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New geographic record of *Meccus mazzotti* in the State of Morelos, Mexico

José Trinidad Sánchez-Vega[1] iD, Arnulfo Eduardo Morales-Galicia[1]* iD, Ricardo Hernández-López[1] iD, Rodrigo Ildefonso Hernández-Covarrubias[1] iD, Mauro Omar Vences-Blanco[2] iD

[1]Laboratorio de Parasitología, Departamento de Microbiología y Parasitología, Facultad de Medicina, Universidad Nacional Autónoma de México (UNAM). Ciudad de México, México. CP 04510.
[2]Laboratorio de Biología de Parásitos, Departamento de Microbiología y Parasitología, Facultad de Medicina, Universidad Nacional Autónoma de México, (UNAM). Ciudad de México, México. CP 04510.

*Email autor para correspondencia: moralesgaliciaarnulfoeduardo@gmail.com

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ABSTRACT

Background: Chagas disease is caused by the hemoflagellate parasite *Trypanosoma cruzi*, transmitted by more than 133 species of hematophagous triatomines of the family *Reduviidae*. There are 8 million infected people in the world and 25 million live in at-risk areas. More than 34 species of triatomine carriers have been reported in Mexico, and *Meccus mazzotti* is considered an endemic species of epidemiological importance. **Methods:** Since 2017, a continuous search for triatomines has been carried out in the community of Tlayacapan, Morelos, Mexico, with the objective of determining the species present in that community, for their taxonomic identification the keys of Lent and Wygodzinsky (1979) are used. **Results:** 106 specimens were captured, of these 105 were identified as *M. pallidipennis and* 1 as *M. mazzotti*. **Conclusion:** For the first time, we report the finding of *M. mazzotti* in the state of Morelos, a region in which *M. pallidipennis* and *T. barberi* have predominated, so it is necessary to continue the search for this new species in that state and to reinforce the control measures for these vectors.

Keywords: Arthropod vectors; Chagas disease; *Meccus mazzotti*; Mexico; Morelos.

RESUMEN

Antecedentes: la Enfermedad de Chagas es causada por el parásito hemoflagelado *Trypanosoma cruzi*, transmitido por más de 133 especies de triatominos hematófagos de la familia *Reduviidae*. Hay 8

millones de personas infectadas en el mundo y 25 millones viven en zonas de riesgo. En México se han reportado más de 34 especies de triatominos portadores, y *Meccus mazzotti* se considera una especie endémica de importancia epidemiológica. **Métodos:** Desde 2017 se realiza una búsqueda continua de triatominos en la comunidad de Tlayacapan, Morelos, México, con el objetivo de determinar las especies presentes en dicha comunidad, para su identificación taxonómica se utilizan las claves de Lent y Wygodzinsky (1979). **Resultados:** Se han capturado 106 ejemplares, de estos 105 fueron identificados como *M. pallidipennis* y 1 como *M. mazzotti*. **Conclusión:** Por primera vez se reporta el hallazgo de *M. mazzotti* en el estado de Morelos, región en la que han predominado *M. pallidipennis* y *T. barberi*, por lo que es necesario continuar con la búsqueda de esta nueva especie en dicho estado y reforzar las medidas de control de estos vectores.

Palabras clave: Artrópodos vectores; Enfermedad de Chagas; *Meccus mazzotti*; México; Morelos.

INTRODUCTION

Chagas disease or American trypanosomiasis is an anthropozoonosis, a disease transmitted from vertebrate animals to humans [1], whose causative agent is the hemoflagellate parasite *Trypanosoma cruzi* (Chagas, 1909). At present, it is considered that around the world there are 8 million people infected and 25 million live in areas at risk. This is a parasitic disease of high importance in Latin America, affecting 21 countries (Argentina, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, Uruguay and Venezuela) (Figure 1).

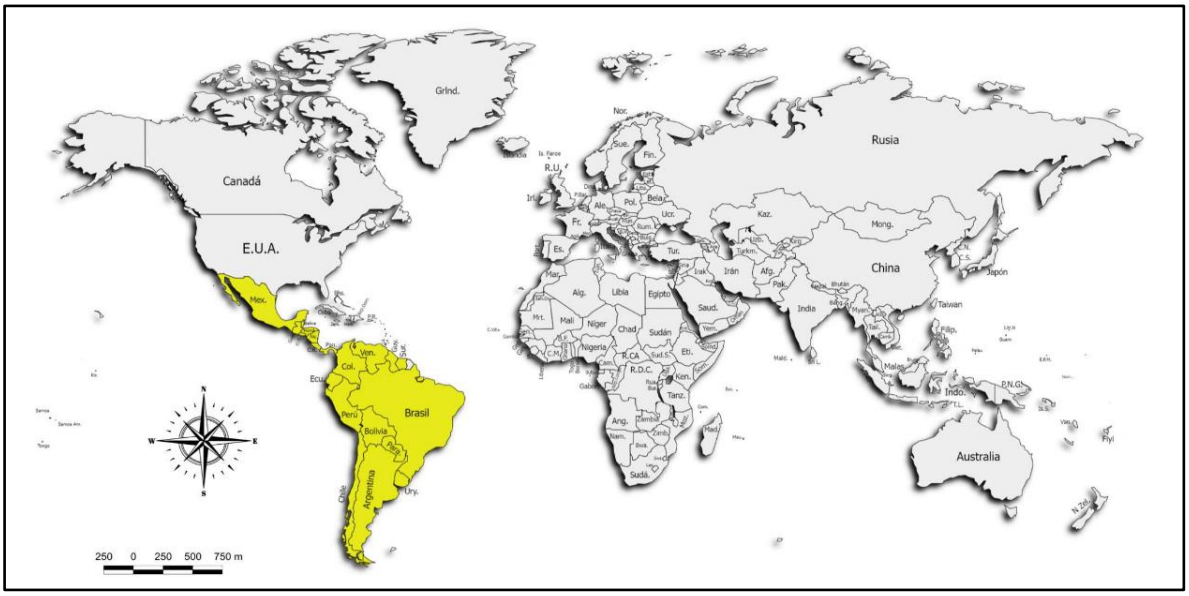

Figure 1. Chagas disease endemic area (Own elaboration, Paint Maps, 2022).

In Mexico during the period 2000-2016, 487 deaths were reported in 18 states [2], in addition, infant mortality (0-5 years) has been estimated at approximately 830 deaths per year according to Ramsey *et al* (2005) [3] and it is estimated that more than 500,000 people are in the chronic phase, whose ages range from 35 to 55 years, affecting their working and productive life, in addition to generating health care expenses [4, 5, 6, 7].

American trypanosomiasis is a disease transmitted mainly by vectors (ETV), these are triatomine insects belonging to the order Hemiptera, suborder Heteroptera, family *Reduviidae* and subfamily *Triatominae,* which are normally found in poor or overcrowded conditions [2]. There are 156 species within this subfamily, distributed in 18 genera and 5 tribes; they have hematophagous habits and by feeding on an infected host, they can acquire and transmit through their fecal matter the infecting forms to a new host [5, 6, 8, 9].

To date, more than 34 species of the genera *Rhodnius, Paratriatoma, Eratyrus, Dipetalogaster, Belminus, Panstrongylus, Meccus* and *Triatoma* have been reported in Mexico. The main species due to their high dissemination and distribution are *Meccus pallidipennis, Meccus longipennis* and *Triatoma barberi*, and *Meccus picturata, Meccus mazzotti* and *Triatoma dimidiata* are considered secondary species [4, 7, 8].

M. mazzotti was identified for the first time by Usinger (1941), it is restricted to Mexican territory and is therefore considered an endemic species, and so far there are reports of its presence in the states of Durango, Guerrero, Jalisco, Mexico, Michoacán, Nayarit and Oaxaca (Figure 2) [10, 11, 12, 13].

The body of triatomines is divided into three regions: head, thorax and abdomen. Its adult size ranges from 1.5 cm to 3 cm in length. The head is elongated and slender, of intermediate length, and the prominent antennae are inserted at the midpoint between the pair of eyes and the clypeus, which allows differentiation of the genera. This head ends in a straight proboscis bent towards its ventral portion that extends when biting, this is a mouthpiece of the stinging-sucking type, segmented in three parts transversely. Their thorax is chitinous, their anterior segment seems to have the shape of a shield and they also have three pairs of legs (anterior, middle and posterior) and two pairs of wings folded over the dorsum, that is why they are considered exopterygous bugs. The anterior pair of wings are called hemielliters and are composed of a hardened region (corium) and a membranous distal one, being the second pair completely membranous, that is, they can be structurally distinct (partially or totally), and despite the presence of wings, they are considered by most authors to be more walking than flying insects and they have a lateral margin connexus to the abdomen, flattened and protruding, dark with light spots [8]. (Figure 3).

The objective of the present work was to explore rural areas in search of possible vectors of Chagas disease.

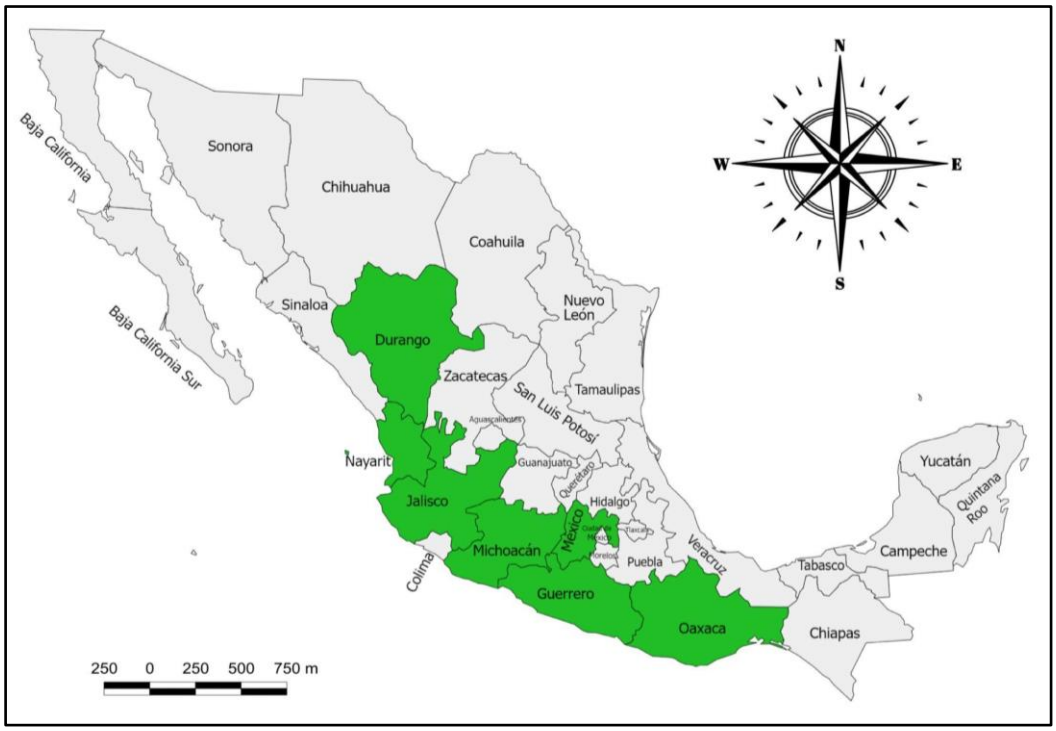

Figure 2. Distribution in Mexico of *M. mazzotti*. (Own elaboration, Paint Maps, 2022).

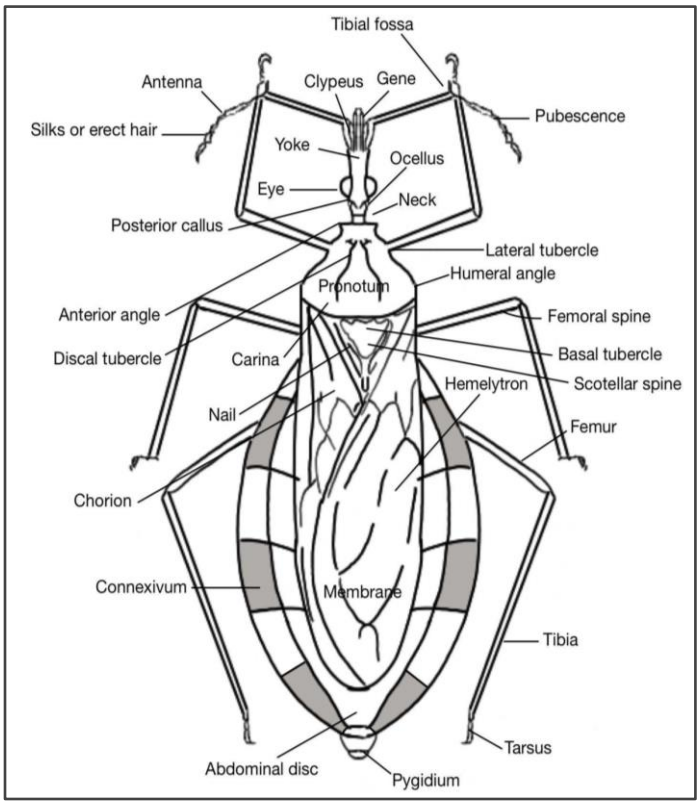

Figure 3. Anatomical structures of triatomines (Own elaboration, Sketch Club, 2022).

METHODOLOGY

Sampling area

Tlayacapan is located northeast of the state of Morelos, with a land area of 52,136 km^2, latitude 18°59'34", south at 18°53'37", east at longitude 98°55'15" and 99°00'58" to the west and 1640 meters above sea level (masl) (Figure 4). There are 3 types of climate: warm sub-humid, temperate sub-humid and semi-warm sub-humid, with the latter predominating [14, 15, 16].

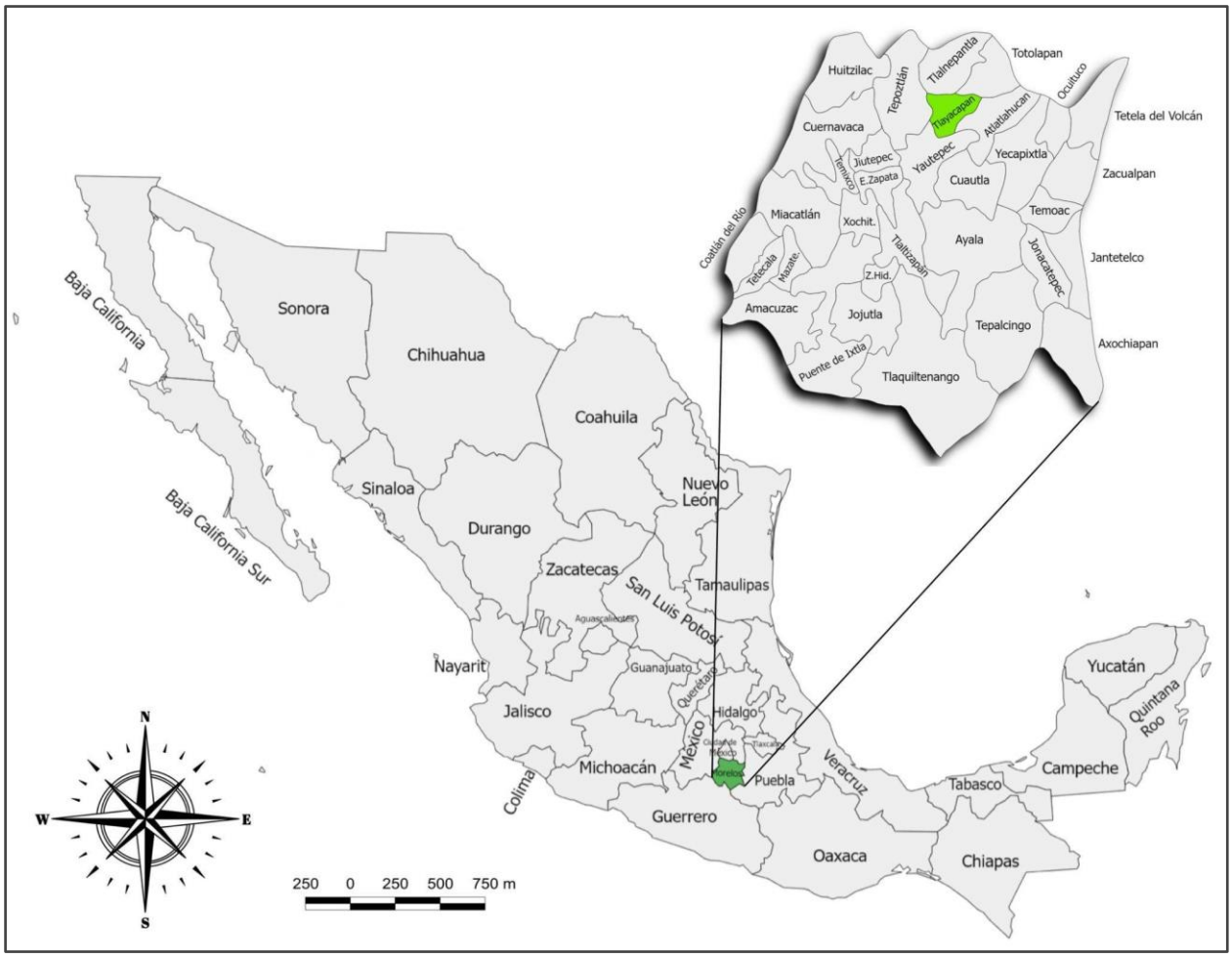

Figure 4. Tlayacapan, Morelos, Mexico (Own elaboration, Paint Maps, 2022).

52.7% of the inhabitants are in a situation of poverty, a percentage of which only 8.2% are in extreme poverty according to the National Council for the Evaluation of Social Development Policy (CONEVAL), 38.7% of the population is vulnerable due to social deprivation [16].

Collection of triatomines

Continuous sampling is carried out under the project "Detection of vectors transmitting *Trypanosoma cruzi* in Tlayacapan, Morelos" from February 2017 to June 2022, following the specifications of NOM-126-ECOL-2000. Help

from the residents has been received, as they have been shown photographs and leaflets with images of vectors previously reported in that area *(M. pallidipennis* and *T. barberi*) and about the characteristics of Chagas disease, as well as asking them that, in the event of capture, they store them in glass jars previously provided by the project, labeling them with the date and biotope of collection, area of uniform environmental conditions for a set of flora and fauna [7], for subsequent transfer to the Parasitology Laboratory [17, 18].

Taxonomic identification

The keys of Lent and Wygodzinsky (1979) are used to identify all captured triatomines. In the case of *M. mazzotti* is considered within the genus, this species has a head not strongly convex dorsally, short antennal tubercles, away from the eyes. The chorion without white area, predominantly black, only with yellow or red-orange spots at base and subapically, with long, delicate, semi-erect hairs, about 0.5 mm long. Its hemielliters are elongated, reaching or almost reaching the extremity of the abdomen and its connexus dorsally with reddish-orange spots occupying from the third part to the posterior half of each segment [5, 8, 9, 11, 19, 20].

RESULTS

The sampling collected 106 specimens (54 females and 52 males), of which 99 were adults and 7 were in the nymphal stage: 105 identified as *M. pallidipennis* and 1 as *M. mazzotti* (adult female). The latter, from the moment it was collected, attracted a great deal of attention, highlighting its peculiar distinctive pattern with red-orange spots on the connexus, different from that of *M. pallidipennis* (Figure 5).

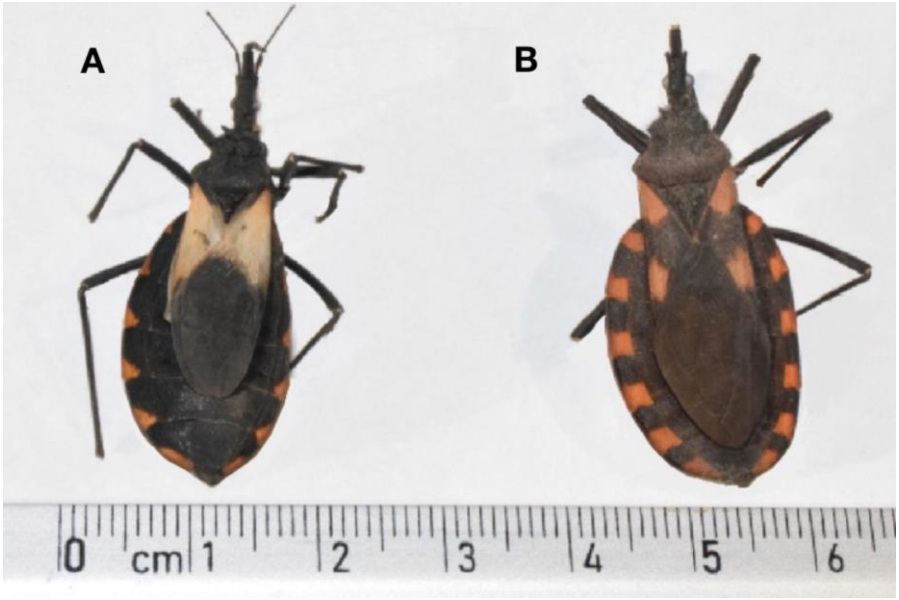

Figure 5. Specimens captured from (A) *M. pallidipennis* and (B) *M. mazzotti*, note the morphological differences according to Lent and Wygodzinsky (1979): (A) black pronotum, black connexus with red-orange spots and creamy to pinkish-white corium of the hemelytra and (B) black pronotum, black connexus with red-orange spots and red-orange corium of the hemelytra (Own photograph, 2022).

This specimen was captured during the month of June 2022 at coordinates 18°57'8" N and -98°59'34" W, an area characterized by a semi-warm sub-humid climate and low deciduous forest type vegetation with few dwellings. A female was identified by the presence of the pygidium at the posterior end. It measures 34 mm long by 12 mm wide. Its pronotum and hemelytron are identified as black (Figure 5). It presents a red-orange pattern in its corium and connective tissue (Figure 6). This agent was captured peridomiciliary, thus defining those species that inhabit the surroundings of houses with yards with debris, corrals, chicken coops, stables or any domestic animal that can function as a food source and occasionally have contact with humans [9].

DISCUSSION

M. mazzotti is dispersed in states of the Pacific coast and the State of Mexico, so far there is no report of its presence in the state of Morelos, so given this finding, it is possible that the processes of deforestation, invasion by agricultural activities and the increase or construction of human settlements, have impacted the ecology of the species, leading to its dispersion in search of food sources. Mention is made of the likelihood that in the states, Morelos for example, where *M. pallidipennis* as the main vector, this being a very competitive and dominant species, prevents the installation of other species in its habitat, which makes it difficult to find different specimens as in this case *M. mazzotti*, in addition to the possible synanthropization of the species, that is, its adaptation to the environment modified by humans; all this without omitting the possible artificial introduction of the species [10, 11, 12, 21, 22].

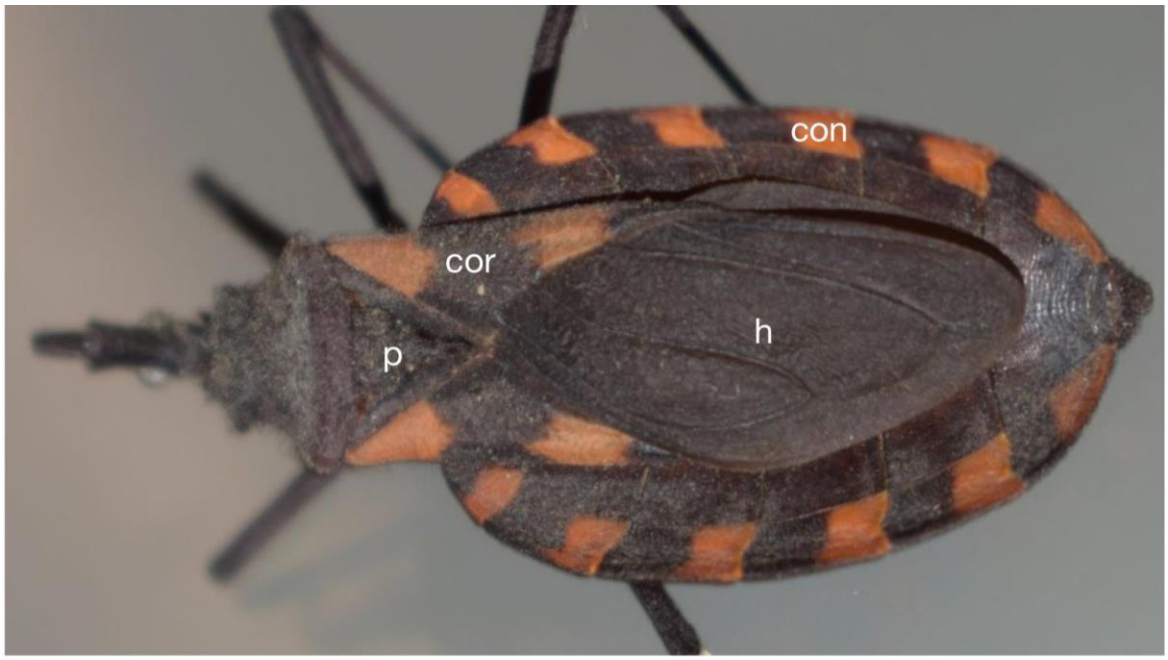

Figure 6. Captured specimen. Pronotum (p) and hemelytron (h) black, corium (cor) and connexus (con) with its characteristic orange-red pattern (Own photograph, 2022).

In this report, the prevalent conditions of the dwellings (adobe walls, accumulation of waste, absence of mosquito nets, etc.), presence of domestic animals (intra and/or extra-domestic), proximity to palm trees, caves and overcrowding, which favor the development and colonization of these arthropods, were considered [5, 23]. This species is normally reported at an altitude between 9 and 750 meters above sea level (Salazar, 2010), although there is also a report of *Meccus mazzottii* in the community of Santiago Textitlán, Oaxaca (Martínez, 2014), at an altitude of 1710 meters above sea level as in this case; Given that these insects do not have a thermoregulatory center, transmitter and parasite are at room temperature, which influences transmission dynamics, the ideal temperature being between 28 and 30°C [10, 12].

It can be considered that in the state of Morelos there are the necessary elements to complete the biological cycle of the parasite: 1) the confirmation of a vector, in this case *M. mazzotti* (although other species have already been reported in the state, such as *M. pallidipennis* and *T. barberi*) [10], 2) presence of susceptible hosts, and 3) patients with Chagas disease, because although they were not the subject of study in this work, in the state of Morelos during the period 2000-2017 there were 9.2% of the 9981 cases registered nationally (acute and chronic) [2, 9, 12, 24].

CONCLUSION

It is reported for the first time the finding of *M. mazzotti* in the town of Tlayacapan, Morelos, thus reconfirming the risk of acquiring American trypanosomiasis in this state, so it is necessary to maintain entomological surveillance of this species, in order to create more adequate and accurate overviews about the distribution of vectors. Although we do not have previous data, we consider that this work can function as a pilot to give rise to the implementation of clinical research, epidemiological studies, identification of reservoirs and the ecology of triatomines in this community.

CONFLICT OF INTEREST

The authors of the present work do not present any conflict of interest regarding the project developed and its writing.

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