

## Successful Feeding of *Amblyomma coelebs* (Acari: Ixodidae) Nymphs on Humans in Brazil: Skin Reactions to Parasitism

MARCOS V. GARCIA,<sup>1</sup> JAQUELINE MATIAS,<sup>2</sup> ANDRÉ DE A. R. AGUIRRE,<sup>2</sup> BARBARA G. CSORDAS,<sup>2</sup> MATIAS P. J. SZABÓ,<sup>3</sup> AND RENATO ANDREOTTI<sup>1,4</sup>

J. Med. Entomol. 1–3 (2015); DOI: 10.1093/jme/tju060

**ABSTRACT** Identifying the tick species that successfully feed on humans would increase knowledge of the epidemiology of several tick-borne diseases. These species salivate into the host, increasing the risk of pathogen transmission. However, there is a lack of data in the literature regarding the ticks that prefer to feed on humans. Herein, we describe the successful feeding of *Amblyomma coelebs* Neumann nymphs on two of the authors after accidental tick bites occurred during field surveys in two preserved areas of Mato Grosso do Sul, Brazil. One of the host–parasite interactions was closely monitored, and the tick development, gross host skin alterations, and related sensations are presented.

**KEY WORDS** human parasitism, *Amblyomma coelebs*, tapir, nymph, Brazil

### Introduction

Ticks are the primary vectors of a diverse set of pathogens to animals and human beings (Jongejan and Uilenberg 2004). Many of these pathogens are associated with one or a few tick species. Therefore, the geographical distribution of the vector determines where a disease occurs. Because disease onset after a human tick-bite may take several days, the tick vector is often lost, and the origin of the pathogen remains unknown or uncertain. Furthermore, within a given area, one might have various levels of contact with multiple tick species, which may be a determinant for pathogen vectoring. It is, therefore, important to distinguish among ticks that are found crawling on a human host, those that bite but are unable to feed, and those that actually feed, enhancing the likelihood of disease transmission. Unfortunately, information on the tick species that feed on humans is lacking in the literature, and increasing knowledge in this area would certainly improve our understanding of the epidemiology of several tick-borne diseases.

Brazil has 66 ticks species (Martins et al. 2014, Nava et al. 2014), with >50% in the genus *Amblyomma*. A key for identifying *Amblyomma* nymphs has only recently become available (Martins et al. 2010). Therefore, although there is a comprehensive list of tick species in South America that bite humans (Guglielmone et al.

2006), the list does not identify ticks that successfully feed on humans and primarily describes only the adult stage. To our knowledge, only one study has described successful feeding with engorgement and molting of *Amblyomma* ticks on humans (Szabó et al. 2006). We herein describe the successful feeding of *Amblyomma coelebs* nymphs on two of the authors after they received accidental tick bites during field surveys.

### Material and Methods

During a survey for tick fauna within two preserved areas of Mato Grosso do Sul, Brazil, several ticks bit the researchers, and in two cases, the tick nymphs remained unnoticed for several hours. These ticks were firmly attached to the skin of the hosts and were able to feed until engorgement. After detachment, the ticks were taken to the laboratory and kept at 28°C with 80% humidity and a photoperiod of 12:12 (L:D) h to encourage molting. The ticks emerged as adults and were identified using standard dichotomous keys (Barros-Battesti et al. 2006).

The first parasitism occurred on the 5th April 2013, on animal trails within a patch of forest in the Aquidauana municipality (20°44'52" S; 55°64'91" W, 220 m above sea level). A tick was found on the right side of the back of one of the authors (A.A.R.A.) 24 h after fieldwork. The second parasitism occurred on the 14th February 2014, on animal trails within a patch of forest in the Terenos municipality (20°56'42" S; 54°81'003" W, 500 m above sea level) and was ~110 km away from the first parasitism. In this case, the tick attached to the left arm of one of the authors (J.M.S.) and was noticed after returning from fieldwork. Both municipalities are rich in wildlife, and the sampled trails are located within the Cerrado Biome. Both human hosts

<sup>1</sup> Laboratório de Biologia Molecular, Embrapa Gado de Corte, Campo Grande, MS, Brasil.

<sup>2</sup> Programa de Pós-graduação em Doenças Infecciosas e Parasitárias, Universidade Federal de Mato Grosso do Sul, Campo Grande, MS, Brasil.

<sup>3</sup> Departamento de Patologia, Universidade Federal de Uberlândia, MG, Brasil.

<sup>4</sup> Corresponding author, e-mail: renato.andreotti@embrapa.br.

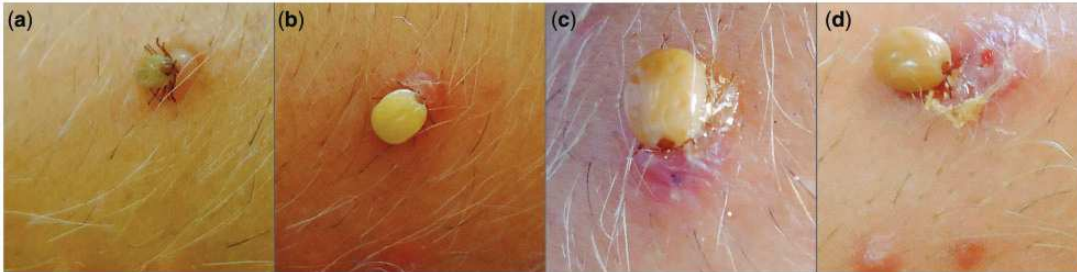
**Table 1. Biological parameters of both tick nymphs of *A. coelebs* that fed on humans**

Tick	Host <sup>a</sup>	Probable date of attachment	Species <sup>b</sup> /stage	Attachment site	Feeding period (d)	Engorged nymph weight (mg)	Skin reaction <sup>c</sup>
1	A.A.R.A.	5 April 2013	<i>A. coelebs</i> /nymph	Right side of back	5	6.1	++
2	J.M.S.	14 Feb. 2014	<i>A. coelebs</i> /nymph	Left arm	7	8.8	+++

<sup>a</sup> Capital letters are the initials of the authors, who were also the individuals parasitized in this study.

<sup>b</sup> Species determined through examination of the adult ticks that molted in the laboratory from the engorged nymphs.

<sup>c</sup> Hyperemia, itching and/or swelling at attachment site during the tick feeding: – insignificant; + slight; ++ moderate; +++ intense.



**Fig. 1.** *A. coelebs* nymph feeding on a human host (J.M.S.); fourth (a), fifth (b), sixth (c), and seventh (d) day of attachment. Note the slight hyperemia of the skin throughout the parasitism and the initially clear (c) and later caseous exudate (d).

were tick-bitten before, although tick species were not recorded.

### Ethics

All procedures were performed in accordance with ethical standards specified by the World Medical Association Declaration of Helsinki.

### Results and Discussion

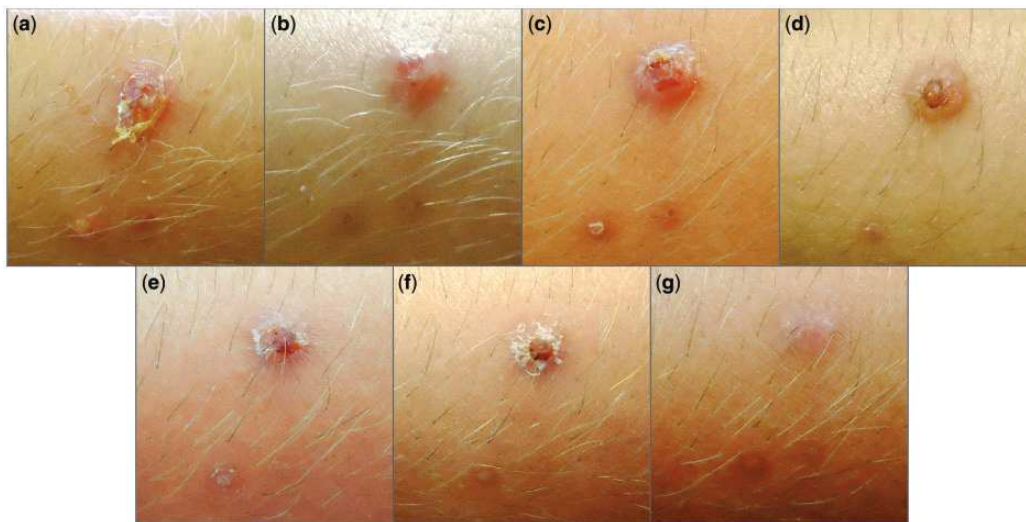
The biological parameters of the two tick nymphs found feeding on humans is shown in Table 1. The nymphs were fully engorged 5–7 d after attachment, and both nymphs molted into *A. coelebs* adults. To our knowledge, no information is available in the literature on the biology of *A. coelebs*. Consequently, the feeding period and engorgement weight of the nymphs are provided here for the first time. Similarly, we are unable to compare our findings to tick performance on natural or laboratory hosts. However, the uninterrupted feeding and molting of both nymphs after engorgement indicates that humans are a suitable host for this species. In fact, there are only a few records of human *A. coelebs* bites from both nymphs and adults in Brazil (Labruna et al. 2005, Guglielmo et al. 2006), and none of these records specifies whether the tick was able to feed.

Under natural conditions, *A. coelebs* adults feed primarily on tapirs (Labruna and Guglielmo 2009), whereas nymphs parasitize a greater variety of hosts (Labruna et al. 2005; Martins et al. 2011, 2014). Tapirs were known to use the trails at both survey locations; however, several other wild animals also used the trails. As a result, the previous host for these nymphs is uncertain, although tapirs are clearly the host of many adult ticks. This tick species should, therefore, be considered

an important source of human parasitism, although it has never been associated with pathogen transmission to either human or animal hosts. However, adult ticks in Rondonia, northern Brazil, can be infected with *Rickettsia amblyommii*, a spotted-fever type of *Rickettsia* with an unknown pathogenicity (Labruna et al. 2004).

The reactions to the tick bites were localized, and neither lymphadenopathy nor fever occurred in either human host. One of the parasitisms was closely monitored (J.M.S.), and the tick development, gross skin alterations, and related sensations were noted (Figs. 1 and 2). During the three first days, the tick attachment site was characterized by slight pruritus, swelling, and hyperemia. Tick engorgement appeared on the fourth day and was associated with slight hyperemia and a vesicle on the surface of the skin. This reaction persisted on the fifth day, but the tick size noticeably increased. On the sixth day, a clear fluid (probably an exudate) was seen underneath the tick, and on the seventh day (6 d of feeding) the tick detached from the skin and left a small red ulcer and a caseous exudate on the skin. Intense pruritus occurred on the first day after tick detachment and persisted for the next 6 d. Thereafter, the pruritus decreased in intensity until the 25th day postdetachment. The skin lesion after tick detachment was elevated and slightly hyperemic for several days, and it presented a caseous spot on the sixth day with crusts afterwards. On the 25th day, a small, slightly bulging scar remained at the tick-attachment site.

The observed skin reactions to the ticks were minor. The slight hyperemia and exudate can be attributed to an inflammatory reaction that was undoubtedly modulated at unknown levels by tick saliva (reviewed in Wikel 2013). The variations in pruritus intensity can be similarly explained, and increased pruritus occurred after tick detachment, despite the fact that no additional saliva was inoculated into the skin.



**Fig. 2.** Tick attachment site 1 (a), 3 (b), 6 (c), 9 (d), 13 (e), 16 (f), and 25 (g) d after host detachment. Note the small red ulcer and a caseous exudate on the skin (a); elevated and slight hyperemia for several days (b–f); and small, slightly bulging scar at the end of the follow-up period (g).

In conclusion, we report that humans are suitable hosts for *A. coelebs* nymphs. The saliva from this tick species seems to effectively modulate human reactions; the nymphs engorge within a few days; the reactions were minor; and pruritus worsened only after tick detachment. Consequently, further information on this tick species, such as the associated pathogens throughout its range and its biological characteristics, are important future research topics.

### Acknowledgments

This work was supported by the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), and Empresa Brasileira de Pesquisa Agropecuária Gado de Corte (Embrapa/CG).

### References Cited

- Barros-Battesti, D. M., M. Arzua, and G. H. Bechara. 2006. Carrapatos de Importância Médico-Veterinária da Região Neotropical: Um Guia Ilustrado para Identificação de Espécies. Vox/International Consortium on Ticks and Tick Borne Diseases (ICTTD-3)/Butantan, São Paulo, Brazil.
- Guglielmone, A. A., L. Beati, D. M. Barros-Battesti, M. B. Labruna, S. Nava, J. M. Venzal, A. J. Mangold, M. P. Szabó, J. R. Martins, D. González-Acuña, et al. 2006. Ticks (Ixodidae) on humans in South America. *Exp. Appl. Acarol.* 40: 83–100.
- Jongejan, F., and G. Uilenberg. 2004. The global importance of ticks. *Parasitology* 129: S3–S14.
- Labruna, M. B., and A. A. Guglielmone. 2009. Ticks of new world *tapirs*. *Tapir Conserv.* 18: 21–28.
- Labruna, M. B., T. Whitworth, D. H. Bouyer, J. McBride, L.M.A. Camargo, E. P. Camargo, V. Popov, and D. H. Walker. 2004. *Rickettsia bellii* and *Rickettsia amblyommii* in *Amblyomma* Ticks from the State of Rondônia, Western Amazon, Brazil. *J. Med. Entomol.* 41: 1073–1081.
- Labruna, M. B., L. M. Camargo, F. A. Terrassini, F. Ferreira, T. S. Schumaker, and E. P. Camargo. 2005. Ticks (Acari: Ixodidae) from the state of Rondônia, western Amazon, Brazil. *Syst. Appl. Acarol.* 10: 17–32.
- Martins, T. F., V. C. Onofrio, D. M. Barros-Battesti, and M. B. Labruna. 2010. Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescription, and identification key. *Ticks Tick Borne Dis.* 1: 75–99.
- Martins, T. F., M. M. Furtado, A. T. Jácomo, L. Silveira, R. Sollmann, N. M. Tôrres, and M. B. Labruna. 2011. Ticks on free-living wild mammals in Emas National Park, Goiás State, Central Brazil. *Syst. Appl. Acarol.* 16: 201–206.
- Martins, T. F., J. M. Venzal, F. A. Terrassini, F. B. Costa, A. Marcili, L. M. Camargo, D. M. Barros-Battesti, and M. B. Labruna. 2014. New tick records from the state of Rondônia, western Amazon, Brazil. *Exp. Appl. Acarol.* 62: 121–128.
- Nava, S., L. Beati, M. B. Labruna, A. G. Cáceres, A. J. Mangold, and A. A. Guglielmone. 2014. Reassessment of the taxonomic status of *Amblyomma cajennense* ( ) 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*, and *Amblyomma sculptum* (Ixodida: Ixodidae). *Ticks Tick Borne Dis.* 5: 252–276.
- Szabó, M.P.J., M. B. Labruna, C. C. Castagnolli, M. V. Garcia, A. Pinter, V. A. Veronez, G. M. Magalhães, M. B. Castro, and A. Vogliotti. 2006. Ticks (Acari: Ixodidae) parasitizing humans in an Atlantic rainforest reserve of Southeastern Brazil with notes on host suitability. *Exp. Appl. Acarol.* 39: 339–346.
- Wikel, S. K. 2013. Ticks and tick-borne pathogens at the cutaneous interface: host defenses, tick countermeasures, and a suitable environment for pathogen establishment. *Front. Microbiol.* 4: 337.

Received 13 August 2014; accepted 8 December 2014.