

# Description of a newly discovered *Triatoma infestans* (Hemiptera: Reduviidae) Foci in Ibipecta, State of Bahia, Brazil

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## ABSTRACT

**Introduction:** Chagas disease transmitted by the *Triatoma infestans* was eradicated from Brazil in 2006. However, reports of triatomine foci threaten the control of Chagas disease. The goal of this study was to determine *T. infestans* foci in the City of Ibipecta, State of Bahia. **Methods:** Triatominae specimens were collected in Ibipecta and entomologic indicators were calculated using indices of domiciliary infestation, density, and colonization. **Results:** *T. infestans* foci was discovery in Ibipecta, State of Bahia. Approximately 95% of the specimens were discovered inside dwellings, of which 34% were *T. infestans*. This species was also discovered forming a colony in tree bark in the peridomicile. **Conclusions:** *Triatoma infestans* foci in peridomestic ecotopes in Ibipecta, BA, indicate increased the risk of transmission Chagas disease.

**Keywords:** *Triatoma infestans*. Chagas disease. Triatominae.

Chagas disease remains a significant public health issue in many parts of the world despite its discovery one hundred years ago, and is estimated to account for more than 10,000 cases of deaths in 2008. In Latin America alone, it is estimated that 25 million people live in high-risk areas, and 7 to 8 million people have the disease<sup>1,2</sup>. The etiologic agent of Chagas disease is the protozoan *Trypanosoma cruzi* (Kinetoplastida: Trypanosomatidae), which is transmitted by insects of the subfamily Triatominae (Hemiptera: Reduviidae)<sup>3</sup>. In the past, *Triatoma infestans* was responsible for the highest number of Chagas disease cases<sup>4</sup>, and in 1983, the World Health Organization (WHO) conducted a vector control program to eradicate *T. infestans* by means of chemical control, dwelling improvements, and reeducation of the exposed population.

Following these efforts, Chagas disease transmitted by *T. infestans* or blood transfusion was eradicated by 2006<sup>5</sup>. However, residual vector foci remain in the States of Bahia, Minas Gerais, and Rio Grande do Sul<sup>4</sup>. *T. infestans* are the major vectors for Chagas disease because they are exclusively domestic, highly anthropophilic, and easily infected by *T. cruzi*. The wide distribution of *T. infestans* has been attributed to transport associated with human migration and enhanced species adaptation to the intradomiciliary environment, including sheltering within wall cracks, roofs, human apparel, under beds,

and additional micro-habitats<sup>6</sup>. Additionally, studies have shown frequent human infection in areas of concentrated *T. infestans*<sup>7</sup>. Recently, a resident of Ibipecta observed the presence of a triatomine in his dwelling, raising important epidemiological questions regarding the emergence of triatomine foci and transmission of Chagas disease. The objective of this study was to identify Triatominae foci in Ibipecta, Bahia, and to collect and characterize each identified species.

This was a cross-sectional epidemiological study of data collected by the entomology team of the Epidemiological Surveillance Board of the Bahia State Bureau of Health (Diretoria de Vigilância Epidemiológica, Secretaria da Saúde do Estado da Bahia, DIVEP/SESAB) in November 2009. The research was conducted in the City of Ibipecta, after a resident identified a triatomine specimen in his dwelling located in the urban area of the city. The City of Ibipecta is located in the State of Bahia within the country of Brazil (Figure 1A and 1B). Ibipecta is in the mesoregion of Irecê and the physiographic area of Northern Chapada Diamantina (encompassing the entire Drought Polygon characterized as the cerrado biome). Triatomines were collected on an Amaralina farm (at an altitude of approximately 593m with the coordinates 11°61.297' S, 42°11.283' W).

Environments consisting of domestic units closed by doors (i.e., houses and annexes) were considered domestic ecotopes. Triatomines were discovered sheltering within infrastructure cracks of the domestic environments and under beds or behind objects placed along walls. The studied peridomestic ecotopes (where domestic or wild animals sleep or are bred) were in a radius of 50m from the dwellings. During the field research, triatomines were collected manually with tweezers and placed in individual flasks labeled with information regarding the place of collection<sup>8</sup>.

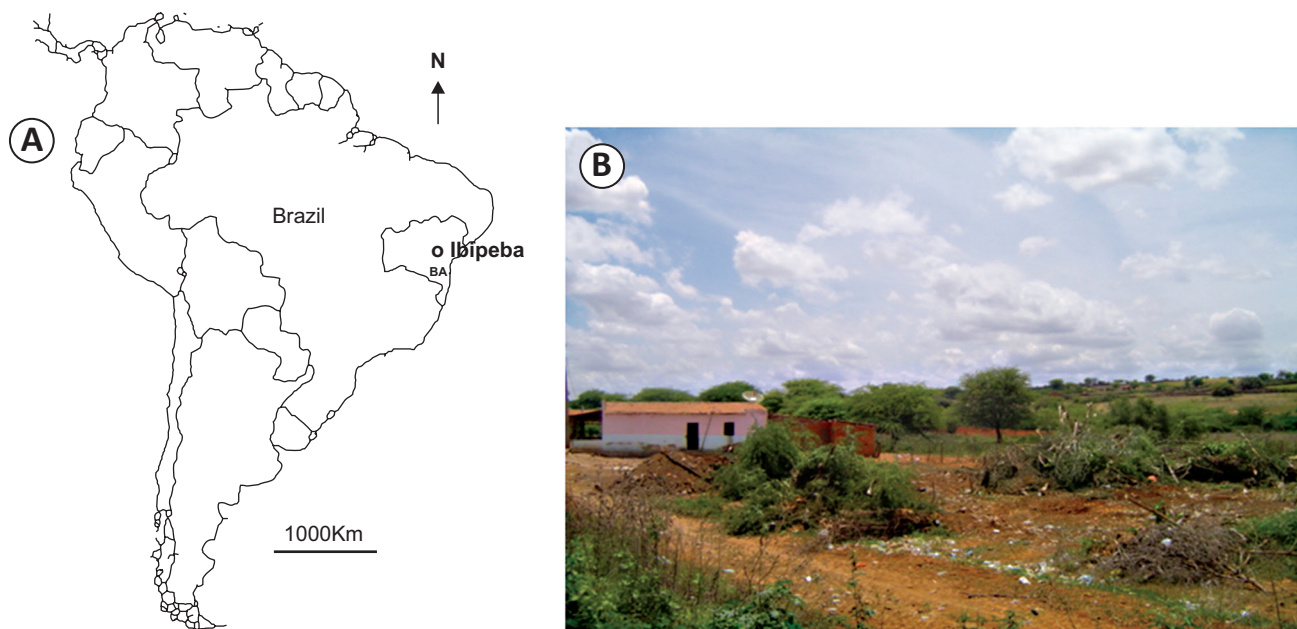
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**FIGURE 1 - Geographical location of the study ecotope. A) The map of South America indicates the location of our Triatominae species survey. The City of Ibipeba is in the State of Bahia, which is one of 26 states in Brazil. B) Image of the Ibipeba ecotope where *Triatoma infestans* was initially discovered.**

Entomological indicators were calculated according to standard equations: index of domiciliary infestation = (number of domiciliary units with triatomines / number of domiciliary units searched)  $\times$  100; index of domiciliary triatomine density = number of samples captured / number of domiciliary units searched; index of colonization = (number of domiciles with nymphs / number of houses inspected)  $\times$  100<sup>9</sup>.

The initial reference point for investigation of Triatominae foci was the dwelling first reported to house a triatomine specimen. From this reference point, 9 locations were surveyed in Ibipeba. The initial *T. infestans* specimen (**Figure 2A**) discovered in Ibipeba was identified using an entomological key<sup>6</sup> at the entomology laboratory of the 21<sup>st</sup> Regional Health Board in Irecê. Images shown in **Figure 2B** demonstrate traces of triatomine feces on intradomicile walls that corresponded to the presence of specimens identified in that area. The image in **Figure 2C** indicates that wild animals, as armadillo, were bred in the peridomicile where triatomine specimens were identified. **Figure 2D** demonstrates a tree trunk (*Leucaena leucocephala*) located approximately 50 m from a rural residence (Amaralina farm in Ibipeba) where *T. infestans* nymphs and adults were identified.

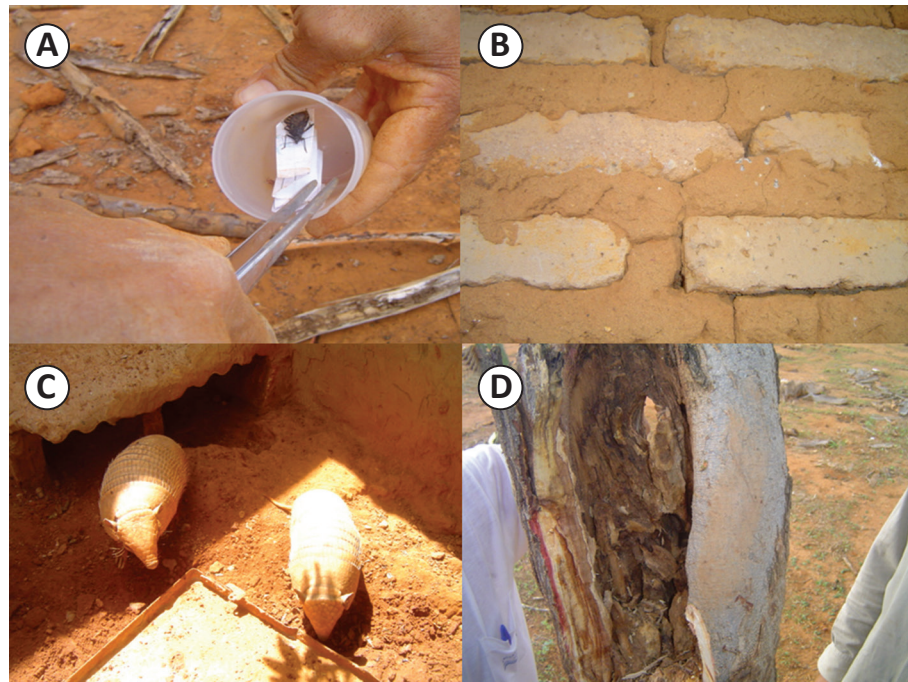
Three triatomine species were discovered in the intradomicile and peridomicile regions of study ecotopes as shown in **Table 1**. The species were *T. infestans* (183 specimens), *Triatoma sordida* (176 specimens), and *Triatoma pseudomaculata* (13 specimens). The calculated indices of domiciliary infestation, domiciliary density, and colonization were 14%, 1.32, and 1%, respectively. Overall, 280 domiciliary units were surveyed and triatomine were discovered in 39 of the units. *T.*

*pseudomaculata* and *T. sordida* adult specimens and *T. infestans* adult and nymph specimens were found in three of the dwellings.

Over the last 5 years, initiatives such as the *T. infestans* Eradication Program (Programa de Erradicação do *Triatoma infestans* (PETi)), which use insecticides to target *T. infestans*, have been conducted throughout Brazil. These initiatives and large-scale entomological surveys carried out since 1975 have shown extensive distribution of *T. infestans* (711 Brazilian cities with domestic infestation)<sup>10</sup>. In 1983, approximately 190,000 specimens of *T. infestans* were collected during surveys, while by 1993, only 83 cities reported *T. infestans* infestation. In 1998, the number of specimens decreased to 485, and in 2007, only 205 specimens were captured from 21 dwellings in 13 cities<sup>11</sup>.

Although the State of Bahia and Brazil as a whole were considered free from *T. cruzi* transmission by *T. infestans* and blood transfusions in 1995 and 2006<sup>5</sup>, respectively, interventions to control spread of Chagas disease must continue. This is due to the presence of other transmitting species (e.g., *Panstrongylus megistus*, *Rhodnius prolixus*, *Triatoma brasiliensis*, *Triatoma maculata*, *T. pseudomaculata*, and *T. sordida*) that colonize human environments in many areas of Brazil.

Although *T. sordida* and *T. pseudomaculata* are less likely to transmit Chagas disease when compared to *T. infestans*, these species are a continual risk for the emergence of new cases of the disease. Furthermore, a recent survey conducted in 2009 in Macaúbas, Bahia, discovered that *Triatoma lenti* adults and nymphs also carried an isolated *T. cruzi* strain<sup>13</sup>. Additionally, a serological survey carried out in Mulungu do Morro, Bahia, suggested the existence of vector transmission



**FIGURE 2 -** Discovery of *Triatoma infestans* at the study ecotope. A) Image of an adult *Triatoma infestans* specimen captured inside a dwelling in Ibipeba. B) Image depicting traces of triatomine feces on a dwelling wall. C) Wild animal breeding in the peridomicile of a dwelling in Ibipeba. D) Image demonstrating the tree bark where *Triatoma infestans* nymphs were discovered in association with rodents.

**TABLE 1 -** Number of collected triatomine species in Ibipeba, Bahia, Brazil according to ecotope.

Species	Ecotope				Total
	intradomicile		peridomicile		
	n	%	n	%	
<i>Triatoma infestans</i>	16	8.7	167	92.3	183
<i>Triatoma pseudomaculata</i>	13	100.0	0	0.0	13
<i>Triatoma sordida</i>	174	98.8	2	1.2	176
Total	203	54.5	169	45.5	372

of *T. cruzi*<sup>14</sup>. These studies demonstrate that vector transmission persists despite breakthroughs in the control of Chagas disease. These findings question the efficacy of insecticide use and indicate a possible resistance to alpha-cypermethrin 20% SC, an insecticide recommended by the Ministry of Health<sup>11</sup> for domestic use.

The results from this study demonstrate the presence of *T. infestans*, *T. pseudomaculata*, and *T. sordida* in Ibipeba, Bahia, for the first time. Discovery of *T. infestans* specimens in a tree trunk located in the peridomicile (50 m from a dwelling) is a novel finding, as there are few reports of similar observations in Brazil<sup>12</sup>. This finding indicates the possibility of *T. infestans* colonies infesting the extradomicile, thus undermining

intervention and control programs only intended to control the vector in the peri- and intradomicile. Importantly, this study demonstrates that vectors could infest dwellings in subhuman conditions. This indicates the need for public authority involvement in controlling infestation beyond the typical range of the health sector.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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