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A mangrove-based dataset to study the ecology of Neotropical mosquitoes (Diptera: Culicidae) in French Guiana

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Abstract

Understanding how mosquitoes are distributed in relation to changes in natural vegetation and human-made areas is crucial but challenging in the tropics. A dataset based on mangroves is presented and made available online through GBIF at https://doi.org/10.15468/k7ru2k to study the ecology of Neotropical mosquito assemblages (Arthropoda: Diptera: Culicidae) in French Guiana. A total of 334 collection events were carried out across a variety of coastal and estuarine mangrove habitats that differed in terms of their species composition, structure, age, and proximity to urban settlements. The dataset comprises a total of 21,765 mosquitoes, belonging to 14 genera and 62 species, and new collections can be added to it. The voucher specimens and their associated DNA are stored at the *Institut Pasteur de la Guyane' Medical Entomology Unit.*

Key words: Culicidae, mangroves, sampling event, occurrences, dataset, habitat, trap collection

Introduction

To date, 3,727 valid species of Culicidae have been identified worldwide (Harbach 2025). Each species exhibits varying degrees of ecological preferences whether for a specific habitat or a range of habitats. As some of these species are important nuisance pests and/or vectors of pathogens, there is an increasing demand for data on their spatial distribution in habitats neighboring human populations (Yan and Zhong 2005). This presence can significantly impact the epidemiology of mosquito-borne diseases (Wouters et al. 2024), making more ecologically sensitive and efficient mosquito control strategies necessary. In the Neotropical Region, the number of recorded species is constantly increasing, despite our limited knowledge of their ecology. In particular, habitats provided by mangroves, swamps, or tropical rainforests in tropical regions remain largely neglected (Siwiendrayanti et al. 2020).

French Guiana is recognized as having one of the highest diversity of mosquito species in the world relative to its surface area (Foley et al. 2007). To date, 250 species have been recorded in this oversea territory of France (Talaga et al. 2015a, 2020, 2025; Talaga and Gendrin 2022, Talaga and Duchemin 2023). Georeferenced occurrences of mosquito species in French Guiana were already reported by Fauran and Pajot (Fauran 1961, Fauran and Pajot 1974) later updated in 2015 (Talaga et al. 2015b). These databases are largely used to exchange biodiversity and molecular data, but their internal structure prevented them from being used to assess the composition of species assemblages and their abundance over time and across space. The overarching objective of this study is to address the paucity of data concerning the distribution of mosquitoes in various habitats of French Guiana. To this end, our primary focus has been on the identification of mosquito assemblages found in various mangrove habitats in French Guiana. This has been achieved by consolidating a robust mangrove-based dataset, detailing sampling events, with a view to its application at a regional scale, and in relation to different other habitats.

Mangroves are defined as natural and dynamic forest ecosystems that grow in the tropical intertidal zone between latitudes 30° north and 30° south (Spalding et al. 2010). Guided by the aim of mitigating any latent health hazards, a number of studies have been conducted on mosquito occurrences in mangrove habitats, with a particular emphasis on pest and disease-carrying species (Giordano et al. 2021, Knight 2011, Knight et al. 2012, Ritchie 1992). On one hand, mangrove habitats represent large

water bodies that harbor and promote the proliferation of a number of mosquito species, including pests and vectors (Garcia-Rejon et al. 2023; Hoyos-López et al. 2016, Talaga et al. 2024). Conversely, they can be poor larval habitats due to frequent tidal and freshwater flooding and flushing, which hinders the oviposition of mosquitoes.

In French Guiana, mangrove forests cover approximately 700 km², representing 0.83% of the territory. Nevertheless, they occupy more than 80% of the Guianese coastline, where 90% of the human population lives (Stier et al. 2020). This article presents a dataset of mosquito species captured in a variety of mangrove habitats in French Guiana. The new dataset has been designed to document the sampling events with the relative abundance of species recorded in each mangrove habitat. Consequently, the presence and absence of species can be inferred based on data collected using similar protocols but at different times or locations. Furthermore, the dataset structure promotes data tracking of collection events and biodiversity data to be shared by providing a fast and efficient tool for reliable information on specimens through online access.

Taxonomic coverage

The dataset under consideration concerns mosquitoes (Diptera: Culicidae). The identification of species is provided whenever possible, or at the genus level at least, based on an examination of adult external features. In the absence of identification keys for all known mosquito species in French Guiana, identification was made using various identification keys listed in Table 1.

Table 1. List of mosquito genera ordered alphabetically and used keys for identification.

Genus	Identification keys
Aedeomyia Theobald	Lane (1953)
Aedes Meigen	Home-made key of Aedes (08/2007)
Anopheles Meigen	Sallum et al. (2020).
Coquillettidia Dyar	Home-made key of Mansoniini tribe (02/2007)
Culex L.	Lane & Whitman (1951); Berlin & Belkin (1970); Sirivanakarn 1983; Sallum & Forattini 1996
Deinocerites Theobald	Adames (1971)
Haemagogus Williston	Arnell (1973)
Limatus Theobald	Lane (1953)
Mansonia Blanchard	Home-made key of Mansoniini tribe (02/2007)
Psorophora Robineau-Desvoidy	Home-made key of Psorophora (08/2007)
Sabethes Robineau-Desvoidy	Neves et al. (2024)
Toxorhynchites Theobald	Lane (1953)
Uranotaenia Lynch Arribálzaga	Galindo et al. (1954)
Wyeomyia Theobald	Lane (1953)

The use of taxonomic names and classification is based on Talaga et al. 2015a, updated using the list of species in the “Mosquito Taxonomic Inventory,” (Harbach 2025). As the present dataset is principally composed of specimens collected from BG-Pro and CDC light traps, some taxonomic groups of mosquitoes are significantly underrepresented. In December 2025, the dataset contained a total of 21,765 mosquito specimens belonging to 14 genera and 62 species, with the *Culex* genus dominantly represented (Fig.1).

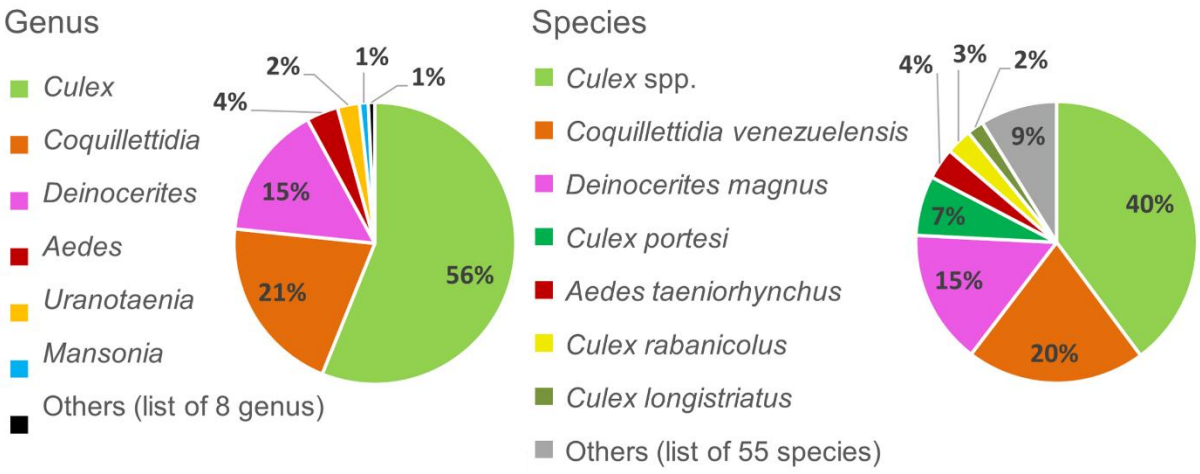

Figure 1. Taxonomic coverage of the dataset by genus (left) and species (right).

Taxa include

Kingdom: Animalia

Phylum: Arthropoda

Class: Insecta

Order: Diptera

Family: Culicidae

Subfamilies: Anophelinae, Culicinae.

Tribes: Aedeomyiini, Aedini, Culicini, Mansoniini, Sabethini, Toxorhynchitini, Uranotaeniini.

Genera: *Aedeomyia*, *Aedes*, *Anopheles*, *Coquillettidia*, *Culex*, *Deinocerites*, *Haemagogus*, *Limatus*, *Mansonia*, *Psorophora*, *Sabethes*, *Toxorhynchites*, *Uranotaenia*, *Wyeomyia*.

Spatial coverage

Description:

The selected sampled habitats are located in the mangroves of French Guiana, a French overseas department situated north of Brazil. The majority of the sampled sites were located in the region of Cayenne and its direct surroundings, extending for approximately 50 km alongshore and about 25 km inland (Fig.2).

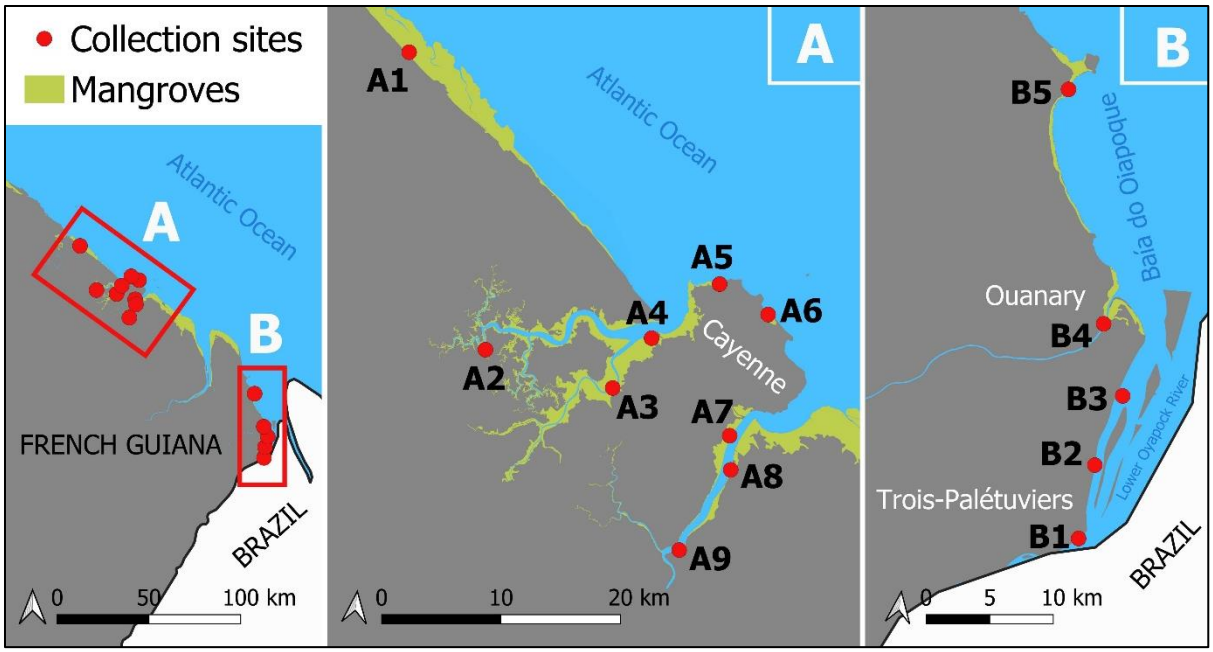

Figure 2. Geographical coverage of mangroves in French Guiana (green areas) and collection sites (red dots) between October 2023 and July 2025. Sites located on the Island of Cayenne and its direct surroundings (A); sites located along the lower Oyapock River (B). Guatemala (A1); Montsinéry (A2); Petit Cayenne (A3); Larivot (A4); IRD (A5); Salines (A6); La Levée (A7); Auberge du Mahury (A8); Dégrad Roura (A9). Trois-Palétuviers (B1); Berge Gauche (B2); Îlet Perroquet (B3); Dégrad Ouanary (B4); Palétuviers (B5). The scale of the map does not allow you to see the narrow strips of mangroves where the three sites on the lower Oyapock are located.

Around Cayenne, mangrove forest covers approximately 45 km^2 within the six municipalities of Cayenne, Kourou, Montsinéry-Tonnégrande, Roura, Matoury and Rémire-Montjoly. Approximately 100 km southeast of Cayenne, a second area was sampled in the Oyapock river mouth at the boundary with Brazil along an upstream-downstream transect about 30 km long between Trois-Palétuviers and Ouanary. Some of the sampled areas are in direct contact with the urban center of Cayenne as well as residential or village areas. Other areas are located further away, sometimes more than ten kilometers from human infrastructures.

All collection events were recorded under the country “French Guiana” in order to comply with ISO 3166-1 and BOLD recommendations.

Geographical methods: GPS coordinates were obtained using a Garmin GPSmap 60CSx device and the accuracy of the coordinates is estimated to be around 30 meters

at a 95% confidence level. The geodetic system used was the World Geodetic System 1984 (WGS 84), combined with UTM 21-22 N for map projection.

Temporal coverage

Notes: From 23 October 2023 to 11 July 2025

Project description

Title: Mosquitoes in the Mangroves of French Guiana (MMFG)

Personnel: Médie Collet

Study area description: A total of 14 locations were used for the collection of events. These locations corresponded to various types of mangrove forest, at different growth stages, ranging from young to mature, and from homogeneous to mixed formations, with different structural characteristics.

Dataset design description: For the Cayenne region, adult mosquitoes were collected with BG-Pro and CDC light traps during 4 to 5 sampling sessions for each of seven selected sites during the dry and wet seasons between 2024 and 2025. For the Oyapock region, adult mosquitoes were collected with BG-Pro and CDC light traps during two sampling sessions for each of the four sites selected along the river upstream-downstream transect. In this remote area, logistics were much more difficult and time-consuming to achieve mosquito sampling.

The dataset also included a few records of immature and adult mosquitoes additionally collected in the sites of Larivot, Auberge du Mahury, Dégrad Roura and Palétuviers (Fig.2). These unique additional sampling events represent 7% of the total of collections events and involve six other trap setups to target a highest diversity of species (Tab.3).

The ID of the collection event was made up based on the abbreviation UEM (Unité d'Entomologie Médicale) directly followed by a unique collection number. Specimen IDs were based after the collection event codes directly followed by a unique specimen number separated by a n-dash.

Funding: These data were obtained as part of a PhD fellowship awarded to Médie Collet and granted by the University of French Guiana. The work done in the Cayenne region was part of the MAGELLAN Living Labs project, which is funded by the France

2030 program on Nature-based Solutions (ANR-22-EXSO-0002). The work done in the Oyapock region was part of the OYAMOUST project, led by Médie Collet, and funded by the Oyapock Observatoire Hommes-Milieux (OHM).

Methods

Study extent description and features:

The region study is part of the 1,500 km long muddiest coast in the world (~1,600km), between the Amazon and the Orinoco river mouths (Anthony et al. 2011). Along the 320 km of coastline in French Guiana, there are a few types of mangrove trees. This includes the following types of trees and shrubs: *Laguncularia racemosa* (L.) C.F. Gaertn, 1807, *Conocarpus erectus* L., 1753, *Rhizophora mangle* L., 1753, *Rhizophora racemosa* G. Mey., 1818, and *Avicennia germinans* (L.) L., 1764. Each species can deal with and grow in the anaerobic, salty and unstable environments. They form large areas of mangrove habitats, which are diverse in terms of forest structures and species composition (Fromard et al. 1998, Fromard et al. 2004, Proisy et al. 2007). Shore-fringed mangroves are distinguished from estuarine mangroves because growth stage development can be disturbed by mud accretion and erosion phases (Proisy et al. 2021). We provide a synthesis description for each mangrove habitat in which the mosquito collections were made, i.e., stand age, species composition along with some structural parameters of the forest stand (Tab.2 and Fig.3).

Table 2. Features of the sampled mangrove habitats.

Locality	GPS coordinates	Features
A1 (Guatemala)	5°05'48"N 52°34'09"W	Mature homogeneous mangroves (*Avicennia germinans*) (**Fig. 3B**).
A3 (Petit Cayenne)	4°51'34"N 52°23'20"W	Mature heterogeneous mangroves (*Avicennia germinans*, *Rhizophora mangle*) (**Fig. 3D**).
A4 (Larivot)	4°54'01"N 52°21'50"W	Mature heterogeneous mangroves (*Avicennia sp.*, but *Rhizophora* sp. is dominant).
A6 (Salines)	4°55'37"N 52°16'42"W	Mature homogeneous backshore mangroves (*Rhizophora mangle*) (**Fig. 3C**).
A5 (IRD)	4°56'46"N 52°19'02"W	Pioneer heterogeneous mangroves (**Fig. 3A**), (*Avicennia germinans* and *Laguncularia racemosa*). Established 1 year before data collection.
A2 (Montsinéry)	4°52'43"N 52°29'15"W	Mature homogeneous mangroves (*Rhizophora mangle*) (**Fig. 3C**).
A7 (La Levée)	4°49'58"N 52°17'50"W	
A8 (Auberge du Mahury)	4°48'26"N 52°17'39"W	
A9 (Dégrad Roura)	4°44'33"N 52°19'35"W	
B1 (Trois-Palétuviers)	4°03'12"N 51°39'50"W	
B2 (Berge Gauche)	4°06'20"N 51°39'32"W	
B3 (Ilet Perroquet)	4°09'25"N 51°38'43"W	
B4 (Dégrad Ouanary)	4°12'22"N 51°39'54"W	
B5 (Palétuviers)	4°22'07"N 51°42'36"W	

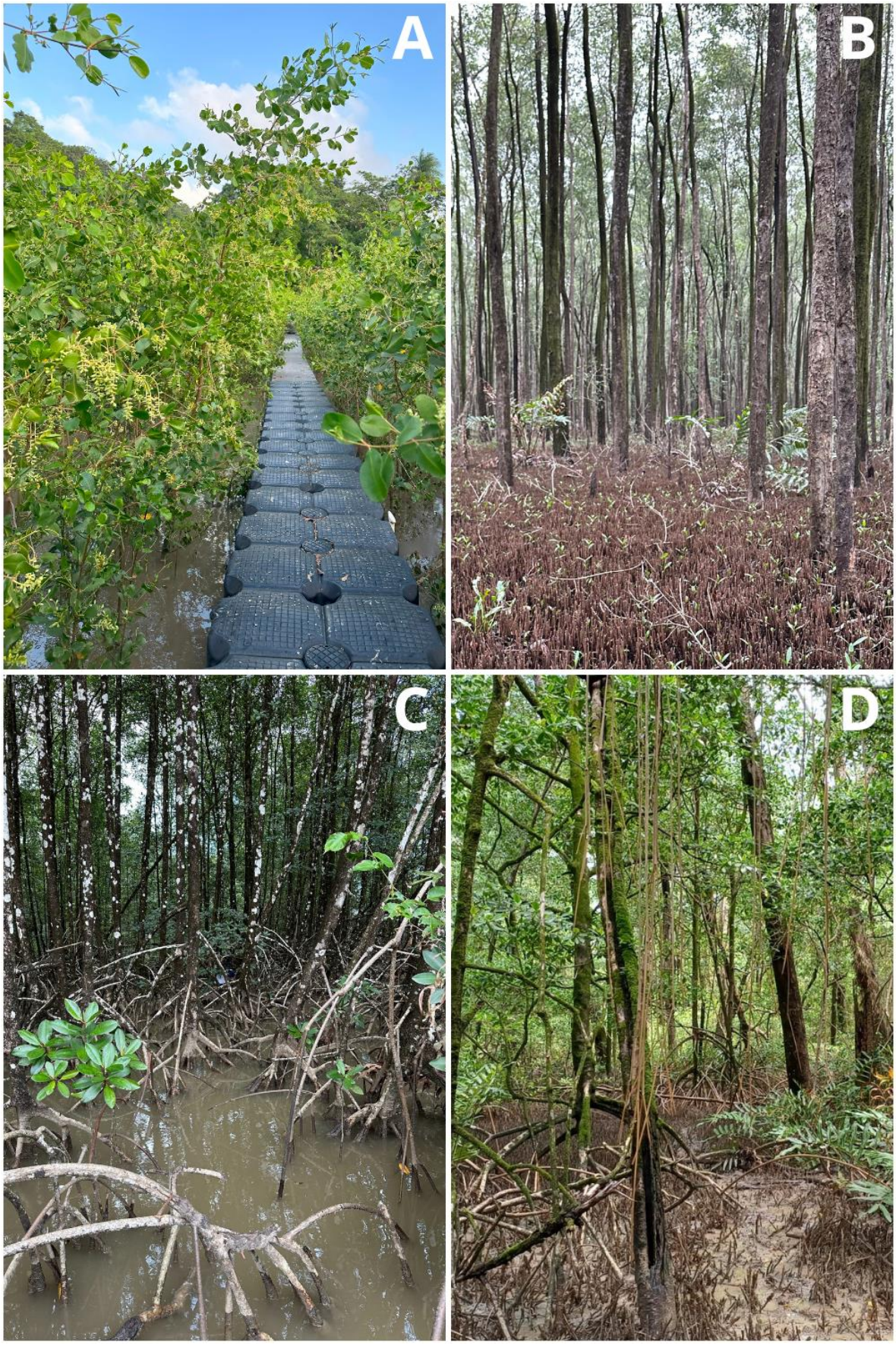

Figure 3. Pictures of various mangrove forests sampled on the Island of Cayenne and its direct surroundings. IRD (A); Guatemala (B); Larivot (C) and Petit Cayenne (D).

On the sampling dates, the sites were situated between 0 and 1 meter above sea level, with an average monthly temperature of 27°C and alternating wet and dry seasons. According to Météo-France, there are four alternating seasons in the region: a long rainy season from the beginning of April to mid-July, a long dry season from mid-July to mid-November, a short rainy season from mid-November to mid-February, and a shorter dry season from mid-February to the beginning of April.

Sampling: The following sampling protocol and setups were used (Tab.3): BG-Pro baited with BG-Sweetscent and CDC light traps were the two main sampling methods used. Usually, traps were for night trapping or day trapping, and occasionally both. At each site, traps were suspended about 1.5 m above the ground level at regular intervals along a transect from 30 m to 60 m. However, due to circumstances, not always the same setups were used at all sites, and the sampling plan was not always the same at all sites. Two larval dipping events were occasionally carried out and included in the dataset.

Table 3. Collection methods used and total number of mosquitoes obtained from mangroves in French Guiana from the dataset.

Traps settings	Total collection events	Total mosquito numbers
BG-Pro BG-Sweetscent	104	273
BG-Pro BG-Sweetscent UV	108	7,049
CDC Light	104	11,425
Others (list of 6 traps settings)	18	3,018
TOTAL	**334**	**21,765**

Processing: Wherever possible, captured specimens were transported alive to the laboratory and frozen to death at -20°C. Mosquito specimens were then sorted, identified and stored in 1.5 ml tubes containing 96% ethanol. Alternatively, captured specimens were stored directly in 96% ethanol on site. The fourth larval and pupal exuviae were also sorted and stored in individual tubes containing 70% ethanol. A few adult specimens were adhered to the right side on a pinpoint attached to a No. 3 insect pin and stored in entomological boxes in the entomological collections of the IPG.

As most species of the genus *Culex* are difficult to identify to species based on external features of adults, 1762 *Culex* male specimens of the dataset (98% of the total number

of *Culex* male specimens) were identified based on the internal structures of the genitalia. In order to complete this process, it was necessary to clear the last abdominal segments in 10% KOH for 2 h at 40°C, stained in a 1% solution of fuchsin acid for 10 min at room temperature, and stored in a solution of Marc André (Cohic and Rageau 1955). In the majority of cases, this process of clearing and staining enabled us to identify *Culex* at species level. In the remaining cases, a total of 100 male genitalia were fully dissected and mounted on microscopic slides in Euparal® for examination and identification under a microscope at up to x1000 magnification.

In order to address the issue of uncertain identifications of Culicidae species, three legs of the right lateral side of a few specimens were carefully dissected and kept in a separate vial containing 96% ethanol and stored at -20°C for further molecular investigations. These represent a total of 400 females Culicidae identified by DNA barcoding (Hebert et al. 2003) and 50 male specimens of the genus *Culex* confirmed using the same method. After extracting DNA using the DNeasy Blood and Tissue Kit (Qiagen, Valencia, CA, USA), PCR amplification was performed using standard 658 base pairs barcode of the mitochondrial Cytochrome c Oxidase subunit I gene (COI) amplified using the primers LCO1490/HCO2198 (Folmer et al. 1994). COI sequences were then compared to the DNA reference library dedicated to the mosquitoes of French Guiana (Talaga et al. 2017). Further details regarding the amplification and sequencing protocol used can be found in previous work (Talaga et al. 2017, Talaga and Gendrin 2022). All sequences originating from this dataset will be uploaded to the Barcode of Life Data Systems (BOLD (Ratnasingham et al. 2007)) under the ongoing FGMOS project.

Advantages and constraints of the sampling plan

Diversifying collection methods through the use of at least two different types of traps provides collections of a wider variety of mosquito species. On one hand, the well-known CDC light trap is designed to collect a wide array of nocturnal mosquito species of adult mosquitoes (Hoyos-López et al. 2016, Sudia and Chamberlain 1962). On the other hand, the use of BG-Pro or BG-Sentinel setups has a recognized performance in collecting mosquito vector species (Degener et al. 2021). However, the attractants used in both traps were selective to antrhopophilic species.

Although immature mosquitoes represent 0.3% of the samples in the present dataset, we had a specific interest in including them. Indeed, locating and sampling larvae in our selected sites was time-consuming but ultimately necessary with the goal of associating breeding cycles of a mosquito species and given mangrove habitats.

The proximity of human activities to mangrove raises concerns about increased health risks and nuisance caused by mosquito species which also lead to management issues (Claflin and Webb 2017, T. Ismail et al. 2018). The sites sampled in this study are also subject to various anthropogenic pressures, resulting from factors such as their distance from urban areas and their conservation status. The dataset has the potential to provide valuable information to assess health risk and assist in the design of management strategies (Brockmeyer et al. 2022, Dale and Knight 2012, Knight 2011).

Conditions fit for the biology of the mosquito species collected exist and vary across mangrove habitats. They particularly affect the production of salt-adapted mosquito species, which are unevenly distributed through time and space (Knight et al. 2012). This dataset aims to study the presence and abundance of mosquitoes by considering the diversity of mangroves typologies, from the ground level to the canopy.

Data resources

Dataset title:

A mangrove-based dataset to study the ecology of Neotropical mosquitoes (Diptera: Culicidae) in French Guiana

Resource: https://doi.org/10.15468/k7ru2k

Character encoding: UTF-8

Format name: Darwin Core Archive (DwC-A)

Usage rights: Creative Commons Public Domain Waiver (CC0 1.0)

Citation:

Collet M (2026). A mangrove-based dataset to study the ecology of Neotropical mosquitoes (Diptera: Culicidae) in French Guiana. Institut Pasteur de la Guyane. Sampling event dataset https://doi.org/10.15468/k7ru2k accessed via GBIF.org on 2026-02-18.

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