

First record of domestic colonies of the dark chromatic variant of *Triatoma infestans* (Hemiptera: Reduviidae)

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Primer registro de colonias domésticas de la variante cromática oscura de *Triatoma infestans* (Hemiptera: Reduviidae)

RESUMEN. *Triatoma infestans* (Klug) es el principal vector de la enfermedad de Chagas en el sur de Sudamérica. Aunque esta especie muestra una morfología y un patrón cromático similar a través de su distribución geográfica, algunas variantes melánicas han sido descritas. La mayoría de estas variantes fueron reconocidas como parte de poblaciones silvestres, que evidenció una distribución silvestre de *T. infestans* mayor a la esperada. Este trabajo informa la presencia de ocho adultos y quince individuos inmaduros de *T. infestans* melánicos en unidades domiciliarias en el Gran Chaco argentino. Este es el primer registro de colonias domésticas de la variante cromática oscura de *T. infestans*.

PALABRAS CLAVE. Morfo oscuro. Triatominae. Variantes geográficas.

ABSTRACT. *Triatoma infestans* (Klug) is the main vector of Chagas disease in southern South America. Although this species shows a similar morphology and chromatic pattern throughout its geographical distribution, some melanic variations have been described. Most of these variants were recognized as part of wild populations constituting evidence of a wild distribution for *T. infestans* greater than the expected. This paper reports the presence of eight adults and fifteen immature individuals of melanic *T. infestans* in domiciliary units of Argentine Gran Chaco. This is the first report of domestic colonies of the dark chromatic morph of *T. infestans*.

KEYWORDS. Dark morph. Geographical variants. Triatominae.

Triatoma infestans (Klug) (Hemiptera: Reduviidae) is a haematophagous insect belonging to the subfamily Triatominae and is the main vector of Chagas disease in the Southern Cone of South America. Although several studies have reported the existence of sylvatic populations (Noireau, 2009), the habitat of this species is mainly human dwelling in rural zones of the endemic area (Lent & Wygodzinsky, 1979). *Triatoma infestans* shows a similar morphology and chromatic pattern

throughout its geographical distribution. However, some particular morphs were described. According to their phenotypic features, these geographical variants can be grouped in a large morph and a melanic morph (Ceballos et al., 2009; Noireau, 2009). The first of them was named "Mataral morph" and is represented by Andean sylvatic insects from Cochabamba department of Bolivia (Cortez et al., 2007). The dark chromatic variant is represented by samples collected from

different non-Andean geographic locations very far from each other (*i.e.* Bolivian Chaco, Argentine Chaco, Paraguayan Chaco and Argentine Mesopotamia) (Martinez et al., 1987; Noireau et al., 1997; Yeo et al., 2005; Ceballos et al., 2009). Most of these morphs were recognized as members of the species as part of wild populations, constituting evidence of a wild distribution greater than expected (Bargues et al., 2006; Noireau, 2009; Piccinali et al., 2011). A particular case is the melanic form found in the north-east of Argentina. This insect was originally described as a subspecies of *T. infestans* and later it was raised to the rank of species as *T. melanosoma* (Martinez et al., 1987; Lent et al., 1994), although at present it is considered a geographical variation of *T. infestans* (Bargues et al., 2006). The specimens were collected in the peridomiciliary area close to chicken coops, but the authors did not clarify whether the insects were found specifically in domestic structures or in natural shelters (Martinez et al., 1987). In this context, the present paper reports for the first time the occurrence of a morph of *T. infestans*, particularly a chromatic variant, in a domestic structure within a domiciliary unit.

The dark chromatic variants of *T. infestans* reported in this paper were collected during the entomological evaluations carried out in Argentina through the coordinated work of the National Chagas Program (NCP) and the corresponding Provincial Organisms (PO) (*e.g.*: Provincial Programs, Epidemiology Directions, etc.). Field insects were collected through active searches in intradomiciliary and peridomiciliary areas of the domiciliary unit by trained technicians from the NCP and POs. The insects were collected and transported to the Centro de Referencia de Vectores (CeReVe), where they were classified by village/locality and department. The specific identification was made based on morphology, according to Lent & Wygodzinsky (1979). Samples were examined microscopically for *Trypanosoma cruzi* infection by direct microscope observation of faeces droplets at X400 magnification. Finally, they were raised under controlled conditions ($26 \pm 1^\circ\text{C}$, 50-70% RH and 12:12 h L:D). A pigeon was weekly provided as a blood meal source (WHO, 1994).

Table I shows the locality of origin, the collection site within the domiciliary unit, and the number and stage of the collected melanic insects. The insects were collected both in peri and in intradomiciliary areas in four domiciliary units from three villages of the General Güemes Department in the Province of Chaco. The sample consisted of six females, two males, three fifth instar nymphs and twelve fourth instar nymphs. Presence of immature stages evidences that the sample came from established colonies. In El Techat, insects were only collected in the intradomicile, which represented 13% of the sample. In La Esperanza, insects came from peridomiciliary structures, and were collected in chicken coop (*i.e.* 82.6% of the sample). In Zaparinqui, insects also came from peridomiciliary

Domiciliary unit	Village	Area	Structure	Sample composition
01	La Esperanza	Peridomicile	Chicken coop	3 females, 2 males, 1 fifth instar and 9 fourth instars
02	La Esperanza	Peridomicile	Chicken coop	1 female, 1 fifth instar and 2 fourth instars
03	El Techat	Intradomicile	Bedroom	2 females and 1 fourth instar
04	Zaparinqui	Peridomicile	Pigsty	1 fifth instar

Table I Data of origin and composition of the samples of melanic *Triatoma infestans* collected in General Güemes department of the Chaco province, Argentina.

structures, but in a pigsty (*i.e.* 4.4% of the sample). None of the insects were infected with *T. cruzi*. All insects were pooled and raised successfully. Descendants of the field insects also showed their dark chromatic pattern.

As a general description, all insects and stages collected showed darker general coloration with smaller yellow/orange areas (*e.g.*: in connexivum or hemelytra) than *T. infestans* with typical coloration (Figs. 1 and 2). The most outstanding feature is the aspect of the connexiva, which has very reduced yellow marks and is confined to the inner edge of the connexiva to the extreme that in some individuals are almost non-existent. This chromatic pattern differs greatly from the connexivum of typical specimens of the species, which have prominent yellow markings occupying the posterior half of each segment from the inner edge of the connexivum to its outer edge (Lent & Wygodzinsky, 1979). In addition, the pale yellow spots of the hemelytra of typical specimens (Lent & Wygodzinsky, 1979) are not visible, or were much reduced in the individuals reported in this paper. Moreover, the entire hemelytra were darker than the typical hemelytra. The prosternum, mesosternum and metasternum and the abdominal sterna of the collected insects showed a lighter brown color than the dark brown or black of typical specimens. Males and females shared this unusual chromatic pattern. The nymphs showed a darker dorsal coloration, with all the yellow spots smaller or nonexistent (*e.g.*: spots in head, thorax, wing pads and connexivum) than typical specimens of the species. The general appearance of the ventral structures of both thorax and abdomen was similar to the typical appearance of the species although the yellow spots were less intense. Remarkably, legs of all stages showed the typical chromatic pattern (*e.g.*: legs of adults, dark brown or black with trochanters and bases of femora yellow/orange) (Lent & Wygodzinsky, 1979).

The dark chromatic morphs of *T. infestans* were previously found in the Bolivian department of Santa Cruz and in the Argentine province of Chaco, within the

Gran Chaco ecoregion, and in the humid forest of the Argentine province of Misiones (Martinez et al., 1987; Noireau et al., 1997, 2000; Ceballos et al., 2009). The Gran Chaco specimens were collected in wild ecotopes and there were evidences of wild populations of *T. infestans* (Noireau et al., 1997; Ceballos et al., 2009). The habitat of the specimens collected in Misiones is less certain. The authors reported that the insects were collected in peridomiciliary habitats near chicken coops without any specification of the exact place where they had been found (Martinez et al., 1987). Therefore, it is not clear if those insects were in a structure of anthropic origin (e.g.: coops, corrals, etc.) or in a non-artificial structure (e.g.: trees, birds' nests, etc.). Thus, the present paper reports for the first time the occurrence of a chromatic morph of *T. infestans* in a domestic or anthropic structure within a domiciliary unit.

Although the dark coloration is the common characteristic of all chromatic morphs of *T. infestans*, the chromatic pattern is not the same. Specimens collected

in Misiones presented a general black coloration with the exception of a clearer medial zone of the sternites and, in the connexivum, a fine yellowish line in the anterior edge of each segment (Martinez et al., 1987). On the other hand, insects of the Gran Chaco showed an overall darker coloration and smaller yellow spots in the connexivum than *T. infestans* with typical coloration, and yellow/orange spots in the posterior coxae which are dark brown or black in the typical specimens (Noireau et al., 1997; Ceballos et al., 2009). Although Martinez et al. (1987) highlighted the black color of the coxae, the connexivum and the proximal part of the femora of Misiones morph, authors who described the insects of the Gran Chaco did not refer to color of the base of the femora. In any case, the dark morph of the Gran Chaco was interpreted as an intermediate chromatic variant between a typical *T. infestans* and a darkest morph of Misiones (Noireau et al., 1997; Catalá & Torres, 2001). The insect here described showed a general black coloration with small yellow/orange spots in the connexivum and the proximal part of femora and trochanters also yellow/orange. Thus, considering the chromatic pattern of each variant, the insects reported in this work would belong to the variant previously found in the Gran Chaco (although they differ in the color of the posterior coxae), differing from those found in Misiones (differentiation based on the color of the base of the femora).

Melanic morphs of *T. infestans* were historically associated to sylvatic populations (Ceballos et al., 2009; Noireau, 2009). In this context, one question had special attention: What is the potential of these wild populations to colonize the domestic environment? Before addressing this question, it is necessary to establish if the insects reported in this work have colonized the domestic environment from the wild habitat, or if they are domestic insects. It is the first time that this morph has been collected in human dwellings. However, these houses are in an area with relatively high frequency of entomological monitoring due to the existence of populations with a very high resistance (Mougabure-Cueto & Picollo, 2015). If these insects were domestic, they should have been detected before and repeatedly. On the other hand, Ceballos et al. (2009) reported dark sylvatic *T. infestans* in a department of the province of Chaco, location of the villages in which the insects reported in this work were collected. In this way, it is highly probable that these insects came from the wild environment. Thus, this research shows that the melanic *T. infestans* can colonize the human dwelling. Considering that the melanic *T. infestans* probably belong to sylvatic populations, this paper shows that the sylvatic *T. infestans* probably colonize the domiciliary environment.

Colonization occurs due to the dispersal of individuals to areas where the species is not established or was displaced (e.g.: by control actions) (Schofield, 1994). Dispersal in triatomines can be passive (e.g.: in the clothes, feathers, or hair) or active (by flight of

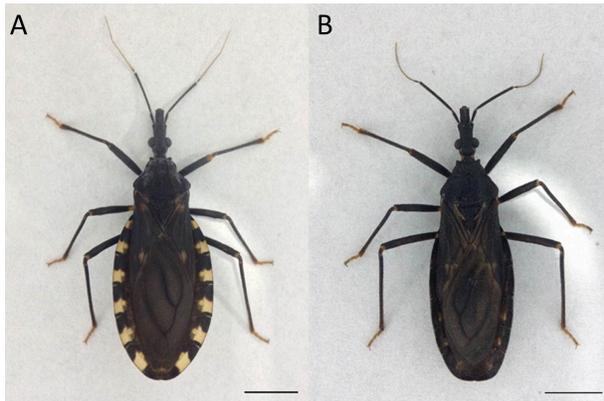


Fig. 1. External appearance of the male of *Triatoma infestans*. A. typical chromatic pattern; B. dark chromatic pattern Bar scale = 5 mm

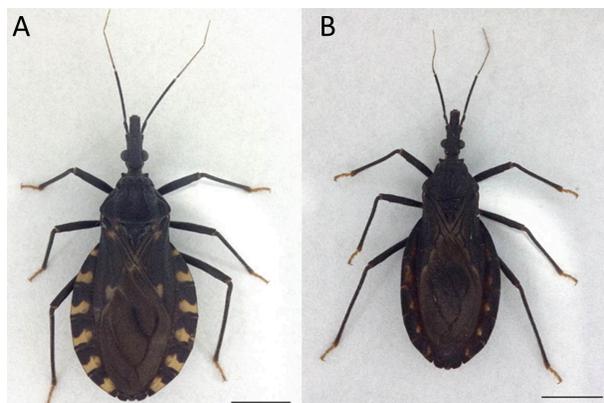


Fig. 2. External appearance of the female of *Triatoma infestans*. A. typical chromatic pattern; B. dark chromatic pattern Bar scale = 5 mm

the adults or walk). Passive dispersal has a relevant role in the explanations of the spread of *T. infestans* from its center of origin as species and also of current dispersive events (Cortez et al., 2010; Faúndez, 2016). Active dispersal was associated to search for food, shelter or couple, and is considered one of the main mechanisms of colonization and/or re-infestation of human dwellings (Schofield et al., 1992; Vazquez-Prokopec et al., 2004). Dispersal by flight has received the most attention in triatomines (Schofield et al., 1992; McEwen et al., 1993; Vazquez-Prokopec et al., 2004). However, in recent years, some studies showed the relevance of walking dispersal in *T. infestans* and suggested its advantage for colonization by allowing the displacement of individuals with high nutritional status and with ovulated eggs (Abraham et al., 2011; Lobbia et al., 2019a, b). Thus, displacement of *T. infestans* between sylvatic and domestic areas and subsequent colonization may be events more frequent than assumed. Recently, Carbajal-de-la-Fuente et al. (2019) reported the presence of a male of *T. infestans* in a sylvatic environment of the Argentine Monte ecoregion and the dispersal from a dwelling would be the most likely explanation since a house very infested with *T. infestans* was within the flight range of this species. More studies are needed to determine the geographical distribution of the dark morph and wild foci of *T. infestans* in Argentina and the relevance of the exchange of individuals between both wild and domestic environments in *T. infestans*.

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