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Authors: Ortíz-Giraldo, Mateo, Cardona-Giraldo, Alexandra, Ez-Guarín, Daniela Velásqu, Ramírez-Chaves, Héctor E., and Rivera-Páez, Fredy A.

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Article

A gynandromorph of the brown dog tick, *Rhipicephalus sanguineus* s.l. (Latreille, 1806) from Colombia

MATEO ORTÍZ-GIRALDO¹, ALEXANDRA CARDONA-GIRALDO^{1, 3}, DANIELA VELÁSQUEZ-GUARÍN¹, HÉCTOR E. RAMÍREZ-CHAVES^{1,2} & FREDY A. RIVERA-PÁEZ¹

¹Grupo de Investigación en Genética, Biodiversidad y Manejo de Ecosistemas (GEBIOME), Departamento de Ciencias Biológicas, Facultad de Ciencias Exactas y Naturales, Universidad de Caldas, Calle 65 No. 26-10, 170004, Manizales, Caldas, Colombia.

²Centro de Museos, Museo de Historia Natural, Universidad de Caldas, Calle 58 No. 21-50, 170004, Manizales, Caldas, Colombia.

³Programa Maestría en Tecnologías de la Información Geográfica, Facultad de Ciencias e Ingeniería, Universidad de Manizales, Carrera 9a No. 19-03, Manizales, Caldas, Colombia.

Corresponding author: fredy.rivera@ucaldas.edu.co

ORCID ID:

Mateo Ortiz-Giraldo: <https://orcid.org/0000-0001-8151-7068>

Alexandra Cardona-Giraldo: <https://orcid.org/0000-0002-7534-994X>

Daniela Velásquez-Guarín: <https://orcid.org/0000-0002-6487-7608>

Héctor E. Ramírez-Chaves: <https://orcid.org/0000-0002-2454-9482>

Fredy A. Rivera-Páez: <https://orcid.org/0000-0001-8048-5818>

Abstract

Gynandromorphism is a condition in which an organism exhibits both male and female characters simultaneously. This condition is the result of an abnormal process during embryonic development, and has been frequently reported in arthropods, especially crustaceans, insects, and arachnids. Here, we report a case of gynandromorphism in the brown dog tick, *Rhipicephalus sanguineus* s.l. in Colombia. The individual was collected from a domestic dog in the municipality of Samaná, Department of Caldas, in the inter-Andean Valley of the Magdalena River Basin of the country. This record is the first documented for this species in Colombia, and the fourth in America where this anomaly was previously reported in countries such as Brazil (two cases) and Mexico (one case).

Key words: Ixodidae, morphological abnormality, Neotropical lineage, species complex

Introduction

Teratological changes in ticks have been classified into two main categories including general and local anomalies (Campana-Rouget 1959a, 1959b). General anomalies include gynandromorphism, changes in body shape, asymmetry, nanism, and duplication (Laatamna *et al.* 2021). Gynandromorphs are individuals that possess phenotypic characteristics of males and females, and is the result of an abnormal process during embryonic development, and has been frequently reported in arthropods, especially insects and arachnids (Farnsworth 1988). Due to the differences presented, there is a commonly used classification for gynandromorphs (Campana-Rouget 1959a): (i) bipartite "protogynander", where the external characters of female and male ticks are equally represented; (ii) "deuterogynander", where the characters of one sex are reduced to one quadrant; (iii) "metagynander", where the traits of one sex are reduced to a small segment; (iv) "gynander intriqué", a "protogynander" or "deuterogynander" in which some portions of male or female characters are

embedded in areas of the opposite sex; and (v) mosaic gynandromorphism, where there is no definite line separating one sex from the other, but the portions intertwine asymmetrically (Salceda-Sánchez *et al.* 2020). For hard ticks (Ixodida), this phenomenon has been widely documented, with about 85 cases globally (Guglielmone *et al.* 1999; Labruna *et al.* 2002; Domínguez & Rodríguez *et al.* 2020) with the bipartite “protogynander” as the most commonly reported condition (Labruna *et al.* 2002; Keskin *et al.* 2012; Salceda-Sánchez *et al.* 2020).

In the Neotropical region, three cases of gynandromorphism have been documented for the brown dog tick, *Rhipicephalus sanguineus* s.l. (Pereira & Castro 1945; Labruna *et al.* 2002; Salceda-Sánchez *et al.* 2020). Nonetheless, this species comprises a complex of species, therefore, the records mentioned refer to the Neotropical lineage (Nava *et al.* 2018). This lineage is considered a vector of multiple pathogens of medical and veterinary importance, especially *Ehrlichia canis*, which causes granulocytic and monocytic ehrlichiosis in canids (Benavides & Ramírez 2003; Cabezas-Cruz *et al.* 2019). In Colombia, only one case of gynandromorphism has been reported in *Amblyomma mixtum* (Rivera-Páez *et al.* 2017). Here, we present a new case of gynandromorphism in *R. sanguineus* s.l., obtained in the inter-Andean valley of the Magdalena River in Colombia.

Material and methods

We collected ticks including *R. sanguineus* s.l. from domestic dogs in the area of influence of the ISAGEN Miel I hydroelectric plant, located in the “Corregimiento” of Berlin, “Vereda” Piedras Verdes, Municipality of Samaná, Department of Caldas (05°36'24.9"N; 74°57'18.1"W; elevation: 681 m.) in February 2021. The ticks were extracted directly from dogs that frequents the forest transfer areas, and were deposited in 70% ethanol and deposited in the Colección de Ectoparásitos of the Museo de Historia Natural, Universidad de Caldas (MHN-UCa-Ec). We morphologically identified the ticks using taxonomic keys (Barros-Battesti *et al.* 2006; Nava *et al.* 2014, 2017). We identified a single individual with gynandromorphism which was assigned following the classification of Campana-Rouget (1959a, 1959b).

We also searched for additional records in the literature and mapped all the localities, in which gynandromorphism in *R. sanguineus* s.l. for the Neotropics has been documented. For this we searched databases such as Google Scholar, without time restriction for searches, and with the following keywords: ‘Ixodidae’, ‘*Rhipicephalus*’, ‘Neotropic’, ‘Gynandromorphism’, ‘Ectoparasite’, ‘genetic phenomenon’.

Results

We collected eight ticks from domestic dogs. The ticks were morphologically identified as six males, one female and one gynandromorph of *R. sanguineus* s.l. The latter was assigned to a “deuterogynander” based on the following traits:

Dorsum: Dorsal traits for male dominant but limited mostly to the left side of the body. Scutum with the typical punctuations of the species, porous areas absent, presence of festoons. Spiracular plates elongated, with a narrow dorsal prolongation. Eyes flat. Basis capituli hexagonal, cornua triangular, palps short and apically rounded (Figure 1).

Venter: Genital aperture located between coxa I–II, U-shaped. Anal aperture broadly U-shaped (right side). Legs: coxa I with two long triangular spurs, the external spur narrower than the internal; coxae II–IV with a single short external spur each. Presence of one adanal plate, subtriangular in shape, rounded posteriorly (limited to the left side of the individual). Hypostome short, blunt, dental formula 3/3 (Figure 1).

In the literature we only found three additional records of gynandromorphs *R. sanguineus* s.l. in the Neotropics, in countries such as Brazil: i) mosaic gynandromorphism (Pereira & Castro 1945), ii) an protogynander (Labruna *et al.* 2002), and iii) deutergynander from Mexico (Salceda-Sánchez *et al.* 2020). Therefore, our record is the first documented of this anomaly for the species in Colombia.

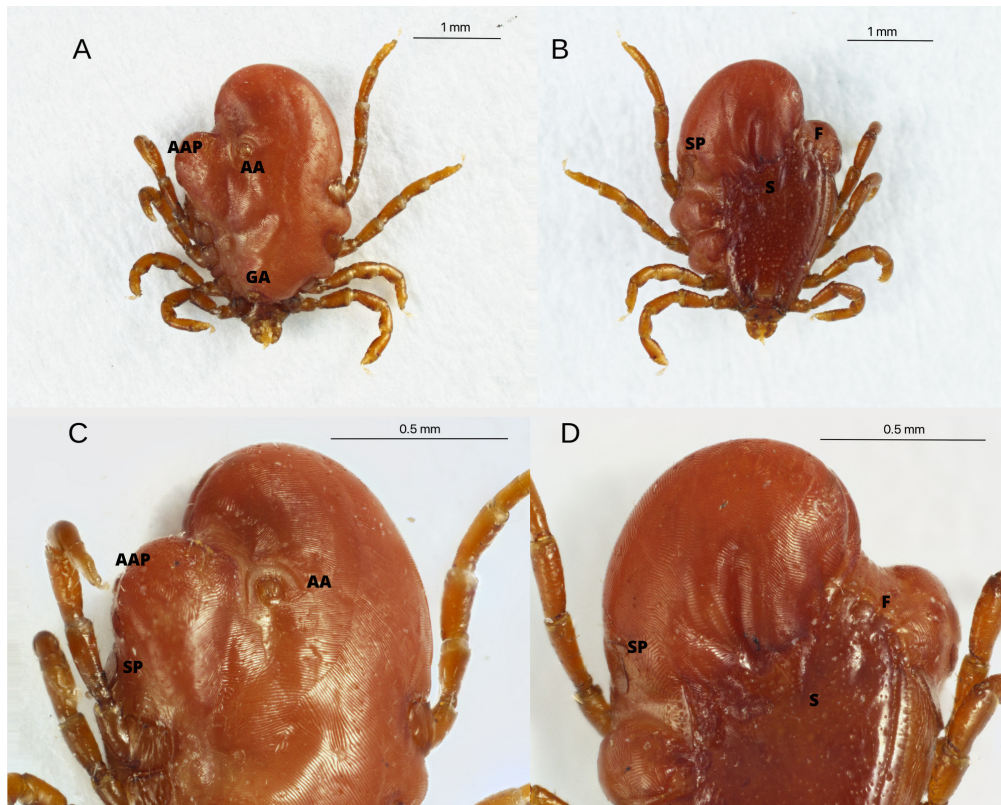


FIGURE 1. Morphological traits of the gynandromorph of *Rhipicephalus sanguineus* s.l. **A., C.** Ventral view, **B., D.** Dorsal view. **AA** Anal Aperture, **S** Scutum, **F** Festoons, **SP** Spiracular Plate, **AAP** Adanal Plate, **GA** Genital Aperture.

Discussion

The record of this gynandromorph is the first for the species *R. sanguineus* s.l. in Colombia. Previously, this species has been reported with other morphological anomalies in Argentina and Panama (Guglielmone *et al.* 1999; Domínguez & Rodríguez 2020). The gynandromorphic type identified, “deutergynander”, has also been previously reported in Mexico and, apparently, is less common in *R. sanguineus* s.l. of the Neotropical lineage (Salceda-Sánchez *et al.* 2020). The number of historical records of gynandromorphs of *R. sanguineus* s.l. is also low although it has been widely studied in countries such as Colombia (as the Neotropical lineage; Nava *et al.* 2018; Rivera Páez *et al.* 2018; Páez-Triana *et al.* 2021). Similarly, the brown dog tick has been widely study globally due to its role as a vector for pathogens such as *Ehrlichia canis*, which causes canine monocytic ehrlichiosis; and associated with other pathogens of importance for human health (Bremer *et al.* 2005; Cabezas-Cruz *et al.* 2019). The wide temporal gaps between the findings of gynandromorphs for *R. sanguineus* s.l. in the Neotropical region, could indicate that it is a phenomenon with low

occurrence. Nevertheless, we cannot discard that additional cases have not been reported considering the increase of records of this condition in the last three years (Salceda-Sánchez *et al.* 2020). For other tick species in Colombia a gynandromorph was reported for *Amblyomma mixtum* (Rivera-Páez *et al.* 2017), and the evidence of additional anomalies is still sub-documented.

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