



Short Communication

Occurrence of triatomines in public spaces: An atypical case in the Southwestern Brazilian Amazon

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ABSTRACT

Background: Triatomines infest atypical public spaces in the Western Amazon.

Methods: Frequent visitors to these spaces captured the insects in the state of Acre, Brazil (Rio Branco and Cruzeiro do Sul).

Results: Six insects were found in a penitentiary, a church, a school, a university, a hospital, and a health center. Five of the insects were adults (three positive for *Trypanosoma cruzi*) and one was a nymph.

Conclusions: This is the first report of triatomine occurrence in schools or churches. These data are important for implementing surveillance strategies and alerting individuals about possible changes in Chagas disease transmission dynamics.

Keywords: Triatominae. Environment changes. Insect vectors.

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Authors' contribution: KSC, MALR, FPM, DSP and ACJ: participated in the Collection, identification of the triatomine, analysis of trypanosomatid infection and writing of the article; JAR and JO: participated in the identification of triatomines and review of writing; LMAC: participated in the review of article writing and review of the English version; DUOM and PSB: coordinated the research, participating in all stages of the study.

Conflict of Interest: The authors declare no conflict of interest.

Financial Support: Graduate Program in Health Sciences in the Western Amazon of the Federal University of Acre (PPGCSAO/UFAC) and Coordination for the Improvement of Higher Education Personnel (CAPES).

• Received 28 January 2023 • Accepted 8 March 2023

Known as vectors of Chagas disease (CD), triatomine bugs (Hemiptera, Triatominae) are insects that feed on blood through all developmental stages¹. Several factors contribute to the invasion of these invertebrates into the household environment, such as chemical signals emitted by hosts, artificial light, and nocturnal habits¹.

Anthropogenic changes influence these vectors and reduced the number of shelters and wild food sources for triatomines leading to the intrusion and invasion of these insects into households and peridomestic environments. This invasion presents a greater risk of human infection by *Trypanosoma cruzi* (Chagas, 1909) (Kinetoplastida, Trypanosomatidae) and consequently CD^{1,2}.

Data on the occurrence of triatomines in domestic environments or public spaces in the Amazon are rare, and this information is important for controlling and monitoring the life cycle of these vectors². Thus, the aim of this study was to report triatomine occurrence in "atypical" public spaces in the state of Acre, Western Amazon, Brazil.

Triatomines were collected between September 2011 and August 2019 in the Brazilian municipalities of Rio Branco, the capital of the state of Acre, and Cruzeiro do Sul, the second most populous city in the state, located in the extreme southwest region of the Amazon (**Figure 1**).

Triatomines were captured in the following institutional environments in the state of Acre, Brazil: a penitentiary, a health center, a university, a hospital (hemodialysis room), a church, and a school. The capture was carried out by frequent visitors to these public spaces. Insects were delivered to the Entomological Surveillance Divisions of Rio Branco and Cruzeiro do Sul and then

sent to the Laboratory of Tropical Medicine (LABMEDT) of the Federal University of Acre (UFAC) in Rio Branco or to the LABMEDT team that operates in the municipality of Cruzeiro do Sul, Acre, Brazil.

Taxonomic identification was based on the key factors described by Lent and Wygodzinsky³ and Galvão¹. Trypanosomatid presence was analyzed in the specimens by investigating the intestinal contents of triatomines based on compression of the abdomen. The material was macerated, diluted in 0.9% saline solution for slide preparation, stained using a quick kit for hematology (0.1% triaryl methane, 0.1% xanthene, and 0.1% thiazine), and then observed under an optical microscope at a magnification of 400x.

Of the insects collected, five were adults and one was a nymph. The identified species were *Rhodnius robustus* (Larrousse, 1927), *Panstrongylus geniculatus* (Latreille, 1811) and *Rhodnius* spp. (*Rhodnius* sp.1 and *Rhodnius* sp.2 - pattern *R. robustus*/*R. montenegrensis* Rosa et al., 2012). *Rhodnius* sp.1 could not be identified at the species level despite the insect being an adult because its genitalia had degraded. The insects identified as *R. robustus* and *P. geniculatus* were positive for trypanosomatids (**Table 1 and Figure 2**).

In the Western Amazon, one study reported the domiciliation of triatomines in households in the state of Roraima⁴. However, recent studies have reported the intrusion of these insects into urban environments in the states of Acre and Amazonas, Brazil^{5,6}.

The genus *Rhodnius* Stål, 1859 is among the three main genera demonstrated by epidemiology to transmit CD, and the species belonging to this genus have been frequently associated with the invasion of artificial environments in the Western Amazon^{4-6,12}.

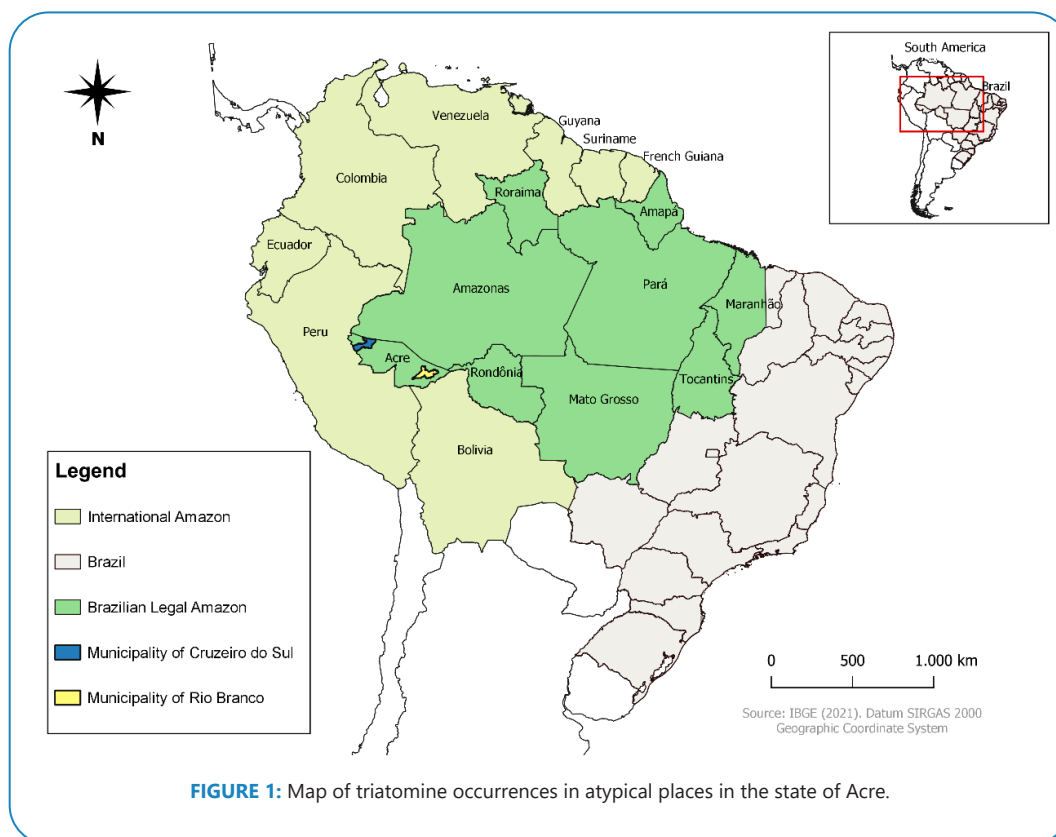
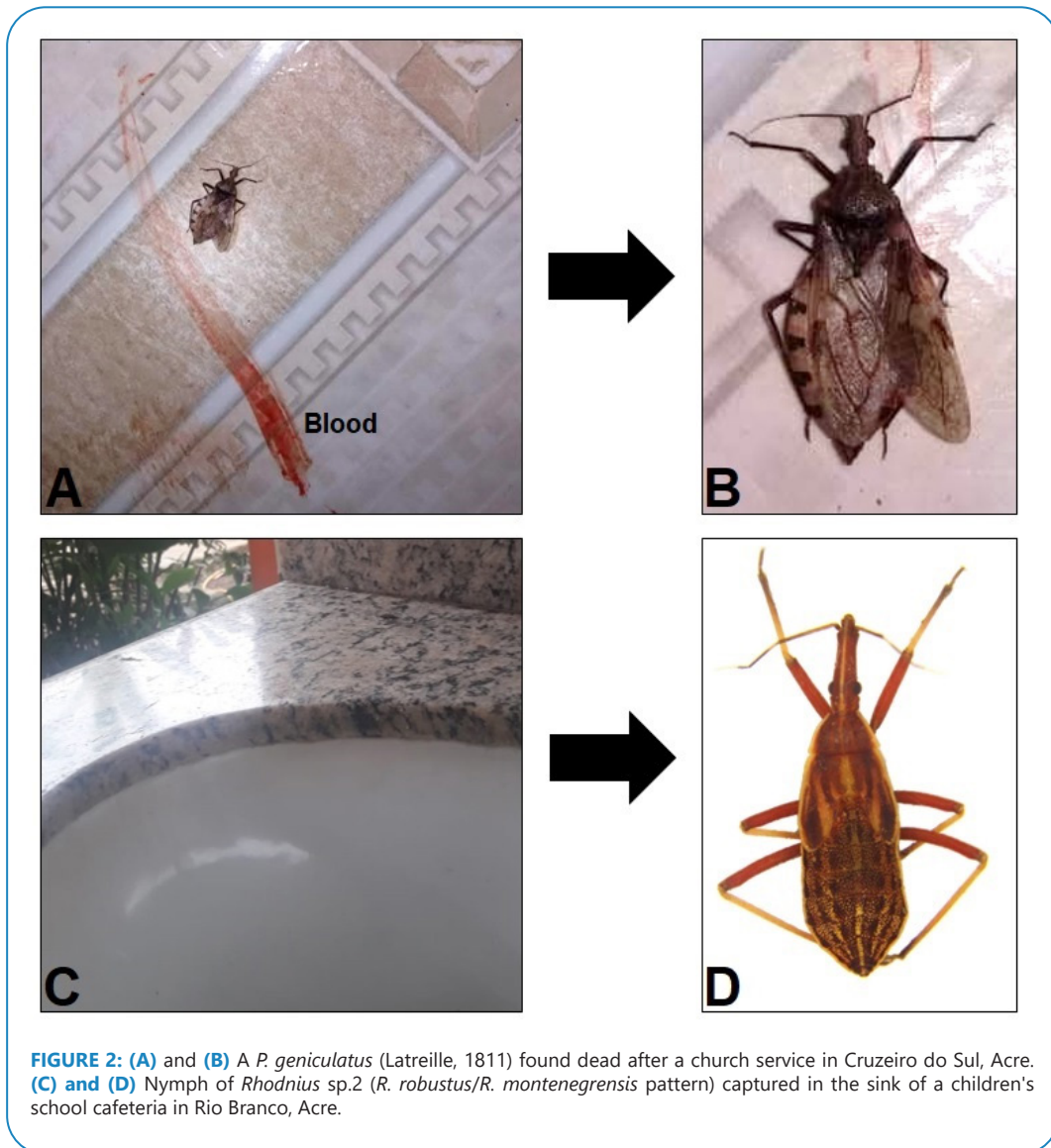


TABLE 1: Species of triatomines collected and positivity status for trypanosomatids.

Year	Genus/Species	Stage	Trypanosomatid infection	Location	Municipality	n*
2011	<i>Rhodnius robustus</i>	Adult	P	Penitentiary	Rio Branco	1
2014	<i>Rhodnius</i> sp.1	Adult	N	Health Center	Rio Branco	1
2016	<i>Panstrongylus geniculatus</i>	Adult	P	University	Rio Branco	1
2016	<i>Rhodnius robustus</i>	Adult	P	Hospital	Rio Branco	1
2018	<i>Panstrongylus geniculatus</i>	Adult	N	Church	Cruzeiro do Sul	1
2019	<i>Rhodnius</i> sp.2 (pattern <i>R. robustus</i> / <i>R. montenegrensis</i>)	Nymph	N	School	Rio Branco	1
Total						6

*n: Sample number.



Several species were found to be naturally infected by *T. cruzi*, including *R. robustus*³, the first species described in the state of Acre and possibly the first autochthonous case of disease transmission in the state⁷. The species *R. robustus* is found in several specimens of palm trees and epiphytic bromeliads and invades households and performs hematophagy on humans^{3,8}. Thus, the emergence of such vectors in public spaces can be a risk factor for CD transmission.

Among the species of the genus *Panstrongylus* Berg¹, 1879, *P. geniculatus* is considered a wild vector, is potentially found in birds' nests and in several palm trees, and has been reported in human habitations, possibly because they are attracted to light³. In addition, studies have reported insects of the genus *Panstrongylus* in domestic environments and subjects infected by *T. cruzi* in western Amazon^{5,9-12}, and some Latin American countries that border Brazil have reported the colonization of *P. geniculatus* in human dwellings¹³.

Although the presence of *P. geniculatus* in the adult phase has been reported in homes in the state of Acre^{5,12}, the native natural habitats of this species are still unknown, as all specimens collected so far were at rare encounters. However, the degradation and occupation of forest environments can cause the adaptation of this species to artificial habitats and, subsequently, favor CD transmission¹⁴.

The triatomine collected in the church was possibly trampled on-site, and it was only identified and handed over to the research team because of the visitor's prior knowledge of the vector, which highlights the importance of health education as an action to combat CD in the Amazon.

It was not possible to determine whether the insect performed hematophagy on humans or other mammals in the vicinity. However, this species was found to be positive for *T. cruzi* and is responsible for the first autochthonous case report in the state of Rondônia, Brazil, thus raising an alert to the presence of this vector in urban areas¹⁴.

Reports of adult insects in human dwellings may be increasingly evident due to the destruction of their natural ecotopes¹⁻³, making monitoring important for detecting changes favoring the domiciliation of some species. In the present study, the spotting of a nymph in an urban, residential area highlighted the importance of this surveillance.

One insect was found on the surface of a sink in a children's school during the day. The school had several palm trees that had been pruned previously, as a form of prevention because an adult triatomine had been found near the school cafeteria. It is important to highlight that the non-identification of a specimen in the nymphal stage is because the reproductive system has not yet fully developed.

The environmental characteristics of the public spaces in this study were similar in terms of the characteristics of the forest fragment, landscaping, and the presence of palm trees in their vicinity, which may have favored the emergence of these insects, mainly of the genus *Rhodnius*, which is directly linked to palm trees^{6,8,13}.

The public spaces where the triatomines were found were urban environments frequented by a large number of people, which is unusual since most insects in published reports were found in residences^{3,6,13}. It is also important to highlight that this study is the first to describe the occurrence of triatomines in schools and churches.

This evidence underscores the importance of reporting the appearance of triatomines in public spaces, to develop surveillance strategies for controlling and monitoring these vectors and to raise awareness of the domiciliation of these insects and possible changes in the dynamics of CD transmission in the region, which has already been observed in other countries¹⁵.

ETHICAL CONSIDERATIONS

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ACKNOWLEDGEMENTS

We would like to thank the Federal University of Acre (UFAC), Acre, Brazil, the Dean of Research and Graduate Studies at the Federal University of Acre (UFAC), the Graduate Program in Health Sciences in the Western Amazon at the University Federal do Acre.

REFERENCES

- Galvão C. Vetores da doença de Chagas no Brasil. Série Zoologia: guias e manuais de identificação. Vetores da doença de Chagas no Brasil. Curitiba: Sociedade Brasileira de Zoologia; 2014.
- Ribeiro MAL, Castro GVS, Júnior SLP, Souza JL, Ávila MM, Araújo FL, et al. Ocorrência de triatomíneos e a positividade para tripanosomatídeos em residências no município de Rio Branco, Acre, Amazônia Ocidental, Brasil. In: Oliveira J, Alevi KCC, Camargo LMA, Meneguetti DUO, editors. Atualidades em Medicina Tropical na América do Sul: Vetores. Rio Branco, Acre: Stricto Sensu; 2021. p. 164-82.
- Lent H, Wygodzinsky P. Revision of the Triatominae (Hemiptera, Reduviidae), and Their significance as Vectors of Chagas Disease. New York: Bulletin of the American Museum of Natural History; 1979;163: 127-520 p.
- Ricardo-Silva A, Gonçalves TCM, Luitgards-Moura JF, Lopes CM, Silva SP, Bastos AQ, et al. *Triatoma maculata* colonises urban domiciles in Boa Vista, Roraima, Brazil. Mem Inst Oswaldo Cruz. 2016;111(11):703-6.
- Ribeiro MAL, Castro GVS, Souza JL, Rosa JA, Camargo LMA, Meneguetti DUO. Occurrence of triatomines in an urban residential complex in the municipality of Rio Branco, Acre, South-Western Amazon. Rev Soc Bras Med Trop. 2019;52:e20180177.
- Fé NF, Magalhães LK, Fé FA, Arakian SK, Monteiro WM, Barbosa MG. Ocorrência de triatomíneos em ambientes silvestres e domiciliares do município de Manaus, Estado do Amazonas. Rev Soc Bras Med Trop. 2009;42(6):642-6.
- Barata JMS, Rocha RM, Rodrigues VLCC, Filho ANF. Primeiro caso autóctone de tripanossomíase americana no Estado do Acre (Brasil) e sua correlação com as cepas isoladas do caso humano e de triatomíneos silvestres da área. Rev Saude Publica. 1988;22(5):401-10.
- Feliciangeli MD, Dujardin JP, Bastrenta B, Mazzarri M, Villegas J, Flores M, et al. Is *Rhodnius robustus* (hemiptera: Reduviidae) responsible for chagas disease transmission in western venezuela? Trop Med Int Heal. 2002;7(3):280-7.
- Almeida FB, Machado PA. Sobre a infecção do *Panstrongylus geniculatus* pelo *Trypanosoma cruzi* em Manaus, Amazonas, Brasil. Acta Amaz. 1971;1(2):71-5.
- Terassini FA, Stefanello C, Camargo LMA, Meneguetti DUO. First report of *Panstrongylus lignarius*, Walker, 1873 (Hemiptera, Reduviidae, Triatominae), in the State of Rondônia, Brazil. Rev Soc Bras Med Trop. 2017;50(4):547-9.
- Valente VC. Potencial de domiciliação de *Panstrongylus geniculatus* (Latreille, 1811) (Hemiptera, Reduviidae, Triatominae) no município

- de Muaná, Ilha de Marajó, nordeste do Estado do Pará, Brasil. Rev Soc Bras Med Trop. 1999;32(5):595-7.
12. Moraes MHS, Jesus AC, Madeira FP, Moresco GG, Oliveira J, Rosa JA, et al. Triatominae (Hemiptera, Reduviidae) in homes: Report of their occurrence in the municipality of Cruzeiro do Sul, Acre, South Western Amazon. Rev Soc Bras Med Trop. 2020;54:1-8.
 13. Vivas RJ, García JE, Guhl F, Hernández C, Velásquez N, Ramírez JD, et al. Systematic review on the biology, ecology, genetic diversity and parasite transmission potential of *Panstrongylus geniculatus* (Latreille 1811) in Latin America. Mem Inst Oswaldo Cruz. 2021;116:e200528.
 14. Julião GR, Bragança MAH, Torres PG, Lima L, Neves R de A, Nobre JMS, et al. Acute Chagas Disease Caused by *Trypanosoma cruzi* TcIV and Transmitted by *Panstrongylus geniculatus*: Molecular Epidemiological Insights Provided by the First Documented Autochthonous Case in Rondônia, Southwestern Amazonia, Brazil. Vector Borne Zoonotic Dis. 2022;22(4):244-51.
 15. Matias A, De La Riva J, Martinez E, Torrez M, Dujardin JP. Domiciliation process of *Rhodnius stali* (Hemiptera: Reduviidae) in Alto Beni, La Paz, Bolivia. Trop Med Int Health. 2003;8(3):264-8.