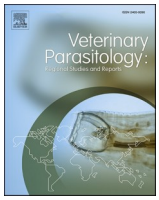
Veterinary Parasitology: Regional Studies and Reports 63 (2025) 101304

Contents lists available at ScienceDirect

Veterinary Parasitology: Regional Studies and Reports

journal homepage: www.elsevier.com/locate/vprsr



Short Communication

Importation of the exotic tick *Amblyomma geoemydae* into Sweden via illegally introduced turtles (*Geoemyda spengleri*) from Thailand

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ARTICLE INFO

Keywords:
Exotic tick
Amblyomma geoemydae
Geoemyda spengleri
Surveillance
Report tool

ABSTRACT

Illegal importation of animals as pets might be followed by the introduction of exotic tick species, potential vectors of pathogens that can have an impact on wildlife and/or domestic animals and on humans. Therefore, permanent measures of surveillance and control on imported reptiles are emphasized. In February 2024, black-breasted leaf turtles (*Geoemyda spengleri*) ($n = 31$) were illegally imported into Sweden from Thailand. The turtles were sent by the Swedish Customs Criminal Department West in Gothenburg to a public aquarium and terrarium (Tropicarium, Kolmården, Östergötland county) to be kept in quarantine. At the Tropicarium the turtles were found to be infested by ticks. All ticks ($n = 3$) found were removed and stored in ethanol. The finding (including photos of the ticks) was reported to the Swedish Veterinary Agency (SVA, Uppsala) using the Report Tick Tool, a surveillance system developed by the SVA itself. The three collected ticks were identified based on morphology and genetics as *Amblyomma geoemydae* nymphs. This discovery demonstrates that SVA's surveillance tool can function as an early warning system for newly introduced tick species and to promptly identify exotic tick species which can carry viruses, bacteria, and/or parasites that are not currently present in the country.

1. Introduction

Ticks are globally important obligate parasites which influence and impact the health of humans and other animals mainly as vectors of pathogens. Hard ticks (family Ixodidae Koch, 1844) encompass 762 species described in the different regions of the world (Guglielmone et al., 2023).

Tick species belonging to the genus *Amblyomma* Koch, 1844, can occur nearly worldwide, primarily in Neotropical regions, second in Afrotropical followed by Australasian regions, but are not endemic in Europe and North Africa (Guglielmone et al., 2023). *Ambylomma* genus contains 136 species (Guglielmone et al., 2023). *Amblyomma geoemydae* (Cantor, 1847) was first described from material collected on *Geoemyda spinosa* (*Heosemys spinosa*, Spiny turtle) in Sumatra, Indonesia. It is primarily a parasite of testudinids (Cantor, 1847; Yamaguti et al., 1971), but it has also been collected from other reptiles, birds, and mammals (Yamaguti et al., 1971; Tanskul et al., 1983; Guglielmone et al., 2014), and it is known to bite humans (Guglielmone and Robbins, 2018). *Amblyomma geoemydae* occurs within the Oriental region, including its northernmost extent: Japan (Ryukyu islands), southern China, and Taiwan (Yamaguti et al., 1971; Keirans and Durden, 2001; Robbins, 2005; Takahashi et al., 2011, 2017), and it has been reported from several countries in this region: Cambodia, China (PRC), India, Indonesia, Japan (Ryukyu Islands), Malaysia, Myanmar, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, and Vietnam (Cantor, 1847; Yamaguti et al., 1971; Vijaya, 1983; Keirans and Durden, 2001; Robbins et al., 2006; Kwak, 2018; Petney et al., 2019). A summary of host diversity and range has been accomplished by Amarga et al. (2022). Further, life cycle of *A. geoemydae* can be completed in 185–271 days under laboratory conditions, while the unfed specimens survived 190, 240, and 315 days for larvae, nymphs, and adults, respectively (Nadchatram, 1960).

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https://doi.org/10.1016/j.vprsr.2025.101304
Received 8 April 2025; Received in revised form 16 June 2025; Accepted 24 June 2025
Available online 25 June 2025

Takano et al. (2014) first provided molecular evidence suggesting that the subtropical lineage of *A. geoemydae* may represent a new species complex which has received limited attention until now. Herein, it is the first report on the importation of *A. geoemydae* into Sweden, infesting illegally imported black-breasted leaf turtles (*Geoemyda spengleri*).

2. Materials and methods

In February 2024, black-breasted leaf turtles (*Geoemyda spengleri*) ($n = 31$) were illegally imported into Sweden from Thailand. To establish the origin of the turtles, a tissue sample was sent to the Vietnam National University in Hanoi, where total genomic DNA was extracted. A fragment of mitochondrial cytochrome *b* was amplified, sequenced using Sanger sequencing, and its phylogeny was assessed according to Le et al. (2020). The analysis traced the turtles' origin to Vietnam. The turtles were sent by the Swedish Customs Criminal Department West in Gothenburg to a public aquarium and terrarium (Tropicarium, Kolmården, Östergötland county) to be kept in quarantine. At Tropicarium, the staff examined the animals carefully and discovered that some turtles were infested by ticks. Ticks (n = 3) were removed and stored in 70 % ethanol. The findings were reported to the Swedish Veterinary Agency (SVA, Uppsala) using the Report Tick Tool (https://rapporterafasting.sva.se/reporttick). Then, the collected specimens were submitted to SVA on 26th of February 2024 and from there sent on to Bundeswehr Institute of Microbiology in Munich, Germany for identification. The three collected ticks were identified based on morphology (Voltziz and Keirans, 2002) and genetics amplifying 16S rRNA gene (Halos et al., 2004).

2.1. Ethical statement

An ethics statement is not applicable as this study was not classified as a human or animal experiment. Reports of ticks and tick specimens were sent in voluntarily by Rescue Center, Tropicarium, Kolmården, Sweden. The responsible veterinarian removed the ticks as a part of the health inspection. The Report Tick Tool 'Rapportera Fästing' only collects information on the location and host of each participant. No personal data or IP addresses are saved. SVA processed the data in accordance with the General Data Protection Regulation (EU) 2016/679. The senders were informed that SVA reserves the right to use the submitted ticks and the accompanying metadata (i.e., images and information on the location of the finding and host) for research purposes as part of SVA's activities.

3. Results

The three collected ticks were identified as *Amblyomma geoemydae* Cantor, 1847 nymphs (Fig. 1) based on morphology and confirmed genetics by sequencing 16S rRNA gene. One tick was attached to the tail of one turtle, and two were attached between the back leg and the body of another turtle (Fig. 2). The morphological identification of the nymphs was based of the following most relevant characteristics: dorsal basis capituli subtriangular, posterolateral edges rounded, posterior margin almost straight, cornua absent; ventral basis capituli nearly subpentagonal, auriculae absent; palps long and slender; hypostome apex bluntly rounded; dentition extending along first half of hypostome, 3/3 dentition; body ovoid with punctations evenly distributed on dorsal and ventral surface; 11 festoons present; scutum cordiform, wider than long, large cervical grooves present, extending to posterolateral edge of scutum, deep at anterior edge of scutum; blunt scapulae present, two ornate patches present between eyes and cervical grooves; eyes present on lateral edge of scutum, large, distinct; spiracular plate subovoid; coxa I with two bluntly pointed spurs, posteromedian spur smaller than posterolateral spur; coxae II-IV each with a large bluntly pointed external spur (Fig. 2). The obtained sequence was submitted to GenBank (accession no: PV067189) and showed 100 % identity with sequences of *A. geoemydae* from West Malaysia (accession no: OL616092).

4. Discussion

This is the first report on the importation of *A. geoemydae* into Sweden, infesting illegally imported black-breasted leaf turtles (*G. spengleri*). This discovery demonstrates that SVA's recently developed surveillance tool can function as an early warning system for newly introduced tick species and to promptly identify exotic ticks which can carry viruses, bacteria, and/or parasites that are not currently present in the country.

In Asia, new records of *A. geoemydae* are regularly reported. For example, Robbins and Platt (2011) collected a single engorged nymph of *A. geoemydae* from the Arakan forest turtle (*Heosemys depressa*) in the Rakhine Yoma Elephant Range, south-western Myanmar. Amarga et al. (2025) reported new host and geographic records of *A. geoemydae* in southern China and Southeast Asia.

In accordance to the present report, *A. geoemydae* has also been reported from several countries outside its natural distribution range as imported on live reptiles (Simmons and Burridge, 2000; Bilbija et al., 2019), but so far there are no records of established wild tick populations outside the Oriental region. *Amblyomma geoemydae* has been

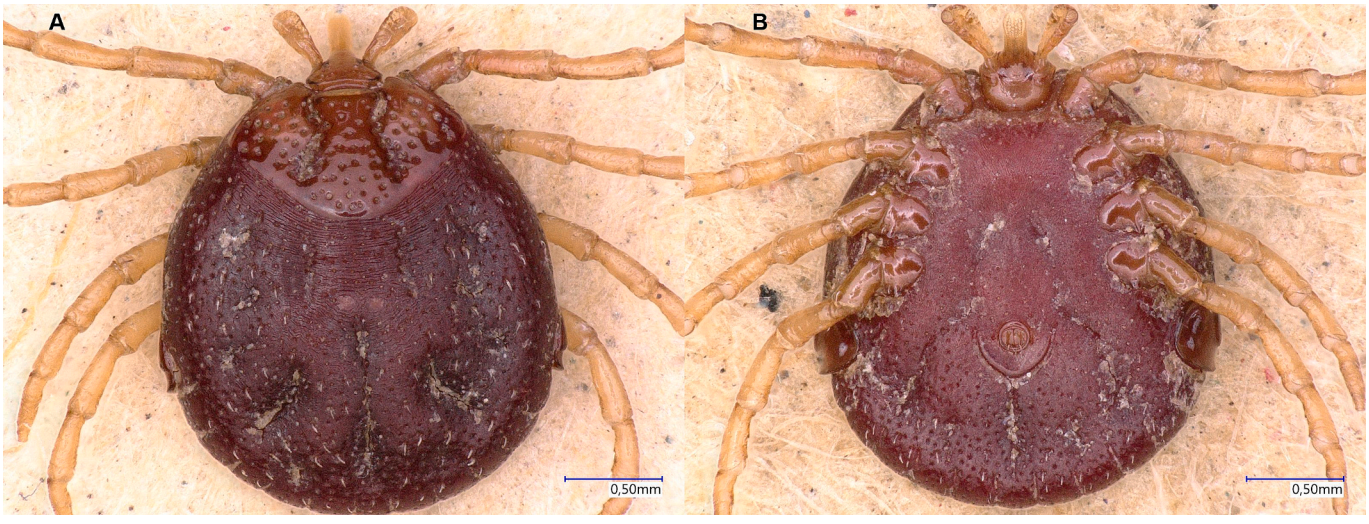

Fig. 1. *Amblyomma geoemydae* (Cantor) nymph: A) dorsal view, B) ventral view.

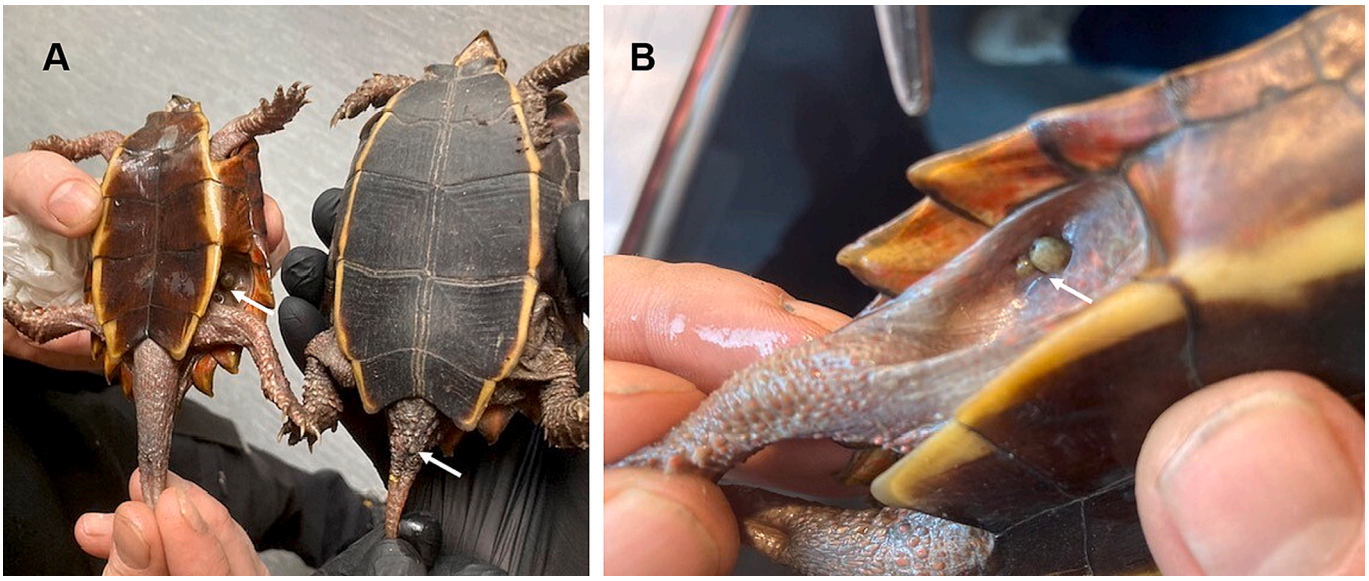

Fig. 2. Ticks feeding on the black-breasted leaf turtles illegally introduced in Sweden: A) both infested turtles; B) ticks feeding in the region between one of the back legs and body; arrows showed the tick location.

inadvertently imported into the USA numerous times on captive turtles and tortoises (Simmons and Burridge, 2000; Keirans and Durden, 2001; Burridge and Simmons, 2003). *Amblyomma geoemydae* has also been imported into Europe (Austria) from yellow-marginated box turtle (*Cuora flavomarginata*) allegedly wild caught from Ryukyu Islands, Japan (Bilbija et al., 2019). In this case, after the import in 2010, the ticks became established with five-year persistence (2010–2015) in the indoor terrarium population. Therefore, careful biosecurity consideration should be given to *A. geoemydae*, particularly in tropical and subtropical regions where climatic suitability may facilitate the establishment of wild populations, such as in Florida, USA.

The molecular differences observed among the populations of *A. geoemydae* collected from the Ryukyu Islands in Japan raised the idea of the existence of more than one species in the region (Takano et al., 2014). Kwak et al. (2025) investigated specimens collected from Ryukyu Island of Japan, Taiwan, and China (Guangxi province), earlier considered as *A. geoemydae*, and observed morphological and genetical differences. Based on the results, Kwak et al. (2025) concluded that another species is present there and they named it *Amblyomma kappa*. All the life stages of this new species defined as a distinctive species native to the subtropics of East Asia sister to the Oriental turtle tick (*A. geoemydae*) were described (Kwak et al., 2025). Considered the description of the new species, the tick imported into Austria belonged most likely the new species, *A. kappa*.

This discovery highlights the importance of involving the public, veterinarians and healthcare staff as well as authorities in the surveillance efforts to detect exotic ticks whenever/if they are introduced to Sweden. The Report Tick Tool is an example of such activities and there is a planned integration of an Artificial Intelligence (AI)-based image recognition system within the tool (Omazic et al., 2025, (submitted October 2024)) to provide instant feedback to the reporter regarding the tick genus. Continuous monitoring can contribute to preventing the spread of exotic tick vectors capable of transmitting new pathogens in Sweden.

CRediT authorship contribution statement

Giulio Grandi: Writing – review & editing, Writing – original draft, Supervision, Conceptualization. **Anna Omazic:** Writing – review & editing, Supervision, Resources, Conceptualization. **Cesar Guevara:** Writing – review & editing, Resources, Data curation. **Anton de Jong:** Writing – review & editing, Validation, Methodology, Investigation, Formal analysis, Data curation. **Lidia Chitimia-Dobler:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Conceptualization.

Funding

This work is funded within the framework of the Horizon Europe program through the project 'Infectious Disease decision-support Tools and Alert System' (IDAlert; http://idalertproject.eu/) with grant no. 101057554.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

Rescue Center Tropicarium is acknowledged for reporting the case to SVA and for managing the collection and submission of specimens to SVA and eGenomic Analysis and Conservation research group (Vietnam National University, Hanoi) for identifying the origin of the turtles.

Data availability

Data will be made available on request.

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