https://doi.org/10.22319/rmcp.v16s4.6699

Technical note

Report on the presence of *Amblyomma inornatum* in Michoacán, Mexico

Carolina Cárdenas-Amaya [a]

Dora Romero-Salas [a]*

Mariel Aguilar-Domínguez [a]

Miguel Ángel Alonso-Díaz [b]

Greta Rosas-Saito [c]

Adalberto Ángel Pérez de León [d]

[a] Universidad Veracruzana. Facultad de Medicina Veterinaria y Zootecnia. Laboratorio de Parasitología, rancho "Torreón del Molino". Cuerpo Académico UV-CA-430 Zoonosis y Vigilancia Epidemiológica. 91710 Veracruz, Ver. México.

[b] Universidad Nacional Autónoma de México. CEIEGT. Facultad de Medicina Veterinaria y Zootecnia. Martínez de la Torre-Tlapacoyan, Veracruz. México.

[c] Instituto de Ecología. Red de Estudios Moleculares Avanzados. Xalapa, Veracruz. México.

[d] United States Department of Agriculture-Agricultural Research Service, San Joaquin Valley Agricultural Sciences Center. California, E.E.U.U.

* Corresponding author: dromero@uv.mx

Abstract:

The genus *Amblyomma* includes ticks that parasitize a wide variety of terrestrial vertebrates in humid tropical and subtropical regions. Globally, 136 species have been identified, some of which are important in public and veterinary health as they act as vectors of zoonotic diseases. Currently, there are records of 25 species that parasitize a diversity of hosts, including amphibians, reptiles, birds, and mammals. In Mexico, 17 species of ticks of the

genus *Amblyomma* were initially identified, but this number has increased significantly over time. The presence of *Amblyomma inornatum*, a neotropical species that shows a preference for infesting ruminants, has been documented in the state of Michoacán. Despite its presence in the region, its status remains not determined (ND) due to a lack of information on its distribution and hosts. This species is relevant in the vector field since it can transmit pathogens such as *Ehrlichia*, *Rickettsia*, and *Borrelia*, which can affect humans. The results of a sampling carried out in a bovine production unit (BPU) in Michoacán during November 2022 are reported here. The presence of *A. inornatum* was verified by scanning electron morphology. This finding establishes the presence of *A. inornatum* in the region and forms the basis for future research on host preferences, including cattle, and the role of this tick as a vector of important diseases in One Health.

Keywords: Ectoparasite, Livestock farming, Taxonomy, One Health.

Received: 30/05/2024

Accepted: 01/01/2025

The genus *Amblyomma*[1] includes ticks that parasitize a wide variety of terrestrial vertebrates, such as amphibians, reptiles, birds, and mammals[2]. These ticks have a cosmopolitan distribution[3], mainly in humid tropical and subtropical regions[4]. Globally, 136 species have been identified within this genus[2], many of which are of importance in both public and veterinary health. These ticks can act as vectors for disease-causing microorganisms, some of which can be transmitted to humans (zoonoses)[5]. Initially, in Mexico, 17 species of ticks belonging to the genus *Amblyomma* were identified (*A. americanum, A. auricularium, A. cajennense, A. castanedai, A. coelebs, A. dissimile, A. imitator, A. inornatum, A. longirostre, A. maculatum, A. oblongoguttatum, A. ovale, A. parvum, A. pecarium, A. rotundatum, A. sabanerae,* and *A. scutatum*)[6]. Nonetheless, since then, the number of species described within this genus has increased considerably.

Currently, a total of 25 species of ticks of the genus *Amblyomma* have been identified, which parasitize a diversity of hosts, including 13 species of amphibians and reptiles, 7 families of birds, and 21 of mammals[7]. These species include *A. americanum, A. auricularium, A. cajennense, A. calcaratum, A. coelebs, A. dissimile, A. humerale, A. imitator, A. inornatum, A. longirostre, A. maculatum, A. multipunctum, A. nodosum, A. oblongoguttatum, A. ovale, A. pacae, A. parvum, A. pecarium, A. rotundatum, A. sabanerae, A. scutatum, A. tigrinum, A. triste, A. tuberculatum,* and *A. varium*.

In the context of the first description of the number of *Amblyomma* species made in 1962[6], in 2011, the presence of *A. inornatum* was described as one of the 25 *Amblyomma* species that are currently recognized in Mexico[7]. This tick has a three-host life cycle and its distribution area extends from southern Texas[8,9] to southern Costa Rica[10], also covering Mexico[11]. It has been observed in a wide variety of hosts, both land and migratory birds, as well as mammals, including humans. Despite its presence in several states of Mexico, such as Michoacán, the status of *A. inornatum* is recorded as "ND" (not determined)[11], which indicates a lack of information to establish its complete situation in the state as well as the description of the infested hosts. This generates a misinformation gap about the presence of this tick species in the region.

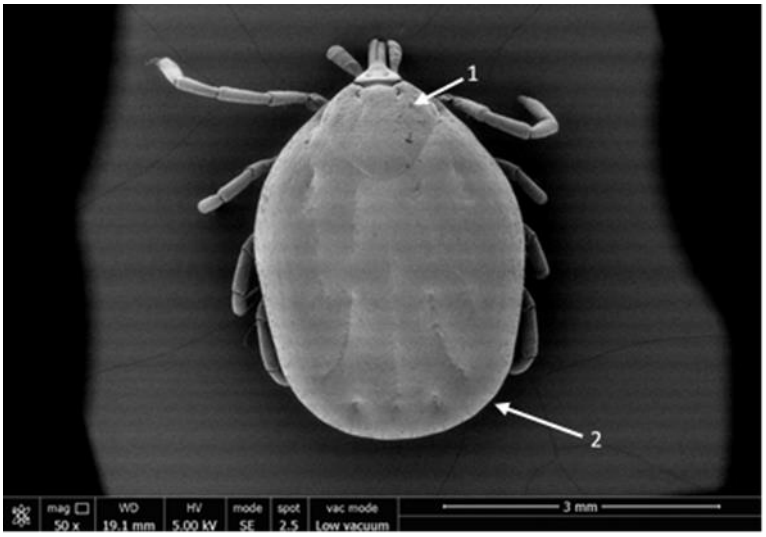
Based on the above, a simple convenience sampling was carried out in a bovine production unit (BPU) located in the state of Michoacán during November 2022. The BPU was selected based on the distribution of the genus *Amblyomma* in the state, as reported in the literature[11]. To collect the specimens, the cattle were thoroughly inspected from head to tail in order to find ticks. Entomological forceps were used for careful removal, following the indications of the Center for Disease Control and Prevention[12,13]. Each tick was individually preserved in 70 % v/v ethanol. The coordinates of the sample points were recorded using a GARMIN® GPSmap device. The collected ticks were transferred to the Parasitology Laboratory, located in the Diagnostic Unit of the Torreón del Molino Ranch of the Faculty of Veterinary Medicine and Zootechnics of the Universidad Veracruzana. In the laboratory, ticks were processed for cleaning following the protocol described[14].

The identification of the specimens was carried out using the morphological taxonomic keys established in 2011[11], where the species belonging to the genus *Amblyomma* in Mexico are described. For a detailed description of the morphological structures, scanning electron microscopy was used following a modified procedure[15,16]. This included a series of steps such as cleaning with forceps and brushes, dehydration with ethanol, and drying with a critical point dryer. Once prepared, the ticks were coated with gold and then analyzed using a FEI Quanta 250 FEG field emission scanning electron microscope.

As part of the results obtained, a total of 20 cattle were analyzed, which belonged to the BPU located at the geographical coordinates 18°02'12.9" N 102°16'46.2"W, in the locality of Buenos Aires, in the municipality of Lázaro Cárdenas, Michoacán. The presence of feral fauna and prominent vegetation at the sampling site is reported. Based on the aforementioned taxonomic keys, two female specimens of *A. inornatum* obtained from a single bovine were identified in this study. No males of *A. inornatum* were collected in this research. The rest of the specimens collected from cattle were identified through the taxonomic keys for the species *A. mixtum*[17] and *Rhipicephalus microplus*[18]. This confirmed the presence of these species, which are of great economic importance in Mexican livestock farming and have been recently reported in the sampled area[19].

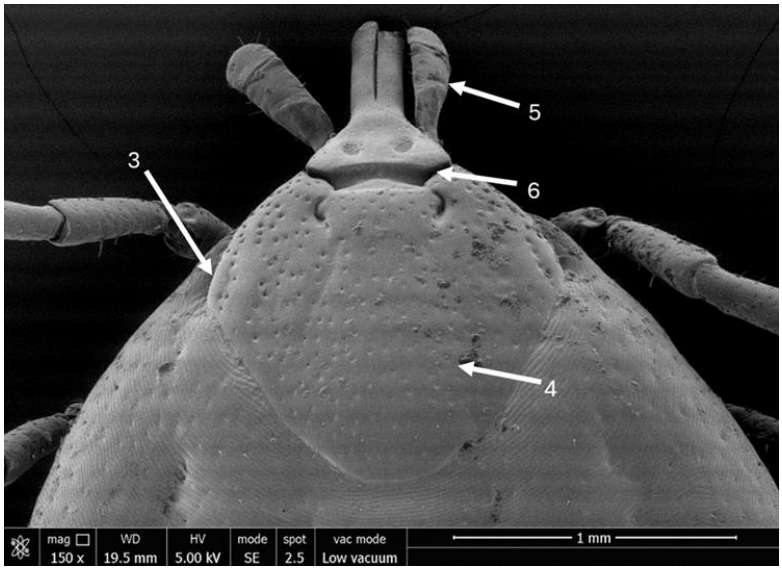
A. inornatum was described in the state of Michoacán; however, its taxonomic status was not fully defined at the time[11]. Morphological structures characteristic of this species in the adult stage are described here, including an inornate scutum and the absence of festoons (Figure 1), the presence of eyes, a scutum with numerous punctuations, robust and slightly shorter palps compared to other species of the genus, and a broad, laterally extended gnathosoma base (Figure 2), and an incomplete or absent marginal groove (Figure 3). The adults of *A. Inornatum* are medium-sized with a 3/3 hypostome dental formula. As for other characteristics, it is mentioned that, ventrally, coxae II and III have a spur and an indication of a second spur. Trochanters do not have spurs. The tibiae of legs II to IV do not have spurs; an observation made at the time of identification but not mentioned in the images due to the limited number of specimens collected.

Figure 1: Dorsal view of a female of *A. inornatum**



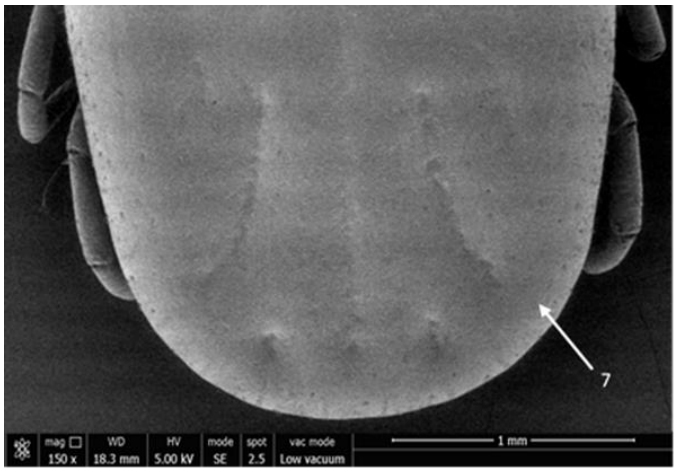
*1) Inornate scutum, 2) Absence of festoons.

Figure 2: View of the scutum and face of a female of *A. inornatum**



*3) Presence of eyes, 4) Scutum with numerous punctuations, 5) Robust and short palps, 6) Wide and extended laterally gnathosoma base.

Figure 3: Dorsal view of the hind body of a female of *A. inornatum**



*7) Incomplete or absent marginal groove.

Previous studies documented the presence of *A. inornatum* in several states of the Mexican Republic[11]. These studies included information on the distribution, location, and infestation of hosts of this genus of ticks and their diversity. Nevertheless, the status of *A. inornatum* in those works was reported as "ND" (not determined). The presence of other species of the genus that share similarities in ecological niches[19,20,21] has been mentioned, which are reported within the state of Michoacán. *A. inornatum* is described as a neotropical tick[21], which is located within the state in the coastal/hot land region, which has a great variability of hosts, which is ideal for the development of its cycle.

It has been observed that this species prefers infesting ruminants, with its presence having being described in cattle[7,11,21]. Although there is agreement with the host inspected, an exhaustive search is required to increase the number of specimens of this species. This is due to its importance in the vector field, or its possible activity as a vector, as indicated by reports that detect the presence of species of the genera *Ehrlichia*, *Rickettsia*, and *Borrelia*[22]. It is important to note that all three genera include species that affect humans.

In conclusion, the presence of the species *A. inornatum* in the state of Michoacán, Mexico, has been confirmed through the use of scanning electron morphology. This finding establishes its current status in the region and underpins future research, especially with regard to the detection of important pathogens in One Health, and the identification of host preferences.

In the conduct of this study, no conflict of interest was generated by the authors. It is also worth mentioning that Carolina Cárdenas Amaya is the beneficiary of a doctoral scholarship granted by the National Council of Humanities, Sciences, and Technologies (CONAHCYT, for its acronym in Spanish), under the number of scholarship holder 999006. Currently, she is a student of the Doctoral Program in Agricultural Sciences at the Universidad Veracruzana, located in Veracruz.

We are thankful to the cattle producers and the Veterinary Zootechnicians (MVZ, for its initialism in Spanish), who facilitated the collection of tick samples in their cattle. We are also grateful to the staff of the Parasitology Laboratory located at the Torreón del Molino Ranch of the Faculty of Veterinary Medicine and Zootechnics of the Universidad Veracruzana for their invaluable support in carrying out this research. Likewise, we thank the Veterinarians who contributed to the logistics of the sampling in the state.

Literature cited:

1. Koch CL. Systematische Übersicht über die Ordnung der Zecken. Archiv für Nat 1844;10:217–239.

2. Guglielmone AA, Nava S, Robbins RG. Geographic distribution of the hard ticks (Acari: Ixodida: Ixodidae) of the world by countries and territories. Zootaxa 2023;5251(1):1–274.

3. Dantas-Torres F, Fernandes MT, Muñoz-Leal S, Onofrio VC, Barros-Battesti DM. Ticks (Ixodida: Argasidae, Ixodidae) of Brazil: Updated species checklist and taxonomic keys. Ticks Tick Borne Dis 2019;10(6):101-252.

4. Sonenshine DE. Biology of ticks. Volume I. New York, USA: Oxford University Press; 1991.

5. Pérez de León AA, Teel PD, Auclair AN, Messenger MT, Guerrero FD, Schuster G, Miller RJ. Integrated strategy for sustainable cattle fever tick eradication in USA is required to mitigate the impact of global change. Front Physiol 2012;3:195.

6. Hoffmann A. Monografía de los Ixodoidea de México, I Parte. Rev Soc Mex Hist Nat 1962;23:191–307.

7. Guzmán-Cornejo C, Herrera-Mares A, Paredes-León R, García-Prieto L. Actualización de la riqueza de garrapatas de los géneros *Ixodes* y *Amblyomma* (Ixodida: Ixodidae) en México. Dugesiana 2023;30(2):163-176.

8. Banks N. Three new ticks from the United States. Proc Entomol Soc Wash 1909;10:170 - 173.

9. Gladney WJ, Dawkins CC, Price MA. *Amblyomma inornatum* (Acarina: Ixodidae): natural hosts and laboratory biology. J Med Entomol 1977;14:85-88.

10. Álvarez V, Bonilla R, Chacón I. Distribución de la garrapata *Amblyomma cajennense* (Acari: Ixodidae) sobre *Bos taurus* y *Bos indicus* en Costa Rica. Rev Biol Trop 2000;48:129–135.

11. Guzmán-Cornejo C, Robbins RG, Guglielmone AA, Montiel-Parra G, Pérez TE. The *Amblyomma* (Acari: Ixodida: Ixodidae) of Mexico: Identification keys, distribution and hosts. Zootaxa 2011;2998(1):16.

12. CDC. Centers for Disease Control and Prevention. What to do after a tick bite. USA: U.S. Department of Health and Human Services. 2021.

13. Gammons M, Salam G. Tick removal. Am Fam Physician 2002;66(4):643–645.

14. Aguilar-Domínguez M, Sánchez-Montes S, Esteve-Gassent MD, Barrientos-Salcedo C, Pérez de León A, Romero-Salas D. Genetic structure analysis of *Amblyomma mixtum* populations in Veracruz State, Mexico. Ticks Tick Borne Dis 2019;10(1):86–92.

15. Corwin D, Clifford CM, Keirans JE. An improved method for cleaning and preparing ticks for examination with the scanning electron microscope. J Med Entomol 1979;16(4):352–353.

16. Dixon BR, Petney TN, Andrews RH. A simplified method of cleaning ixodid ticks for microscopy. J Microsc 2000;197(3):317–319.

17. Nava S, Beati L, Labruna MB, Cáceres AG, Mangold AJ, Guglielmone AA. Reassesssment of the taxonomic status of *Amblyomma cajennense* (Fabricius, 1787) with the description of three new species, *Amblyomma tonelliae* n. sp., *Amblyomma interandinum* n. sp. and *Amblyomma patinoi* n. sp., and reinstatement of *Amblyomma mixtum* Koch, 1844, and *Amblyomma sculptum* Berlese, 1888(Ixodida: Ixodidae). Ticks Tick Borne Dis 2014;5(3):252–276.

18. Nava S, Venzal JM, Acuña DG, Martins TF, Guglielmone AA. Ticks of the Southern Cone of America: Diagnosis, distribution, and hosts with taxonomy ecology and sanitary importance. Argentina: Academic Press; 2017.

19. Cárdenas-Amaya C, Romero-Salas D, Aguilar-Domínguez M, Cruz-Romero A, Alonso-Díaz MA, Sánchez-Montes S, *et al*. Infestation of cattle with the tick *Amblyomma mixtum* in the States with the highest cattle inventory in Mexico. Agro Prod 2024;17(6):47-57.

20. Samuel WM, Trainer DO. *Amblyomma* (Acarina: Ixodidae) on white-tailed deer, *Odocoileus virginianus* (Zimmerman), from South Texas with implications for theileriasis. J Med Entomol 1970;7:567–574.

21. Medlin JS, Cohen JI, Beck DL. Vector potential and population dynamics for *Amblyomma inornatum.* Ticks Tick Borne Dis 2015;6(4):463–472.

22. Ojeda-Chi MM, Rodriguez-Vivas RI, Esteve-Gasent MD, Pérez de León A, Modarelli JJ, Villegas-Perez S. Molecular detection of rickettsial tick-borne agents in white-tailed deer (*Odocoileus virginianus yucatanensis*), mazama deer (*Mazama temama*), and the ticks they host in Yucatan, Mexico. Ticks Tick Borne Dis 2019;10(2):365-370.