

## Pet transportation or tourism: risk for moving zoonotic pathogens

Dear Editor:

Pet transportation has become relevant. However, since adequate sanitary measures are not taken, pets can be carriers of pathogens, such as ticks which at the same time may turn into zoonotic agent vectors. Ticks are frequent ectoparasites in warm areas. However, they may be dispersed in temperate regions such as Mexico City (CDMX) and become responsible for other vector-borne diseases relevant to Veterinary Medicine and/or public health. It shows that moving animals from one place to another, including tourism with pets, can cause dispersion and proliferation of pathogens if the adequate sanitary measures are not taken. Therefore, this article is of great importance from a biological, ecological, public and veterinary health, since it shows the role of humans in the spread of pathogens particularly of *Rhipicephalus sanguineus*, its introduction to a site otherwise naturally free of them, and the adaptation mechanisms they may display to infect other hosts with the potential to transmit other emerging pathogens.

*R. sanguineus* is an ixodid, ectoparasite found in dogs and an important pathogen vector of certain medical and veterinary importance. It is the main vector of the rocky mountain fever,<sup>(1)</sup> an emerging disease mainly in Baja California, Mexico and the United States, caused by *Rickettsia rickettsia*, and transmitted to humans through the bite of the tick *R. sanguineus*.<sup>(2, 3)</sup> Likewise, it has been determined that *R. sanguineus* is a vector of *Ehrlichia canis*, the etiological agent of canine ehrlichiosis, so there is a risk of transmission between companion animals, and of *Borrelia burgdorferi* that causes borreliosis or Lyme disease.<sup>(4, 5, 6, 7)</sup>

*R. sanguineus* is probably the most widely distributed ixodid;<sup>(8)</sup> it is located in tropical and subtropical regions throughout the year, for example, in Mexico, where it has been identified in warm areas such as Coahuila, Cuernavaca and Yucatan.<sup>(6, 9)</sup>

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Additional information and declarations  
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However, although less frequently, its presence has also been recorded in temperate regions,<sup>(10)</sup> showing its highest activity after spring and until the beginning of autumn when prevalent environmental conditions (temperature and humidity) prevent its survival.

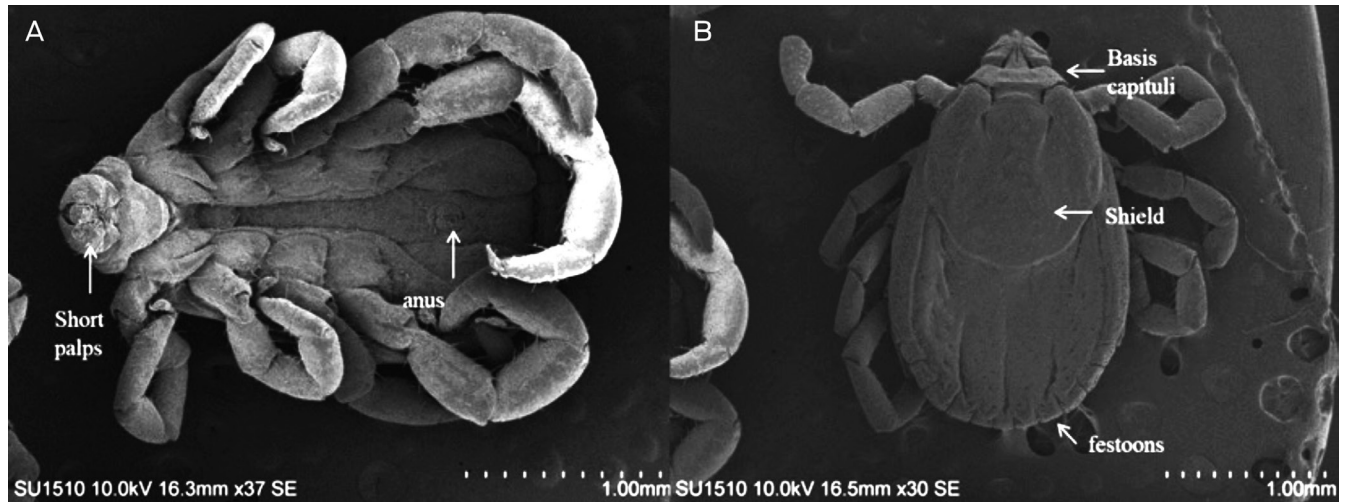
Animal species have a specific area of distribution; mountain systems and altitude are natural barriers that prevent the spread of some animals. Nevertheless, human activities related to transport or tourism can promote dispersal of certain species. Mexico City is a basin surrounded by mountainous systems, it has a temperate climate and so far, the presence of *R. sanguineus* has not been recorded; hence, there is a potential zoonotic risk.<sup>(9)</sup> For this reason, the objective of this study was to notify the presence of *R. sanguineus* as a possible zoonotic agent in Mexico City, as a consequence of the pet tourism that has increased in recent years.

The research was carried out in Mexico City. Mexico City is at an altitude of 2 240 meters above sea level. It is located in the Basin of Mexico, a closed hydrological unit located on a lake plain, it is a closed basin surrounded by a mountainous area where a system of lakes existed. It has characteristics, such as the climate, which is predominantly temperate with an average annual temperature of 15 °C and a heavy rainfall season from May to October. In addition, it is located on the Transversal Neovolcanic Axis. To the south are the mountains of the Ajusco-Chichinautzin corridor with an altitude of 3 900 meters; to the east it borders the Sierra Nevada where the Popocatepetl and Iztaccíhuatl volcanoes are located, and to the west with the mountains of Las Cruces, Monte Alto and Monte Bajo, which continue north to the mountains of Sierra de Guadalupe, Tepotzotlán, Tezontlalpan and Pachuca.<sup>(11)</sup>

Animals: At the Clínica Integral de Cuidado Animal (CICA, for its acronym in Spanish: Comprehensive Animal Care Clinic), 7 dogs from different owners were inspected. The presence of ticks was identified even after treating them. One of the patients presented a medical history of being transferred to Guerrero State (tropical climate) and later, returned to CDMX. Two dogs with a record of being transported to the state of Morelos (tropical climate) infected three other dogs that cohabit in the same dwelling and without a history of traveling. Afterwards, another dog with history of transportation to another region with a tropical climate Malinalco in the State of México, subsequently infected two other dogs which had no history of ever leaving home. After inspection, the ticks were carefully extracted, with the intention of complete removal and placed in 70 % alcohol.

Ticks were observed under a stereoscopic microscope and taxonomically identified.<sup>(12)</sup> The specimens were prepared for electron microscopy; they were preserved in 70 % ethyl alcohol subsequently, dehydrated with a series of ethyl alcohol solutions and then dried at a critical point with carbon dioxide. Samples were mounted on metal stumps with silver paste, coated with gold and examined in a Hitachi Stereoscan model SU1510 (Hitachi High-Technologies México SA de CV, México) at 10 kV.<sup>(13)</sup>

At least four dogs were in tropical states and were transferred to CDMX which has a temperate climate, and infected after arrival. After the inspection of 7 dogs, ticks that were removed, were identified as *Rhipicephalus sanguineus* (Figure 1). Between 5 and 10 ticks were extracted from each dog. Fluralaner was administered (Bravecto 250 mg/4.5-10 kg). The dog owners did not return for a second review. However, data may be underestimated, as only dogs that received veterinary care at CICA were considered.



**Figure 1.** *Rhipicephalus sanguineus* female. A. Ventral region. B. Dorsal region: hexagonal basis capituli, partial shield, inornate, presence of festoons.

*Rhipicephalus sanguineus* ticks are common ectoparasites in dogs from warm or tropical areas.<sup>(14, 15)</sup> Mexico City could be considered a geographically isolated site where ticks are not commonly distributed due to its altitude, temperate climate, and the Transversal Neovolcanic Belt that acts as a barrier. Nonetheless, this barrier could be disrupted by human activities such as animal transportation. The trend of taking dogs on tourism activities, mainly to tropical areas, is promoting pathogens displacement, thus allowing the rapid adaptation of ticks to new locations. This fact is relevant since these ectoparasites can be vectors of other important diseases in veterinary and human medicine.

This record is the first notification of the presence of *R. sanguineus* in Mexico City; it is an example of how pet transportation without adequate surveillance may introduce zoonotic pathogenic species to a new environment and their ability to reproduce and infect new hosts. Even when the present report only considered dogs that have been received at veterinary care at CICA, it points out that ticks could have been introduced to Mexico City. It highlights the necessity to inform pet owners to avoid transportation/ tourism of pets without adequate sanitary measures. According with Gray et al. (2013), this information provides data required for development of predictive models of future tick distribution in a climate change scenario.

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## Conflicts of interest

The authors have no conflict of interest to declare in regard to this publication.

## Author contributions

Acevedo-Ramírez: study proposal, laboratory work and writing of the manuscript.  
Campos-Juárez, Elizalde-Monroy: field support and writing of the manuscript.  
Torres-Gutiérrez: support in laboratory techniques, writing the manuscript  
Mendoza-Garfias: support in laboratory techniques, writing the manuscript  
All authors read and approved the manuscript.

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