

CASE REPORT

INFESTATION OF BED BUGS *Cimex lectularius* (HETEROPTERA: CIMICIDAE): A WARNING ON INCREASED INFESTATIONS AND PUBLIC HEALTH IMPLICATIONS IN PARANÁ, BRAZIL.

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ABSTRACT

Bed bugs are hematophagous bugs of wide distribution in the world, responsible for both economic and public health damage. In Brazil, records of their occurrences are neglected, with those reported located in the Northeast and Southeast regions, mostly in metropolitan areas. Therefore, the objective of this study was to report the occurrence of bed bugs in the municipality of Cafelândia, in the interior of the State of Paraná. Between February and March 2024, two residents of Cafelândia sent small hematophagous insects found inside their homes to the Paraná State Department of Health. Later, these insects were identified as *Cimex lectularius*. This is the first record of *C. lectularius* for the southern region of Brazil, consequently for the State of Paraná. This report expands the distribution area of *C. lectularius* in Brazil. In addition, it is essential for monitoring and decision-making for the control of these insects.

KEY WORDS: Bed bug; citizen science; ectoparasitic infestations; epidemiological surveillance; monitoring.

INTRODUCTION

Cimicidae (Hemiptera: Heteroptera) is a family of ectoparasitic bugs comprising six subfamilies, 24 genera, and 110 species (Akhoundi et al., 2020). Cimicids are wingless, oval to oblong-shaped, dorsoventrally flattened, with coloration ranging from dark brown to reddish-brown, and body lengths between 4 to 10 mm (Usinger, 1966). These hematophagous insects coevolved with specific groups of birds and bats, with most species exhibiting

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specialized feeding habits. However, two species, *Cimex hemipterus* (Fabricius, 1803) and *C. lectularius* (Linnaeus, 1758), prefer human blood (Ryckman et al., 1981).

Cimex hemipterus and *C. lectularius* are widely distributed worldwide and responsible for economic and public health issues (Akhoundi et al., 2023). They are commonly found in hotels and homes, infesting beds, chairs, and upholstery, but can also be found in shared spaces like public transportation and hospitals (Nascimento et al., 2013; Lima et al., 2021; Farias et al., 2024). Primarily at night, they disturb humans while attempting to feed, leading to dermatological reactions and psychological disorders (Doggett et al., 2012; Burrows et al., 2013).

REPORT OF CASES

In February 2024, a resident of the urban area of Cafelândia, Paraná, Brazil (Figure 1), submitted small wingless hematophagous insects found inside her home to the Paraná State Department of Health (Secretaria Estadual da Saúde do Paraná/ SESA-PR). The following month, another resident, whose home was approximately 500 meters from the first, also handed over similar insects found in his bedroom to the SESA-PR. For taxonomic identification, the specimens were sent to the Parasitology Laboratory at the School of Pharmaceutical Sciences of UNESP, in Araraquara, São Paulo. The taxonomic identification was performed based on the dichotomous key provided by Usinger (1966).

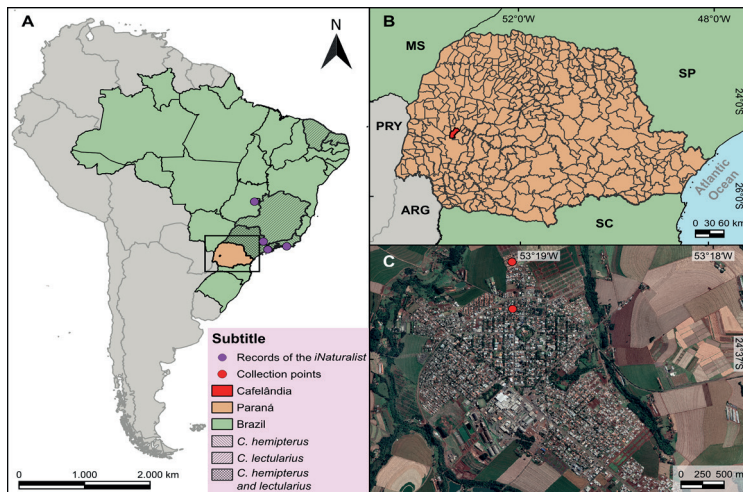


Figure 1. Map of distribution of occurrences of *Cimex lectularius* recorded in Brazil. (A) Geographic distribution of *C. hemipterus* and *C. lectularius* in Brazil based on iNaturalist records and collection points. (B) Map of Paraná, showing Cafelândia municipality (red) and its location relative to neighboring states and countries. (C) Satellite image of Cafelândia with red markers indicating the specific collection sites within the urban area. The map was prepared using QGIS® Software version 3.34, which used the cartographic bases of IBGE (2017).

The insects were collected from two houses. The first house had no information regarding bites or allergic reactions. In the second house, however, the patient's medical record contained the following: "The patient reports intense itching on the arms and legs after being bitten by an insect, mentioning an infestation in her house.

Symptoms have been present for one week; deny allergies; physical examination”.

Regarding the number of specimens found, the first house sent six adults, eight nymphs, and two eggs, while the second house included two adults and five nymphs. The specimens were identified as adults and nymphs of *C. lectularius* (Figure 2). Adult specimens exhibited a pronotum with broad lateral lobes; the width of the pronotum was more than twice its length; the head was wider than the length of the third antennal segment; and females had a cleft and bristled paragenital sinus (Usinger, 1966).

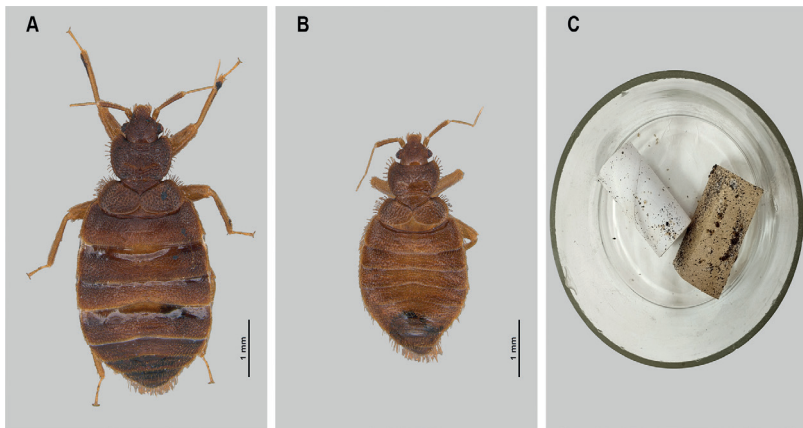


Figure 2. Specimens of *Cimex lectularius*. (A) Dorsal view of an adult female *C. lectularius*. (B) Dorsal view of an adult male *C. lectularius*. (C) Overview of the *C. lectularius* colony inside a glass tank, with the bottom covered in filter paper and cardboard structures for ambience.

DISCUSSION

This report presents the first recorded occurrence of *C. lectularius* in the State of Paraná and the southern region of Brazil. The municipality of Cafelândia is located in the western region of Paraná, approximately 550 km from the capital, Curitiba, and 150 km from the Paraguayan border, with an estimated population of 20,000 inhabitants and a territorial area of 274.904 km² (5.97 km² of urbanized area). The area falls within the Atlantic Forest biome, with an average temperature of around 20 °C and a relative humidity of 76% (IBGE, 2024).

In Brazil, the number of reports of bed bug infestations has been increasing (Nascimento et al., 2013; Filho et al., 2015; Lima et al., 2021; Farias et al., 2024), and many other occurrences go unreported, raising questions about the current situation of these insects in the Country (Pereira et al., 2018). According to Pereira et al. (2018), the rise in occurrences in Brazil is related to the movement of people to areas already infested within the country, leading to the passive spread of cimicids.

Both *C. hemipterus* and *C. lectularius* are species found in Brazilian territory (Figure 1A), with the latter reported more frequently (Filho et al., 2015; Farias et al., 2024). To date, only one Brazilian State, São Paulo, has reported the presence of both species, infesting homes, daycare centers, cinemas, prisons, and businesses in the metropolitan region of São Paulo (Nascimento et al., 2013). *Cimex hemipterus* has also been recorded in the State of Rio de Janeiro, infesting mattresses in homes and hotels (Filho et al., 2015).

In addition to the metropolitan region of São Paulo State, *C. lectularius* has also been reported over the past ten years in the State's interior, specifically in the municipality of Gavião Peixoto

(Kawasima et al., 2022) and in three other States: one in the Central-West region and two in the Northeast. In Minas Gerais, it was reported in the capital, Belo Horizonte, infesting mattresses in a homeless shelter (Pessoa et al., 2021); in Ceará, in the capital, Fortaleza, infesting a hospital surgical ward (Farias et al., 2024); and in Rio Grande do Norte, in the capital, Natal, and Parnamirim, infesting crevices and mattresses in commercial and residential areas (Lima et al., 2021).

The occurrence records are not limited to scientific journals; there are also records of *Cimex* on *iNaturalist*, a biodiversity information-sharing platform based on citizen science. The first record was made in 2009, and since then, a total of ten occurrences have been reported: nine in metropolitan areas - Rio de Janeiro (4), São Paulo (4), and Brasília (1) - and one in a rural area, in Altinópolis (1), a municipality in the State of São Paulo (iNaturalist, 2024).

It is not only Brazil that is facing the resurgence of bed bugs; this issue has been widely reported in European countries and in the United States (Doggett et al., 2018). The control of cimicids has been a longstanding problem. These insect populations were controlled from the 1950s to the mid-1980s using dichloro-diphenyl-trichloroethane (DDT), organophosphates, and carbamates. However, with the widespread use of these chemicals, including in Brazil, cimicids quickly developed resistance to these compounds (Potter, 2011; Dang et al., 2017; Pessoa et al., 2021). Currently, the use of commercial insecticides is contraindicated (Dang et al., 2017; Parola & Izri, 2020).

Due to chemical resistance, it is essential to use nonchemical methods to control cimicids (Dang et al., 2017). The environment must be inspected; a vacuum cleaner must be used to capture individuals and eggs; in addition, furniture must be brushed or dry cleaned, and clothes and other textile materials must be heated to 60 °C; thermal control can also be used in environments (Parola & Izri, 2020). Despite the effectiveness of nonchemical methods, the elimination of these insects in residential complexes is a challenge, as residual foci located in third-party environments allow for rapid re-infestation (Doggett et al., 2012, Stedfast & Miller, 2014).

Bed bug infestations cause economic damage estimated in the millions of dollars worldwide, primarily affecting hotel chains and the real estate market (reducing credibility, preference, and market value, as well as incurring costs for pest control and replacement of condemned and discarded furniture) (Doggett et al., 2018); however, there are no studies that portray the economic impact of cimicids in Brazil. Additionally, infestations drive thousands of people to seek medical help due to clinical manifestations such as skin lesions (itching and secondary infections) (Liebold et al., 2003; Filho et al., 2015), problems related to sleep and mental health (insomnia, stress, anxiety and suicide) (Burrows et al., 2013; Sheele, 2021), and in cases of severe infestations, anemia (Sheele et al., 2021) and respiratory problems (Sheele, 2022).

Cimicids are potential vectors of pathogens, with studies reporting the infection of *C. lectularius*, in both laboratory and natural settings, by dozens of etiological agents, such as viruses - smallpox, yellow fever, and hepatitis; bacteria - *Mycobacterium tuberculosis* and *Rickettsia rickettsii*; fungi - *Aspergillus flavus*; and protozoa - *Leishmania* spp., *Plasmodium* spp., and *Trypanosoma cruzi* (Delaunay et al., 2011; Zorrilla-Vaca et al., 2015). Salazar et al. (2015) conducted experiments infecting *C. lectularius* with *T. cruzi*. As a result, infective forms of the protozoan were observed in the excreta of cimicids, similar to what is observed in triatomines.

This report of the occurrence of *C. lectularius* in the interior of Paraná, along with recent occurrences in other States, signals a warning for epidemiological surveillance in Brazil. Moreover, assertive actions and subsequent notifications are necessary for a better understanding of the distribution and incidence of these insects in the Country.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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