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NOTES ON GEOGRAPHIC DISTRIBUTION

First record of *Bichromomyia flaviscutellata* (Mangabeira, 1942) (Diptera, Psychodidae, Phlebotominae), a vector of *Leishmania* (*Leishmania*) *amazonensis* (Lainson & Shaw, 1972), in the state of Paraíba, Brazil

Lucas José Macêdo Freire[1], Alessandre Pereira-Colavite[2], Maurício Luiz Vilela[1]

1 *Laboratório Interdisciplinar de Vigilância em Diptera e Hemiptera, Instituto Oswaldo Cruz, Fiocruz, Rio de Janeiro, Rio de Janeiro, Brazil*
2 *Laboratório de Entomologia, Departamento de Sistemática e Ecologia, CCEN, Universidade Federal da Paraíba, João Pessoa, Paraíba, Brazil*

Corresponding author: *Lucas José Macêdo Freire (macedolucasjf@gmail.com)*

Abstract. *Bichromomyia flaviscutellata* (Mangabeira 1942), a vector of *Leishmania* (*Leishmania*) *amazonensis* (Lainson & Shaw 1972), has been recorded for the first time in the state of Paraíba, northeastern Brazil. A female specimen was captured using an HP-type light trap in an urban park in the municipality of João Pessoa in December 2022. The new record of Bi. flaviscutellata enhances our understanding of the sandfly fauna in Paraíba, particularly in an epidemiological context, given its significance in the transmission of Leishmania pathogens.

Key words. Atlantic Forest, geographic distribution, leishmaniasis, sandfly

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INTRODUCTION

Sandflies, blood-feeding insects belonging to the subfamily Phlebotominae (Diptera, Psychodidae), are recognized vectors of pathogens that cause diseases, including viruses, bacteria, and most notably, protozoa of the genus *Leishmania* Ross, 1903 (Brazil and Brazil 2003). Currently, approximately 1,060 species of sandflies have been identified worldwide, with 539 species found in the Americas. Hosting 279 species, Brazil is among the countries with the highest diversity of sandflies (de Aguiar and Vieira 2018; Galati 2023). About 10% of these species are vectors of the infectious agents responsible for leishmaniasis (Rangel and Lainson 2009; Shaw et al. 2018).

Leishmaniasis in Brazil, initially associated with rural and forested environments, has undergone urbanization due to human intervention in the environment and the adaptability of sandflies. This has led to a higher incidence of the disease in domestic and peri-domestic areas within urban centers (Harhay et al. 2011; Temponi et al. 2018). Additionally, the proximity of human dwellings to forest fragments and the rise in ecotourism have increased the risk of human contact with vectors, thereby facilitating the transmission of leishmaniasis (Uzcategui et al. 2020; Thomaz-Soccol et al. 2023). Understanding the distribution and composition of these insect species is therefore crucial to understanding the dynamics of leishmaniasis in areas both with and without reported cases of the disease.

In Brazil, there are two primary forms of leishmaniasis: American visceral leishmaniasis (AVL), which is considered the most fatal, and American tegumentary leishmaniasis (ATL), which can manifest in cutaneous, mucocutaneous, or diffuse forms (Maroli et al. 2013). In the Brazilian Northeast, although the incidence of AVL is high, the number of cases has remained stable (Bruhn et al. 2023). The region also reports many cases of ATL, despite having one of the lowest diversities of sandflies compared to other regions (de Aguiar and Vieira 2018). In Paraíba, there is limited recorded diversity of these insects, and few studies have been conducted on their fauna, leading to undersampling (Silva et al. 2022), even in municipalities with endemic cases of leishmaniasis (SINAN 2023). This study aims to document for the first time the presence of the species *Bichromomyia flaviscutellata* (Mangabeira 1942), a vector of *Leishmania* (*Leishmania*) *amazonensis*

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(Lainson & Shaw 1972), in Paraíba, thereby contributing to the knowledge of sandfly fauna in the state. The motivation or purpose of your research should appear in the Introduction, providing some of the historical basis for those questions.

METHODS

Monthly collections were conducted at the Monitoring Station of Cuiá Municipal Natural Park (EMPNMC) (07°11′27.0″S, 034°51′23.4″W) under permanent license SISBIO No. 81583-1. Five CDC light traps (HP model) (Pugedo et al. 2005) were placed along the park's main trails in areas likely to attract sandflies, such as tree hollows, sites with high organic matter content, and animal burrows. The traps were active for three consecutive nights each month, from 5:00 PM to 7:00 AM, from May 2022 to May 2024.

The captured insects were transported to the laboratory in nylon nets, where they were euthanized by cryogenic methods, sorted, and stored in tubes containing 70% alcohol. The specimens then underwent clarification and diaphanization processes, which included immersion in 10% KOH for 3 h, followed by absolute acetic acid for 20 min, a 30-min rinse in distilled water (Type II), and a 24-h immersion in lactophenol to facilitate the identification of taxonomic structures (Vilela et al. 2018).

Specimens were mounted on slides using Berlese solution and examined under a stereomicroscope. Identification was conducted using an optical microscope with the aid of Galati (2023) taxonomic key and the species abbreviations proposed by Marcondes (2007). All specimens were deposited in the Entomological Collection of the Federal University of Paraíba (DSEC). Thematic maps were created using QGIS Desktop v. 3.36.0 (QGIS 2024), and specimen photographs were taken with a Carl Zeiss Primostar binocular microscope equipped with an integrated camera.

RESULTS

During the 25 months of study, a single female *Bichromomyia flaviscutellata* (Mangabeira 1942) was captured in December 2022 at the Monitoring Station of Cuiá Municipal Natural Park (EMPNMC) (Figure 1), specifically at the capture site (Figure 1, red dot) located in a hollow tree trunk in a forested area.

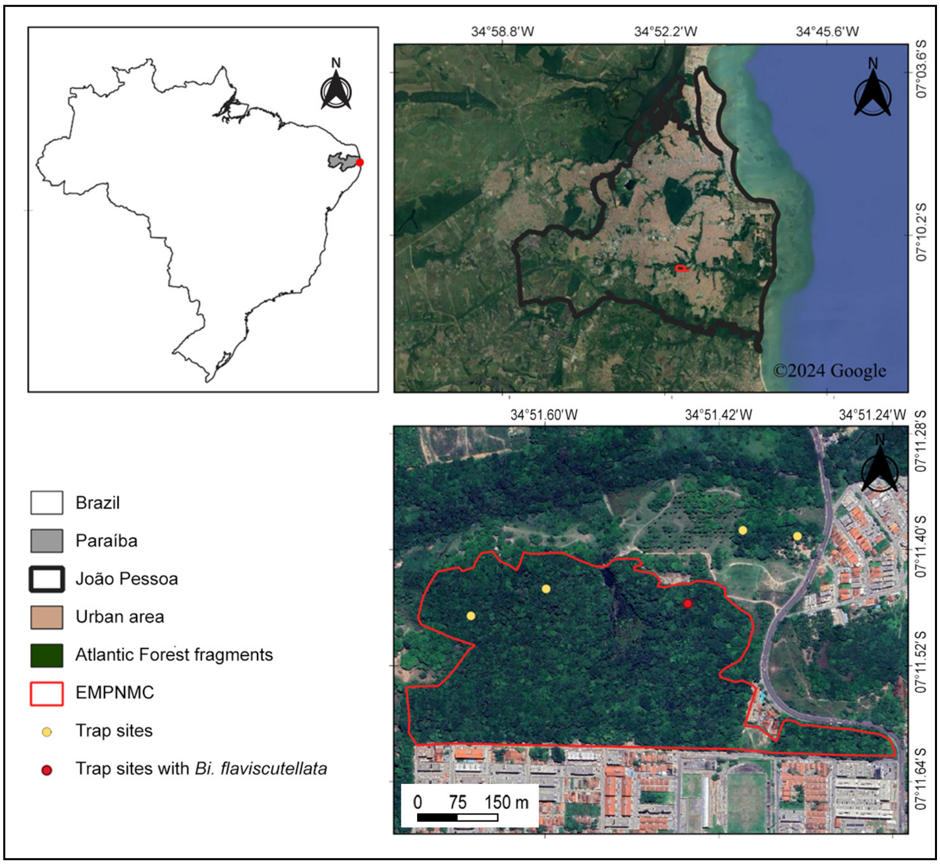

Figure 1. Capture point where the species *Bichromomyia flaviscutellata* was recorded at the Monitoring Station of the Cuiá Municipal Natural Park (EMPNMC) during the months of May 2022 to May 2024 in the municipality of João Pessoa, Paraíba.

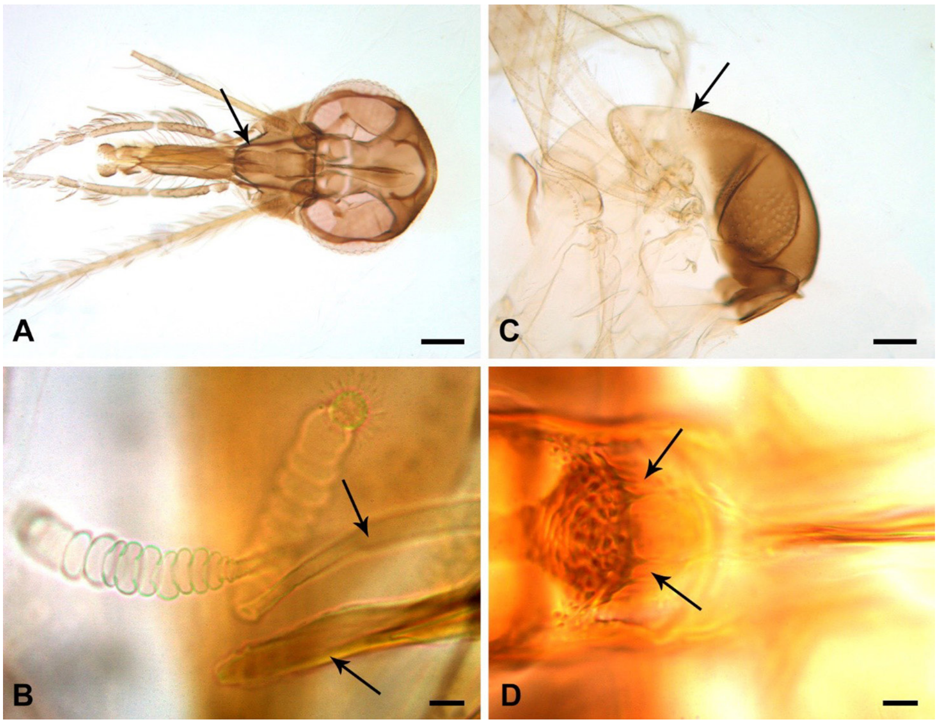

Figure 2. Specimen of *Bichromomyia flaviscutellata* collected in João Pessoa, Paraíba. **A.** Ventral view of the head; arrow showing the clypeus. **B.** Ventral view of the abdomen with the spermatheca of the female; arrow showing the relationship between the common spermathecal duct and the stem region of the genital furca. **C.** Lateral view of the thorax; arrow showing the bicolor division of the thorax. **D.** Ventral view of the head; arrow showing the anterior teeth of the cibarium. Scale bar: A = 100 µm; B = 10 µm; C = 100 µm; D = 10 µm.

***Bichromomyia flaviscutellata* (Mangabeira, 1942)**
Figure 2

New record. BRAZIL – PARAÍBA • João Pessoa, Cuiá Municipal Natural Park, Capture Point 3; 07°11′27.3″S, 034°51′27.9″W; 112 m alt; 22.XII.2022; L. J. Macedo, collector; HP light trap, hollow tree trunk; 1 ♀, slide mounted, DSEC005499DP.

Identification. A single individual of the species was identified. The key characteristics include a clypeus equal in size to the eyes (Figure 2A) and a bicolored mesonotum, with the posterior part of the scutum and scutellum lighter than the rest, which is dark brown (Figure 2C). Interspecifically, the spermatheca of the female *Bi. flaviscutellata* differs from that of *Bi. reducta* (Feliciangeli, Ramirez-Pérez & Ramirez, 1988) by the width of the common duct relative to the median region of the genital furca, which is narrower in the former species (Figure 2B). The apical ring is narrower than the pre-apical ring, with a head larger than the sum of the last three rings, oriented toward the center of the genital furca (Figure 3B). The cibarial region of *Bi. flaviscutellata* contains 6–8 horizontal teeth (Figure 2D).

DISCUSSION

The genus *Bichromomyia* (Galati, 2003) includes four species, among them, three subspecies of *Bi. olmeca*, distributed throughout Neotropical region, primarily in the Amazon region. In Brazil, the species recorded are *Bichromomyia flaviscutellata*, *Bi. inornata* (Martins, Falcão & Silva, 1965), *Bi. olmeca* (Vargas & Díaz-Nájera, 1959) (ssp. *bicolor* (Fairchild & Theodor, 1971) and *Bi. nociva* (Young & Arias, 1982)), and *Bi. reducta.* Of these, *Bi. flaviscutellata*, *Bi. olmeca nociva*, and *Bi. reducta* are epidemiologically significant as potential vectors of *L*. (*L*.) *amazonensis*, the causative agent of ATL in its diffuse form (Rangel et al. 2018).

Bichromomyia flaviscutellata was first described by Mangabeira in 1942, based on a male specimen collected in Belém, Pará. This species has an almost cosmopolitan distribution in Brazil, present in 19 of the 26 states and the Federal District, in all of the five Brazilian regions (Costa et al. 2009), and it is also found in other countries within the Amazon region (Figure 3). Records of *Bi. flaviscutellata* are common in the Northern, Northeastern, Central-Western, and Southeastern regions of Brazil, across diverse habitats ranging from primary forests to peri-urban areas (Andrade et al. 2009; Vilela et al. 2011; Carvalho et al. 2013; de Aguiar and Vieira, 2018; Rangel et al. 2018; Galati 2023).

Documenting *Bi. flaviscutellata* in a new state broadens our understanding of the eco-epidemiology of leishmaniasis, enhancing our knowledge of the distribution and ecology of this vector species. Despite its highly rodentophilic behavior (Lainson and Shaw 1968) and low attraction to humans, *Bi. flaviscutellata* is the primary vector of *L*. (*L*.) *amazonensis* in Brazil (Lainson and Shaw 1972), which causes ATL in its diffuse form. Environmental and climatic changes in Brazil may be contributing to the expansion of this species into peri-urban areas, thereby increasing the incidence of new leishmaniasis cases (Shaw et al. 2007; Queiroz et

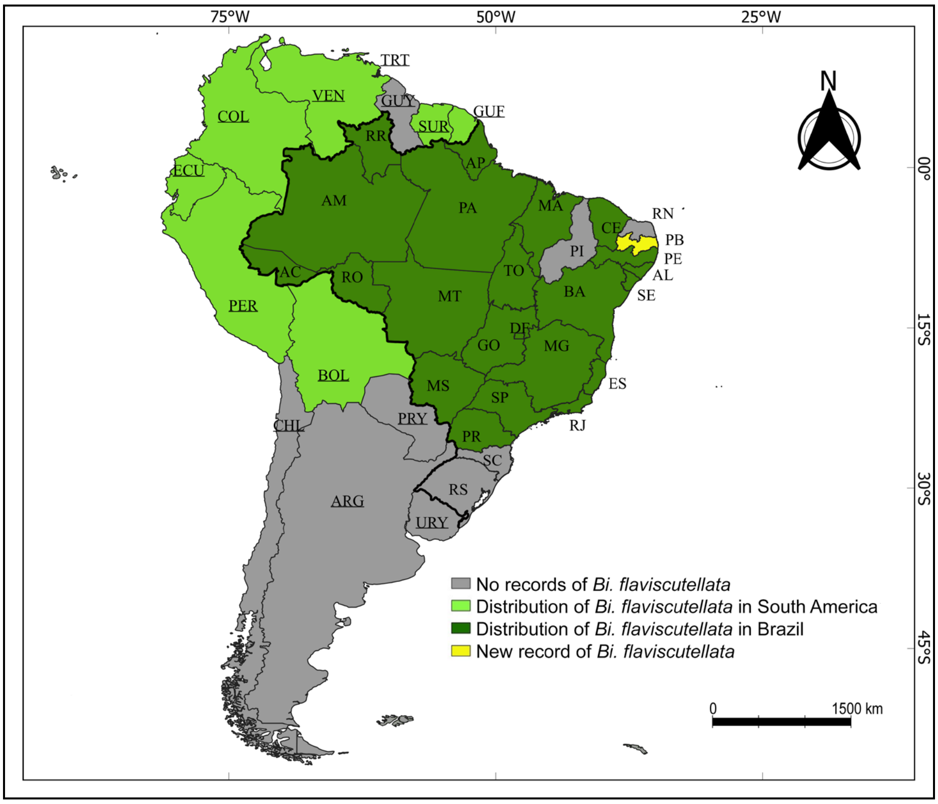

Figure 3. Geographic distribution map of *Bichromomyia flaviscutellata* in South America. Brazil highlighted (in dark green) with its political division into states. Abbreviations of the Brazilian states (acronyms not underlined): AC, Acre; AL, Alagoas; AP, Amapá; AM, Amazonas; BA, Bahia; CE, Ceará; DF, Federal District; ES, Espírito Santo; GO, Goiás; MA, Maranhão; MT, Mato Grosso; MS, Mato Grosso do Sul; MG, Minas Gerais; PA, Pará; PB, Paraíba; PR, Paraná; PE, Pernambuco; PI, Piauí; RJ, Rio de Janeiro; RN, Rio Grande do Norte; RS, Rio Grande do Sul; RO, Rondônia; RR, Roraima; SC, Santa Catarina; SP, São Paulo; SE, Sergipe; TO, Tocantins. Abbreviations of the South American countries (light green) (underlined acronyms): ARG, Argentina; BOL, Bolivia; CHL, Chile; COL, Colombia; ECU, Ecuador; GUF, French Guiana; GUY, Guyana; PRY, Paraguay; PER, Peru; SUR, Suriname; URY, Uruguay; VEN, Venezuela; TRT, Trinidad and Tobago. Brazilian limits in bold.

al. 2012). Carvalho et al. (2015) observed that in a scenario with environmental changes, through ecological niche modeling algorithms, the range of environments suitable areas for *Bi. flaviscutellata* will be expanded throughout Brazil, especially in areas where human density would be greater than today.

The capture of *Bi. flaviscutellata* in this study occurred in a fragment of the Atlantic Forest used for ecotourism. This suggests a possible interaction between humans and the enzootic cycle of leishmaniasis, potentially leading to infection (Brilhante et al. 2015; Fonteles et al. 2018). Additionally, this forest fragment is in a recently urbanized area experiencing significant human pressure, which could facilitate the spread of this species into peri-urban areas (Queiroz et al. 2012). This finding opens up new opportunities for research on the bioecology of this vector and molecular analyses for the identification of Leishmania, aiming to improve leishmaniasis knowledge and surveillance.

With the new record of *Bi. flaviscutellata*, the number of sandfly species in Paraíba increases from 16 to 17, although the state remains one of those with the lowest species richness in the Northeastern Region (de Aguiar and Vieira 2018; Silva et al. 2022).

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ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

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Author contributions

Conceptualization: LJMF, MLV. Data curation: LJMF. Formal analysis: LJMF. Investigation: LJMF. Methodology: LJMF, MLV. Resources: LJMF, APC. Supervision: APC, MLV. Validation: MLV. Visualization: LJMF, APC. Writing – original draft: LJMF. Writing – review and editing: APC, MLV.

Author ORCID iDs

Lucas José Macêdo Freire https://orcid.org/0000-0003-3243-2847
Alessandre Pereira-Colavite https://orcid.org/0000-0002-7660-8384
Maurício Luiz Vilela https://orcid.org/0000-0001-7610-0719

Data availability

All data that support the findings of this study are available in the main text.

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