III et VIII avec des taches circulaires sombres; tergite IX avec 3 carènes caractéristiques ; volselle supérieure terminée par une soie atypique courte et recourbée, soie latérale insérée dans sa moitié distale ; gonocoxite avec des soies très longues), *P. guianensis* sp. n. appartient à un nouveau groupe du sous-genre *Polypedilum* : le groupe *guianensis*. Ainsi, la nouvelle espèce peut être considérée comme un élément biogéographique représentatif de la forêt primaire guyanaise. Des remarques sur la position taxonomique et des commentaires succincts sur l'écologie de la nouvelle espèce sont fournis.

Mots-clés : Diptera Chironomidae, *Polypedilum (Pol.) guianensis* sp. n., Guyane française, forêt primaire.

*Ephemera* est une revue du groupe Opie-benthos publiée par l'Office pour les insectes et leur environnement en libre accès et en flux continu. Rendez-vous sur <https://ephemera.insectes.org> pour toutes vos propositions d'articles.

ISSN (électronique / electronic) : en cours. DOI : en cours.

urn:lsid:zoobank.org:pub:BA439CED-EE9B-413D-A8BC-2969DAC2B0A2

## 1. Introduction

Many investigations of Chironomidae implemented over the canopy and aquatic habitats extended along the undergrowth of the primary rainforest in French Guiana, generated a first list of more than 50 genera, not yet published. A larger material composed of adults, pupae, pupal exuviae and larvae will be collected in the years to come, which will provide additional biological and ecological data based on associated species. The organizers of the project named Canopy Raft (“Radeau des Cimes” in French), allowed prof. F. Hallé (Montpellier university) and his team of collaborators (botanists, entomologists, climbers) to collect a precious and valuable patrimonial material of both terrestrial and aquatic insects. Sampling methods and all other various technics of capture are documented in ABERLENC (2017).

However, there is still a large divergence between the number of described species and the estimated number of undescribed species from this poorly explored geographical area. Moreover, there is always an increasing need to assume not only a better knowledge in diversity of genera but also in species inventories, as well in description and classification of new species.

The material composed of adults, collected in October 1989 over the canopy of the primary rainforest in French Guiana, revealed the presence of three new species, of which two (*Stenochironomus hallei* sp. n. and *Einfeldia aberlencii* sp. n.) are already described by MOUBAYED (2024) and MOUBAYED & LANGTON (2025). In the present paper, a third new species belonging to the genus *Polypedilum* s. str. is diagnosed and described as male adult.

To date, the genus *Polypedilum* Kieffer is considered as the most enriched genus in number of species, since up to 450 species have been described and reported from almost all of the zoogeographical Regions as documented by BIDAVID & FITTKAU (1995), BIDAVID (1996), OYEWO & SÆTHER (1998), SAETHER & OYEWO (2008).

Data and knowledge on the taxonomy, geographical distribution and ecology of the genus *Polypedilum* s. str. (KIEFFER 1924, JOHANSEN 1932, TOWNES 1945, FREEMAN 1957, 1958, 1961, LEHMANN 1971, 1979, 1981, FREEMAN & CRANSTON 1980, HUDSON et al. 1990, BIDAVID & FITTKAU 1995, BIDAVID 1996, SPIES & REISS 1996, OYEWO & SÆTHER 1998, CRANSTON et al. 1989, MASCHWITZ & COOK 2000, SPIES & SÆTHER 2004, SÆTHER & OYEWO 2008, SÆTHER et al. 2010, YAMAMOTO et al. 2012, SÆTHER & SPIES 2013, SWANSON & BILGER 2021), show that the latter subgenus is well-reported in most of the zoogeographical Regions: Afrotropical, Australasian, Nearctic, Neotropical, Oriental and Palearctic. In particular, there is still a high number of undescribed new species from some geographic Regions, namely the Australasian, Nearctic (North and Central America) and Neotropical Regions where up to a hundred or so species may be described in the years to come as documented by BIDAVID & FITTKAU (1995), BIDAVID (1996), MOUBAYED-BREIL et al. (2021).

## 2. Material and methods

The described male adults were collected by sweep net exclusively over the canopy of the primary rainforest of Petit-Saut in French Guiana. Sampling methods and various technics of capture are detailed in ABERLENC (2017). The examined material was preserved in 80-85% ethanol for additional taxonomic examination and description. Information on the methodology of mounting and conservation of the type-material is provided in MOUBAYED (2024). Morphological terminology and measurements follow those of SÆTHER (1980), NIITSUMA (1992) and LANGTON & PINDER (2007).

## 3. Description

### *Polypedilum* (*Pol.*) *guianensis* sp. n.

urn:lsid:zoobank.org:act:08680E2A-DABA-4393-9FD2-FF3FBFAF2DF36

## Material examined

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

**Paratypes.** Two male adults (1 mounted and 1 preserved in 80% ethanol), undergrowth of the primary forest of Petit-Saut, same date as for the 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' (GBIFCH01217139). The paratype is deposited in the collection of the senior author.

**Etymology:** the name "guianensis" of the new species refers to the French Guiana (a French Overseas Department located north-eastern Brazil), which is part of the Neotropical Region.

## Diagnostic characters

Though some morphological similarity (general shape of hypopygium including tergite IX, anal point, apodemes) is observed between *P. guianensis* sp. n. and other related members of the genus *Polypedilum*, subgenus *Polypedilum*, the unusual apical short-curved seta on superior volsella combined with the following differentiating characters, the new species is easily separated from all other congeners. Inner temporals 13 in 2 separate rows; caudal margin of frontal area widely bilobed; antenna 1250  $\mu\text{m}$  long, terminal segment 730  $\mu\text{m}$  long, distinctly tapering distally, densely covered with setae, AR 1.74; palpomere 3 longer than 4 and 5; scutellum with 12 setae in 2 rows, posterior row with much longer and stouter setae; tergites I-III and VIII with distinct postero-lateral dark circular spots, pulvilli bifurcate; tergite IX with 3 characteristic ridges; projection of superior volsella straight medially, abruptly upturned blunt apically, apex with one atypical short curved seta, outer lateral seta located on distal half; gonocoxite with about

10 long setae (7 lateral, 3 median), those located apically are much longer (480-500  $\mu\text{m}$  long); gonostylus slender, nearly parallel-sided, setae located laterally much longer than those on median area.

## Male imago

(n = 3; Figs 1A-J)

Medium to big sized species. Total length 4.35 mm. Wing length 1.64 mm, TL/WL = 2.65. General colouration brownish with contrasting brown to dark brown thorax. Antenna brownish, mesonotal stripes dark brown, wing pale brown, legs brownish; tergites I-III and VII with rounded dark pigmentation on postero-lateral sides; anal segment contrasting brown to dark brown

Head (Fig. 1A). Eyes bare; coronal triangle small; base of coronal triangle semicircular, caudal margin of frontal area bilobed, widely extended laterally; temporals 16, 13 inner and 3 outer verticals, inner verticals located in 2 distinct rows. Antenna 13-segmented, 1150  $\mu\text{m}$  long; ultimate flagellomere 430  $\mu\text{m}$  long, not clubbed, tapering distally; densely covered with setae, segments 2-12 each with 8-12 setae, last segment with about 270-300 setae; sensilla chaetica weakly-developed; antennal groove beginning on segments 2/3; AR 1.72. Clypeus (Fig. 1B) 125  $\mu\text{m}$  long, 135  $\mu\text{m}$  maximum width, cup shaped, with 16 setae in 3 rows. Palp 5-segmented, first and second segments fused; length ( $\mu\text{m}$ ) of palpomeres: 20, 40, 150, 105, 125; sensilla coeloconica absent; palpomere 5 with 7 sensilla clavata located close to the lateral margin. Thorax. Lobes of anteprenotum not gapping, basal part thicker, lateral anteprenotals 5; acrostichals 13 located close to scutum in 1-2 rows; dorsocentrals 11 in one row; prealars 5 uniserial; scutellum (Fig. 1D) with 12 setae in 2 rows (6 anterior, 6 posterior; 6 on each side of the midline), posterior row composed of distinctly longer and stouter setae. Wing. Brachiolum with one seta; subcosta overreaching fork of radius; costal expansion absent. Number of setae on veins: R, 26; R<sub>1</sub>, 17; remaining veins bare; squama with 8 setae. Legs. Tarsomere ta<sub>5</sub> of PII 70  $\mu\text{m}$  long,

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV	BR
PI	1025	965	1345	465	440	225	115	1.39	2.68	1.48	2.20
PII	995	890	495	290	215	145	70	0.56	3.31	3.81	2.65
PIII	1055	945	760	445	385	240	105	0.80	2.35	2.63	2.40

Table 1. 'LR = Length of tarsomere ta<sub>1</sub> divided by length of tibia (ti); BV = Combined length of femur (fe), tibia and ta<sub>1</sub> divided by combined length of tarsomeres ta<sub>2</sub>-ta<sub>5</sub>; SV = Ratio of femur plus tibia to tarsomere ta<sub>1</sub>; BR = Ratio of longest seta of ta<sub>1</sub> divided by minimum width of ta<sub>1</sub>, measured one third from apex'

much longer in PI-PIII (respectively 115 and 105  $\mu\text{m}$  long). Tibial scale of PI broadly triangular, nearly pointed apically; comb of PII-PIII well developed as in the genus *Polypedilum*; length in  $\mu\text{m}$  of tibial spurs: PI, 90; PII, 60, 25; PIII, 40, 30; sensilla chaetica present on: apical part of tibia and tarsomeres ta<sub>1</sub>-ta<sub>5</sub> of PI-PIII; pulvilli *Polypedilum*-type, not lobed. Length (in  $\mu\text{m}$ ) and proportions of legs (n = 1, paratype) as in the Table 1.

Abdomen. Tergites I-III and VIII with dark pigmentation on caudo-lateral sides, those on VII slightly larger, base of tergite VIII broadly triangular. Hypopygium in dorsal and ventral view as in Figs 1F-G (Fig. 1F, dorsal; Fig. 1J, lateral; Fig. 1G, ventral with tergite IX and anal point omitted). Tergite IX 125  $\mu\text{m}$  long, 175  $\mu\text{m}$  maximum width, broadly cup shaped, median part parallel-sided; dorsal hump absent; anal tergite bands (ATB) extended from basal median area of tergite VIII to distal half of tergite IX, thicker at base, abruptly interrupted at postero-median area; dorsal side with 15 setae 60-65  $\mu\text{m}$  long located antero-medially in 4-5 transverse rows; posterior margin with 8 lateral setae (4 on each side of the anal point); 6 vertically extended specific ridges located on each side of the ATB. Anal point as in Figs 1F, J (Fig. 1F, dorsal; Fig. 1J, lateral), about 60-65  $\mu\text{m}$  long, 15  $\mu\text{m}$  maximum width at base, 3  $\mu\text{m}$  at mid-section, 5  $\mu\text{m}$  apically; slender, median part parallel-sided, ventral part with 6-7 setae. Laterosternite IX with 6 setae (3 on each side). Apodemes (Fig. 1G), sternapodeme not projecting, transverse apodeme straight, lateral corner right-angled; phallapodeme linearly elongate. Superior volsella (Figs 1F, G-I: 1F-G, dorsal;

1H, lateral; distal half, 1I), base inwardly projecting, with 4 inner setae; projection about 65  $\mu\text{m}$  long, median part 2  $\mu\text{m}$  wide, distal part abruptly upturned inwards; apex with one characteristic short curved seta of about 2  $\mu\text{m}$  long, well visible in Figs 1H-I); lateral seta (Figs 1F-I) located on outer distal half. Inferior volsella (Figs 1F-G), 130  $\mu\text{m}$  long, 25-30  $\mu\text{m}$  maximum width; apical part not bilobed, narrowed dorsally, rounded ventrally; dorsal side (Fig. 1F) with 8-9 stout curved setae located apically, apical long seta 95-100  $\mu\text{m}$  long, visible in both dorsal and ventral view; ventral side with one apical seta, setiferous ventral lobe indistinct. Gonocoxite 115  $\mu\text{m}$  long; ventral side (Fig. 1G) with 4 setae on inner margin; dorso-lateral side with weak caudo-lateral expansion, bearing 10 long setae (7 lateral, 3 median); lateral setae on proximal half are shorter (50-80  $\mu\text{m}$  long), those located on apical part much longer (480-500  $\mu\text{m}$  long) reaching tip of gonostylus as in Fig. 1F. Gonostylus (Figs 1F-G), 180  $\mu\text{m}$  long, 40  $\mu\text{m}$  maximum width, slender, not swollen medially, distal half parallel-sided, slightly tapering distally; dorsal side with long and short setae in 2 rows, setae on median part much shorter; inner distal margin with about 12-13 thin/needle-like setae visible in dorsal and ventral sides. HR 0.64; HV 2.42.

Female adult, pupa and larva: unknown.

## 4. Remarks and differential diagnosis

Although some common morphological characters (general shape of tergite IX, anal point and inferior volsella) are also observed in other known members of the subgenus *Polypedilum*

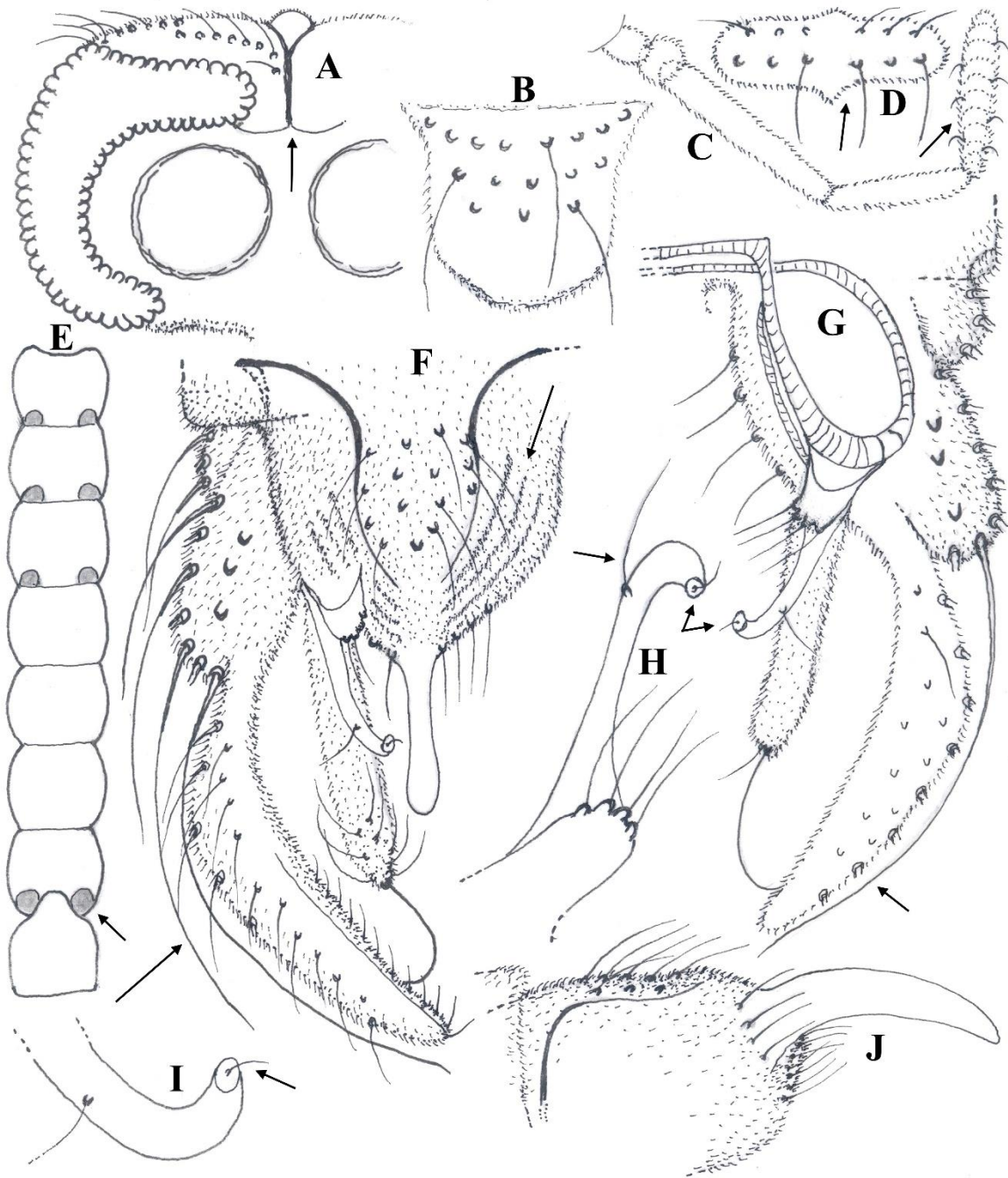


Figure 1. Male imago of *Polypedilum* (Pol.) *guianensis* sp. n. Head (left side, dorsal), frontal area, vertex and temporal setae (A); clypeus (B); palpomeres 1-5 (C); scutellum (D); tergites I-VIII (E); hypopygium in dorsal (F) and ventral view (G); superior volsella, lateral (H); superior volsella, distal half (I); tergite IX and anal point, lateral (J). The arrows indicate some distinctive characters.

Figure 1. Imago mâle de *Polypedilum* (Pol.) *guianensis* sp. n. Tête (côté gauche, vue dorsale), aire frontale, vertex, et soies temporales (A); clypéus (B); palpomères 1-5 (C); scutellum (D); tergites I-VIII (E); hypopyge en vue dorsale (F) et ventrale (G); volselle supérieure, vue latérale (H); volselle supérieure, moitié distale, vue latérale (I); tergite IX et pointe anal, vue latérale (J). Les flèches indiquent quelques caractères distinctifs.

worldwide, the unusual apical seta on superior volsella combined with the distribution pattern of spots on tergites will easily separate the new species from all other congeners.

However, a combination of some distinctive characters found in the male adult of *P. guianensis* sp. n. are highlighted in the following differential diagnosis:

- Head (Fig. 1A). Basal side of coronal triangle semicircular, inner verticals located in 2 distinct rows, caudal margin of frontal area bilobed, low, extended laterally;

- Abdomen (Fig. 1E). Tergites I-III and VI with circular pigmentation on posterolateral corner;

- Hypopygium (Figs 1F-G). Tergite IX, anal point, superior and inferior volsella, gonocoxite and gonostylus are all differently shaped in other related congeners.

## 5. Ecology and distribution

Larval populations of the genus *Polypedilum* are mostly encountered in both lotic and lentic aquatic habitats, including wet meadows, peat bogs, temporary pools and bordering riparian wetlands along streams and rivers. Adults of *P. guianensis* sp. n. were exclusively collected in the primary rainforest of French Guiana (Petit-Saut area). Currently, the type-material was captured only over the canopy but can eventually be found as well along undergrowth aquatic habitats. 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 may be more widely distributed in other similar primary rainforest located in French Guiana or in some neighbouring geographical countries, namely Brazil and Suriname.

### Acknowledgements

The author is greatly indebted to H.P. Aberlenc and G. Delvare, who kindly entrusted the precious captured adults of chironomids, which currently includes the type-material

of *P. guianensis* sp. n. and many other yet undescribed species from French Guiana.

### References

- ABERLENC, H.-P. 2017. « *L'aventure du radeau des Cimes* » : pp. 291-297. In : Hallé F., 30 ans d'exploration des canopées forestières tropicales. Plaisan, Museo Éditions, 368 pp.
- BIDAWID, N. & E.J. FITTKAU. 1995. Zur Kenntnis der neotropischen Arten der Gattung *Polypedilum* Kieffer, 1912. Teil I. (Diptera, Chironomidae). *Entomofauna*, **16** (27): 465-536.
- BIDAWID-KAFKA, N. 1996. Zur Kenntnis der neotropischen Arten der Gattung *Polypedilum* Kieffer, 1912. Teil I. (Diptera, Chironomidae). *Entomofauna*, **17** (11): 165-5240.
- CRANSTON, P.S, M.E. DILLON, L.C.V PINDER & F. REISS (1989). The adult males of Chironominae (Diptera, Chironomidae) of the Holarctic Region - Keys and diagnoses. In: Wiederholm, T. (ed.): Chironomidae of the Holarctic region. Keys and diagnoses. Part 3 - Adult males. *Entomologica Scandinavica*, Supplement **34** : 353-502.
- FREEMAN, P. 1957. A study of the Chironomidae (Diptera) of Africa south of the Sahara. Part III. *Bulletin of the British Museum Natural History, Entomology*, **5**: 323-426.
- FREEMAN, P. 1958. A study of the Chironomidae (Diptera) of Africa south of the Sahara. Part IV. *Bulletin of the British Museum Natural History, Entomology*, **6**: 263-36.
- FREEMAN, P. 1961. The Chironomidae (Diptera) of Australia. *Australian Journal of Zoology*, **9**: 611-637.
- FREEMAN, P. & P.S. CRANSTON. 1980. *Family Chironomidae*. Pp. 175-202 in 'Catalogue of the Diptera of the Afrotropical Region', Ed. Crosskey, R.W., British Museum (Natural History).
- HUDSON, P.L., D.R. LENAT, B.A. CALDWELL & D. SMITH. 1990. Chironomidae of the southeastern United States: A checklist of species and notes on biology, distribution and habitat. *US Fish and Wildlife publications*, **7**: 1-46.
- JOHANNSEN, O.A. 1932. Chironominae of the Malayan subregion of the Dutch East Indies. *Archiv für Hydrobiologie*, Supplement **11**: 503-552.

- KIEFFER, J.J. 1924. Quelques Chironomides nouveaux et remarquables du Nord de l'Europe. *Annales de la Société Scientifique de Bruxelles*, **43**: 390-397.
- LANGTON, P.H & L.C.V. PINDER. 2007. *Keys to the adult males of Chironomidae of Britain and Ireland*. Volume 1 (239 pp) and volume 2 (68 pp). Freshwater Biological Association, Scientific Publication, n° 64.
- LEHMANN, J. 1971. Die Chironomiden der Fulda. (Systematische, ökologische und faunistische Untersuchungen). *Archiv für Hydrobiologie*, Supplement **37**: 466-555.
- LEHMANN, J. 1979. Chironomidae (Diptera) aus Fließgewässern Zentralafrikas (Systematik, Ökologie, Verbreitung und Produktionbiologie). Teil I: Kivu-Gebiet, Ostzair. *Spixiana*, Supplement **3**: 1-144.
- LEHMANN, J. 1981. Chironomidae (Diptera) aus Fließgewässern Zentralafrikas. Teil II: Die Region um Kisangani, Zentralzair. *Spixiana*, Supplement **5**: 1-85.
- MASCHWITZ, D.E. & E.F. COOK. 2000. Revision of the Nearctic species of the genus *Polypedilum* Kieffer (Diptera, Chironomidae) in the subgenera *P. (Polypedilum)* and *P. (Uresipedilum)* Oyewo & Sæther. *Bulletin of the Ohio Biological Survey*, New Series, **12**: 11-35.
- MOUBAYED, J. 2024. 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). *Ephemera*, **25**: 83-90.
- MOUBAYED, J. & P.H. LANGTON. 2025. On the genus *Einfeldia* Kieffer from France. Description of *E. aberlencii* sp. n. from French Guiana with emendation of four recently described species from continental France (Diptera, Chironomidae). *Ephemera*, **26** : 1-9.
- MOUBAYED-BREIL, J., N. MARY & P. ASHE. 2021. Chironomidae connus de Nouvelle-Calédonie. I. Sites prospectés et premières données faunistiques (Diptera). *Ephemera*, **22** (2): 103-126.
- NIITSUMA, H. 1992. The *Polypedilum convictum* species group (Diptera, Chironomidae) from Japan, with descriptions of two new species. *Japanese Journal of Entomology*, **60**: 693-706.
- OYEWO, E.A. & O.A. SÆTHER. 1998. Revision of Afrotropical *Polypedilum* Kieffer subgenus *Uresipedilum* Sasa & Kikuchi, 1995 (Diptera, Chironomidae) with a review of the subgenus. *Annales de Limnologie*, **34**: 315-362.
- SÆTHER, O.A. 1980. Glossary of chironomid morphology terminology (Diptera, Chironomidae). *Entomologica Scandinavica*, supplement **14**: 1-51.
- SÆTHER, O.A., T. ANDERSEN, L.C. PINHO & H.F. MENDES. 2010. The problem with *Polypedilum* Kieffer (Diptera, Chironomidae), with the description of *Probolom* subgen. n. *Zootaxa*, **2497**: 1-36.
- SÆTHER, O.A. & E.A. OYEWO. 2008. Keys, phylogenies and biogeography of *Polypedilum* subgenus *Uresipedilum* Oyewo & Sæther (Diptera, Chironomidae). *Zootaxa*, **1806**:1-34.
- SÆTHER, O.A. & M. SPIES. 2013. *Fauna Europaea: Chironomidae*. In P. Beuk & T. Pape (eds): *Fauna Europaea: Diptera Nematocera*. Fauna Europaea version 2.6. Internet database at <http://www.fauna-eur.org> [accessed February 2015].
- SPIES, M. & F. REISS. 1996. Catalog and bibliography of Neotropical and Mexican Chironomidae (Insecta, Diptera). *Spixiana*, supplement **22**: 61-119.
- SPIES, M. & O.A. SÆTHER. 2004. Notes and recommendations on taxonomy and nomenclature of Chironomidae (Diptera). *Zootaxa*, **752**: 1-90.
- SWANSON, D.R. & E.E. BILGER. 2021. An updated checklist to the Non-biting Midges (Chironomidae) of Illinois. *The great Lakes Entomologist*, **54** (2): 1-103.
- TOWNES, H.K. 1945. The Nearctic species of Tendipedini (Diptera, Tendipedidae (= Chironomidae)). *American Midland Naturalist*, **34**: 1-206.
- YAMAMOTO, N., M. YAMAMOTO & T. HIROWATARI. 2012. Three new species of the genus *Polypedilum* Kieffer (Diptera, Chironomidae) from the Yaeyama Island, Japan. *Japanese Journal of Systematic Entomology*, **18** (1), 75-83.