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SHORT COMMUNICATION

First finding of the tick *Amblyomma tigrinum* parasitizing a Molina's hog-nosed skunk, *Conepatus chinga* (Molina 1782), in South America

Primer hallazgo de la garrapata *Amblyomma tigrinum* parasitando un chingue, *Conepatus chinga* en la zona norte-centro de Chile

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RESUMEN

Se colectan por primera vez individuos adultos de *Amblyomma tigrinum* en un chingue (*Conepatus chinga*), capturado en área rural del norte-centro de Chile, los cuales fueron descritos e identificados morfológicamente. Existen escasos estudios que aborden el rol del chingue como hospedador de ectoparásitos; sin embargo, la gran plasticidad de *A. tigrinum* para habitar diferentes ambientes y su especificidad estricta a moderada por el orden Carnivora sugieren a este mefítido como un hospedador potencialmente adecuado para esta especie de garrapata.

Palabras clave: *Amblyomma tigrinum*, área rural, *Conepatus chinga*.

ABSTRACT

Adult individuals of *Amblyomma tigrinum* were collected for the first time from a Molina's hog-nosed skunk (*Conepatus chinga*), captured in a rural area of north-central Chile, which were described and identified morphologically. There are scarce studies that address the role of the skunk as ectoparasite host; however, the great plasticity of *A. tigrinum* to inhabit different environments and its strict to moderate specificity for Carnivora order suggest this mephitid as a potentially suitable host for this tick species.

Keywords: *Amblyomma tigrinum*, *Conepatus chinga*, rural area.

The family Ixodidae, whose members are commonly known as hard ticks, is composed of 758 species distributed around the world, of which 137 are present in the Neotropics, and are represented by the genera *Ixodes*, *Dermacentor*, *Haemaphysalis*, *Rhipicephalus* and *Amblyomma* (Guglielmone *et al*. 2021). *Amblyomma* spp. inhabit diverse habitat types throughout their geographic distribution (Nava *et al*. 2017). Three species have been described in Chile: adult individuals of *A. triste* Koch, 1844, recorded in the extreme north of the country, near the border with Perú (Abarca *et al*. 2012), *A. parvitarsum* Neumann, 1901, present in the altiplano in Chile (González-Acuña *et al*. 2004a) and immature individuals of this species were collected in the periarid mediterranean zone bordering the Chilean altiplano (Muñoz-Leal *et al*.

2014), and *A. tigrinum* Koch, 1844, which is present from the Coquimbo to Aysén regions (Guglielmone *et al*. 2021; Abarca *et al*. 2016). The first record of *A. tigrinum* in Chile was located in the central-southern zone, with findings of ticks parasitizing wild canids, which was mistakenly identified as *A. maculatum* by Tagle & Álvarez (1957), and then, corrected by the same authors (Tagle & Álvarez 1959). Adult stages of *A. tigrinum* are classified as strictly or moderately specific for the order Carnivora (Hoogstraal & Aeschlimann 1982), usually parasitising wild canids and dogs mainly in rural areas (Abarca *et al*. 2016) and occasionally humans and other hosts (Eberhardt *et al*. 2020; Nava *et al*. 2017; Abarca *et al*. 2016; Abarca *et al*. 2013; González-Acuña *et al*. 2003; Muñoz & Casanueva 2002; Guglielmone *et al*. 2000). While immature stages can be found parasitizing small rodents (Cricetidae and Caviidae) and ground forest feeding birds, constituting crucial hosts for the maintenance of the life cycle of *A. tigrinum* in natural environments (Nava *et al*. 2017; Guglielmone & Nava 2010; Nava *et al*. 2006; González-Acuña *et al*. 2004b; Guglielmone *et al*. 2000).

The Molina's hog-nosed skunk (*Conepatus chinga* Molina, 1782) is a South American medium-sized mammal belonging to the Mephitidae family, which is distributed across the southern limit of Brazil, northern Argentina, Uruguay, Bolivia and central Chile (Kasper *et al*. 2009), inhabiting shrubby open and rocky hillside habitats (Donadio *et al*. 2001). In Chile, the species is distributed from Coquimbo to Los Lagos regions (Muñoz-Pedreros & Yáñez 2009). Currently, the scientific literature has been mostly focused in ecological (Kasper *et al*. 2012; Castillo *et al*. 2011; Reppucci *et al*. 2009), dietary (Montalvo *et al*. 2008; Donadio *et al*. 2004) and taxonomic (Schiaffini *et al*. 2013) aspects of Molina's hog-nosed skunk. While the role of this mammal as endoparasite host has been previously reported (Gómez-Puerta *et al*. 2012; Gómez-Puerta *et al*. 2009; Pietrokovsky *et al*. 1991), there is still scarce evidence on ectoparasite species parasitizing skunks along its native range (Labruna *et al*. 2005; Almeida *et al*. 2003).

Here, we documented the first finding of *A. tigrinum* parasitizing a Molina's hog-nosed skunk captured at a rural area in north-central Chile. We performed morphological identification and description of collected tick individuals.

The study was conducted in the coastal zone of the Coquimbo region in north-central Chile (71°12' to 71°40'W, 29°58' to 30°39'S). The study area poses a semiarid weather with a mean annual rainfall of 126.8 mm, with 90% of rainfall concentrated during winter months (May-September), and warm, dry summers (December-March) (Montecinos *et al*. 2016). Mean temperature ranges from 12°C to 18°C (measured at 2 m above ground nearby the coast), and relative air humidity can reach 90 to 100% at higher altitudes. Field site was a private 31 km^2-site inserted into the "El Tangue" ranch, a farm of nearly 45,000 ha situated 10 km south of Tongoy town. The property is characterized by a mosaic of agricultural fields, grasslands, and a mixture of exotic shrub plantations (i.e., *Atriplex nummularia* Lindl.) and pioneer native vegetation, with small properties scattered along the westward border distance up to 3 km of the field site.

In April 2020, we sampled a male Molina's hog-nosed skunk to assess their tick loads at the sampling location. Within capture efforts targeting wild foxes, the skunk was captured with a soft leg-hold trap, which was kept active for a minimum of seven consecutive days, baited with tuna and a commercial lure (Murray's Wolf Urine, West Virginia, USA), and checked at least every six hours to reduce animal stress. After physical immobilization, we anesthetized the skunk with a mixture of ketamine (2.5mg/kg) and dexmedetomidine (70µg/kg), and reverted with atipamezole (350µg/kg), modified from wild carnivore protocols reported by Acosta-Jamett *et al*. (2010). The skunk was aged as adult based on incisor wear and eruption (Olifiers *et al*. 2010), while its weight was estimated to be ~3 kg for the calculation of anesthetic doses. While anesthetized, we inspected the animal body coat and collected ticks during 10 minutes. The skunk was released at the site of capture. Ticks were stored into a 2 ml Corning® cryovial (Corning Incorporated, Lowell, Massachusetts, USA), labeled with a unique code and kept with ice packs. After ticks were preliminary identified, sexed and counted, they were placed in liquid nitrogen, transported to the Universidad Austral de Chile in Valdivia, and stored at -80 °C (for other research purposes). Two ticks were placed into 70% ethanol before definitive morphological characterization. All procedures for animal trapping and handling were approved by Universidad Austral's Bioethics Committee for Research Animal Use (314/2018 – 315/2018) and Chilean Livestock and Agricultural Service (Resolución Exenta N° 6184/2019 – 2128/2020).

Two ticks were analyzed morphologically following the key of Estrada-Peña *et al*. (2005). Ticks were photographed in a scanning electron microscope (SEM) (Hitachi SU3500) utilized Ultra Variable-pressure Detector (UVD), backscattered electrons y cool stage system, and an Euromex (NexiusZoom) stereo microscopic.

We collected a total of nine ticks (eight males and one female), which corresponded to *A. tigrinum*. The two morphologically analyzed ticks corresponded to males of this species, which have a long and strong spine on coxa I and IV, spur on coxa IV not reaching anus, coxa II and III with a short and obtuse spine (Fig. 1A), one spine on tibiae II to IV (Fig. 1B), spiracular plate comma-shaped (Fig. 1C), ornate scutum

(Fig. 2A), absent of tubercles on ventral side of festoons, marginal groove complete (Fig. 2B), mouthparts longer than the base of the capituli (Fig. 2C). (Santa Cruz *et al*. 2011; Estrada-Peña *et al*. 2005).

The literature referred to ectoparasites hosted by Molina's hog-nosed skunk is mostly restricted to records of *Ornithodoros brasiliensis* Aragao, 1923 (Labruna *et al*. 2005) and *Neotrichodectes* spp. (Tricodectidae) (Almeida *et al*. 2003), being our study the first record of the occurrence of *A. tigrinum* in this mephitid in Chile and South America. Although adult stages of *A. tigrinum* typically parasite wild and domestic canids (Guglielmone *et al*. 2021), other carnivores belonging to the families Felidae (i.e., *Leopardus colocolo* Molina, 1782 (Martins *et al*. 2011), *Puma concolor* Linnaeus, 1771 and *Pathera onca* Linnaeus, 1758 (Durden *et al*. 2006)) and Procyonidae (i.e., *Nasua nasua* Linnaeus, 1766 (Magalhães-Matos *et al*. 2017)) can also harbor this tick species; including domestic dogs (Tomassone *et al*. 2010; Guglielmone *et al*. 2000) and cats (Guglielmone *et al*. 2000), and other non-carnivore species as suids, cervids and bovines (Nava *et al*. 2017; González-Acuña *et al*. 2006).

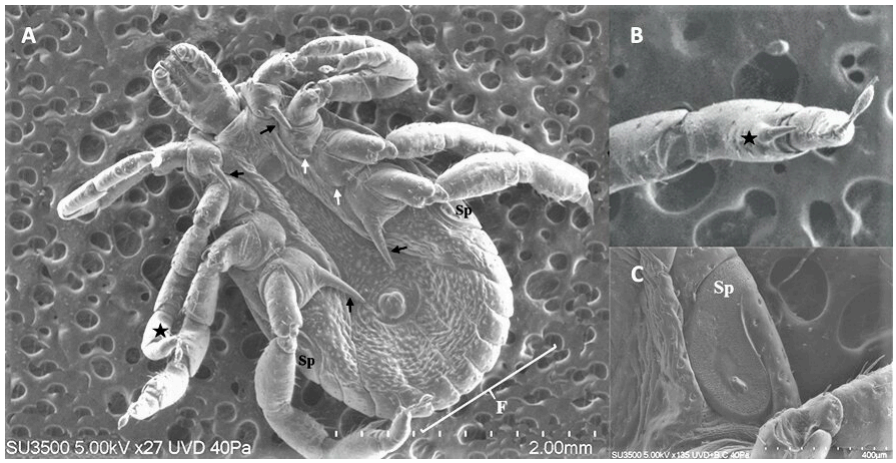

Figure 1. *Amblyomma tigrinum* male ventral view in SEM. A. Black arrow: Long and strong spine on coxa I and IV. White arrow: coxa II and III with a short and obtuse spine. Sp: Spiracle. B. Star: one spine on tibiae II. C. Spiracular plate comma-shaped. / Vista ventral del macho de *Amblyomma tigrinum* en SEM. A. Flecha negra: Espina larga y pronunciada en las coxas I y IV. Flecha blanca: coxa II y III con una espina corta y obtusa. Sp: Espiráculo. B. Estrella: una espina en las tibias II. C. Placa espiracular en forma de coma.

Figure 2. *Amblyomma tigrinum* male. A. Dorsal view in stereo microscopic, s: ornate scutum. B. Dorsal view in SEM, Black arrow: Marginal groove complete, f: Festoons. C. Ventral view in SEM, p: Palps, h: Hypostome. / Macho de *Amblyomma tigrinum*. A. Vista dorsal en microscopio estereoscópico, s: escutum ornamentado. B. Vista dorsal en SEM, Flecha negra: Surco marginal completo, f: Festones. C. Vista ventral en SEM, p: Palpos, h: Hipostoma.

Given the plasticity of *A. tigrinum* to thrive across areas with contrasting climatic conditions across its geographic distribution (Mendoza-Uribe & Chávez-Chorocco 2004; Guglielmone *et al*. 2000), and tick moderate specificity for canid hosts (Hoogstraal & Aeschlimann 1982), may support Molina's hog-nosed skunk as a potentially suitable *A. tigrinum* host. Indeed, previous studies have characterized the wild carnivore community inhabiting the study area, which is compounded mostly by canids as culpeo (*Lycalopex culpaeus* Molina, 1782) and chilla (*Lycalopex griseus* Gray, 1837) foxes that inhabit the study area (Hernández *et al*. 2021); both fox species have been reported to harbor *A. tigrinum* and they co-occur with Molina's hog-nosed skunk across this zone (data not published); perhaps suggesting potential cross-species tick infestation from environments they share. Our finding contributes to expand the records about other carnivore species acting as *A. tigrinum* hosts, which may have certain epidemiological interest considering this tick species may act as vector of zoonotic infectious agents (Romer *et al*. 2014; Abarca *et al*. 2013; Pacheco *et al*. 2013).

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Author contributions

JM and FAH conceived the ideas of the study, and carried out the field work and sampling. JM and MCS analyzed the collected ticks. JM and FAH led the writing of the manuscript. GAJ obtained the funding for this study. All authors revised the manuscript, contributed critically to the drafts and approved the final version for publication.

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