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Prevalence of Hard Ticks Infested Rabbits (Leporidae) Family in Iraq.

Afkar M. Hadi*[1], Zainab A. Makawi[2], Mareym M. Alkhaiat[3]
Iraq Natural History Research Center and Museum, University of Baghdad, Baghdad, Iraq

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Abstract

The present study aims to isolate and identify ectoparasites, specifically hard ticks, that infest both domestic and wild rabbits. This research is motivated by the heightened sensitivity of rabbits to infestations by hard ticks, which are recognized as the primary vectors of certain blood-borne diseases, particularly Viral Hemorrhagic Fever (VHF). The study areas were spread across five provinces in Iraq: Baghdad, Karbala, Wasit, Mosul, and Al-Anbar. A total of 85 hard ticks (42 male and 43 female) were infested by 57 rabbits (Leporidae Family), including 19 wild rabbits (hare) with an infestation rate of 100% and 38 domestic rabbits with an infestation rate of 18.42%. Total of infestation was 45.61%. The current results are the occurrence of two genera and five species of Ixodidae Family of hard ticks as follow: *Hyalomma anatolicum* (Koch, 1844) *Rhipicephalus turanicus* (Pomerantsef, 1946), *Rhipicephalus leporis* (Pomerantsef, 1946), *Rhipicephalus pravus* (Donitz, 1910) and *Rhipicephalus appendiculatus* (Neumann, 1901). Leporidae is considered the new host for the two species *R. pravus* and *R. appendiculatus*, as they previously recorded infested other domestic animals such as cattle and sheep in Iraq. Thus, this result contributes additional data to the understanding of hard tick biodiversity in Iraq.

Keywords: Hare, Leporidae, Rabbits, Hard Tick, Iraq.

انتشار القراد الصلب المعزول من الارانب (العائلة الارنبية) في العراق

أفكار مسلم هادي[1] وزينب علوان مكاوي[2] ومريم ماجد الخياط[3]
مركز بحوث ومتحف التاريخ الطبيعي جامعة بغداد، بغداد العراق

الخلاصة

تهدف الدراسة الحالية إلى عزل وتشخيص الطفيليات الخارجية وخاصة القراد الصلب الذي يصيب الأرانب المنزلية والبرية. الدافع وراء هذا البحث هو حساسية الأرانب المتزايدة للإصابة بالقراد الصلب، والتي يتم التعرف عليها باعتبارها الناقلات الرئيسية لبعض الأمراض المنقولة بالدم، وخاصة الحمى النزفية الفيروسية (VHF). وتوزعت مناطق الدراسة على خمس محافظات في العراق: بغداد وكربلاء وواسط والموصل والأنبار. بلغ عدد القراد الصلب 85 (42 ذكور و 43 اناث) المعزول من مجموع 57 من الارانب، 19 من الارانب البرية بمعدل اصابة 100% و 38 من الارانب الداجنة بمعدل إصابة 18.42%، بلغ مجموع الإصابة الكلي 45.61 %

اشارت نتائج الدراسة الحالية أن خمسة أنواع من القراد الصلب من عائلة Ixodidae تنتمي إلى جنسين على النحو التالي:

*Email: afkar_hadi_iraq@yahoo.com

Hyalomma anatolicum (Koch, 1844) *Rhipicephalus turanicus* (Pomerantsef, 1946), *R. leporis* (Pomerantsef, 1946), *R. pravus* (Donitz, 1910) and *R. appendiculatus* (Neumann, 1901).

تعتبر Leporidae العائل الجديد للنوعين *R. pravus* و*R. appendiculatus*، حيث كانت قد أصابت سابقًا حيوانات أليفة أخرى مثل الأبقار والأغنام في العراق؛ لذا فإن هذه النتيجة هي بيانات إضافية للتنوع البيولوجي للقراد الصلب في العراق. وبالتالي، تساهم هذه النتيجة ببيانات إضافية لفهم التنوع البيولوجي للقراد الصلب في العراق.

الكلمات المفتاحية: الارانب الداجنة، الارانب البرية، القراد الصلب، بغداد، العراق.

Introduction

The Family Leporidae, which belongs to the mammalian Order Lagomorpha, includes rabbits and hares. The main distinguishing physical characteristics of members of this family include short, furry tails; elongated ears; and hind legs that are longer than their forelegs [1]. The habitat of Leporidae are forests, mountains, deserts, and swampland, this widespread may lead to the spread of hard ticks in the environment due to the sensitivity of rabbits to infestation with hard ticks [2].

For numerous ixodid tick species, laboratory New Zealand rabbits have shown to be the most accessible and appropriate hosts [3, 4]. Ticks, particularly those in their early stages, such as larvae or nymphs, make feeding on rabbit's ears a less than elegant method. the animal discomfort and make it difficult to monitor tick feeding and/or remove engorged ticks when they crawl and adhere deep in the ear canal [4].

Hard ticks (Ixodidae), notorious for their slow feeding behavior, can remain attached to a host for extended periods, ranging from days to weeks, depending on the species and developmental stage. As obligate hematophagous arthropods, they pose a significant risk to both human and animal health, serving as vectors for a multitude of infectious diseases, including viral, bacterial, and protozoal pathogens [5]. The molecular studies approved that hard ticks borne many pathogens like *Rickettsia* sp., *Babesia* sp., *Theleria* sp., and *Anaplasma* sp. [6]. Iraq is considered an endemic country for both diseases Theileriosis and Babesiosis that are transmitted by hard ticks [7].

The real risk disease for both humans and animals that is transmitted by ticks is Viral Hemorrhagic fever VHF [8]. *Hyalomma* species play an important role in the prevalence of Theileriosis in animals and Haemorrhagic Fever in Humans [9].
Establishing a reliable tick-feeding system is essential for researching tick biology or testing out novel control strategies to adequately plan the trials and reach the study's objectives. Several artificial tick-feeding systems have recently been created by [10], avoiding the usage of live animals if feasible.

The aim of the study is to determine the prevalence of hard tick species in the Leporidae family, which are considered reservoir hosts for the spread of hard ticks to domestic animals, posing a risk to livestock in Iraq.

Materials and Methods

Study area: A total of 19 samples of wild rabbit (Hare) were hunted from five provinces, as follows: Baghdad (Al-Rashdiya and AL-Attariya), Karbala, Wasit (Al-Dujaila), Mosul

(Sinjar), and Al-Anbar (Al-Rutba, Nukhaib and AL-Okla). (Figure 1). While 38 samples of the domestic rabbit were collected from the local markets of Baghdad province.

Specimens' collection and processing:

A total of 57 rabbits were sampled to isolate hard ticks. Nineteen wild rabbits (hares) were hunted via shooting from various areas of Iraq from March 2022 to October 2023. Additionally, 38 domestic rabbits were obtained from local animal markets in Baghdad during this same period. All rabbits were tested upon collection. All animals were examined to detect hard ticks in their ears, the area around the eyes, neck, back, between the legs, and tail. Using cotton dipped in alcohol, place it on the location of the tick to numb and loosen the parts of the mouth attached to the skin, then remove it with tweezers [1]. The isolated ticks were preserved in 70% alcohol and transported to the "Iraq Natural History Research Center and Museum INHM" to be identified and photographed. Statistical analysis was applied to differences between the infestation rates of hares and rabbits.

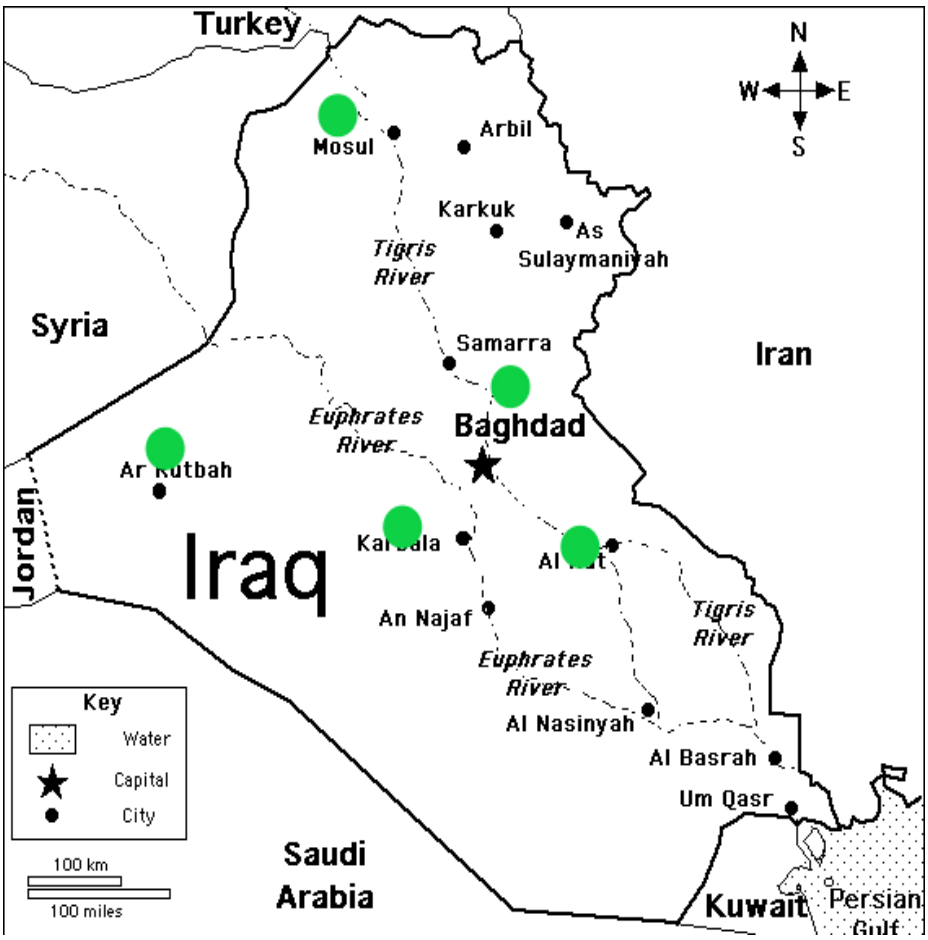

Figure 1: Map of Iraq includes the collection of wild Hares from five provinces pointed in green circles, Mosul, Baghdad, Al Anbar, Karbala, and Wasit.

Results

The study found that all the hares examined were infested with hard ticks at various stages of their life cycles. Notably, some of the ticks were so heavily engorged with blood that they had grown larger than their typical size. The total infestation rate of hard ticks in the Leporidae Family is 45.61% in hares 100% and in rabbits 18.42%, so, there are significant differences between the infestation of hares and rabbits on $p < 0.01$ as (Table 1).

Table 1: Total infested rates of hard ticks in the Leporidae Family in Iraq.

Common name	No. of tested	No of infested	%
Hare	19	19	100
Rabbit	38	7	18.42
Total	57	26	45.61

*There are significant differences between the infestation of hares and rabbits on $p < 0.01$

The current results revealed that the Leporidae Family in Iraq was infested with two genera *Hyalomma* and *Rhipicephalus*, A total of 85 hard ticks (42♂ and 43♀) were detected from Leporidae Family belong to five species: *R. turanicus* (52.63%), *R. leporis* (43.85%) *R. pravus* (8.77%), *R. appendiculatus* (5.26%), and *Hyalomma anatolicum* (38.59%) with different rates of infestation as (Table 2) and (Figure 2).

Table 2: Hard tick species were diagnosed from the Leporidae Family in Iraq.

No. of samples	*R. turanicus*	*R. leporis*	*R. pravus*	*R. appendiculatus*	*H. anatolicum*
Hare 19	8 ♂+ 5 ♀	12 ♂+ 13 ♀	4♂+ 1 ♀	1 ♂+ 2 ♀	**2 ♂+ 5 ♀**
Rabbit 38	6 ♂+ 11♀	0	0	0	**9 ♂+ 6 ♀**
♂+ ♀	14+16	12+13	4+1	1+2	**11+11**
Total (%)	30 (52.63)	25 (43.85)	5 (8.77)	3 (5.26)	**22 (38.59)**

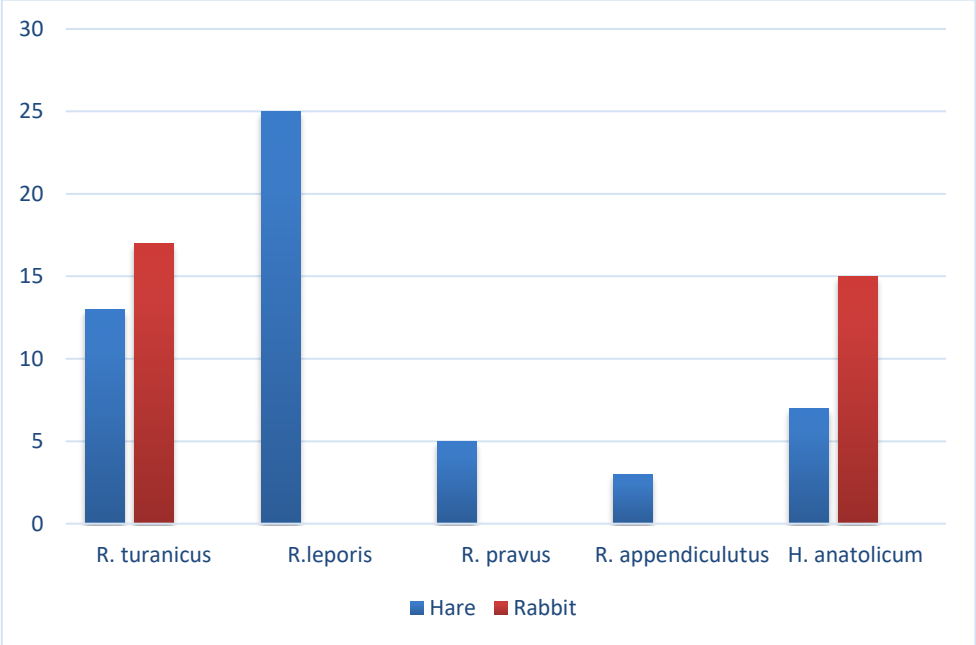

Figure 2: The infestation rates of hares and rabbits with hard ticks' species.

The morphological study of the five hard tick species was carried out by examining their diagnostic characteristics which included the approved taxonomic keys [12,13,14], namely: Cervical fields depression, Conscutum colored, Lateral grooves, Posterior ridges, Central festoon, Posteromedium groove, Paramedian grooves, Spiracle areas, Adanal plates shape and Subanal plates. (Figures 3-7).

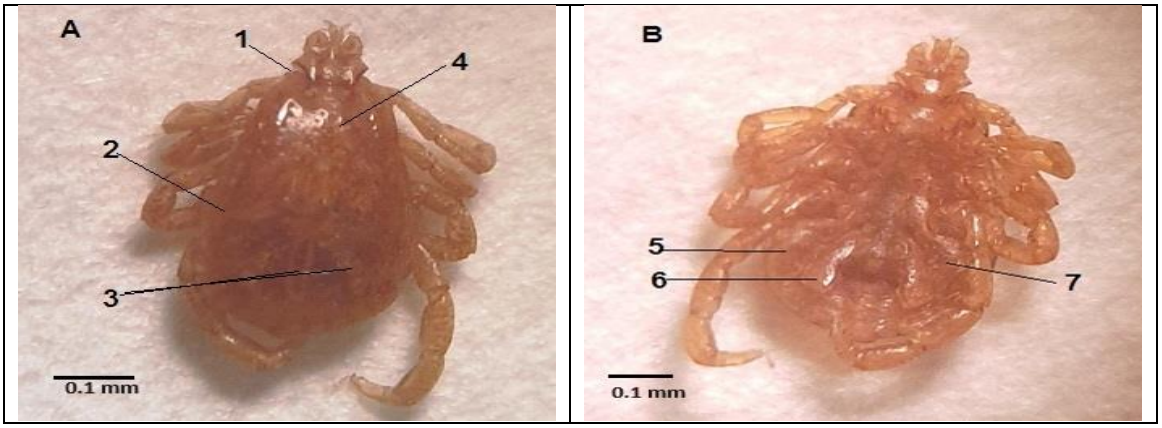

Figure 3: A. *R. turanicus* male, dorsal. 1. First Coxae anterior spurs not visible dorsally. 2. Lateral grooves distinct 3. Posterior grooves distinct. 4.Cervical fields depression apparent. B. *R. turanicus* male, ventral. 5. Spiracle areas have sparse setae. 6. Adanal plates shape broad and curved. 7. Accessory adanal plates large.

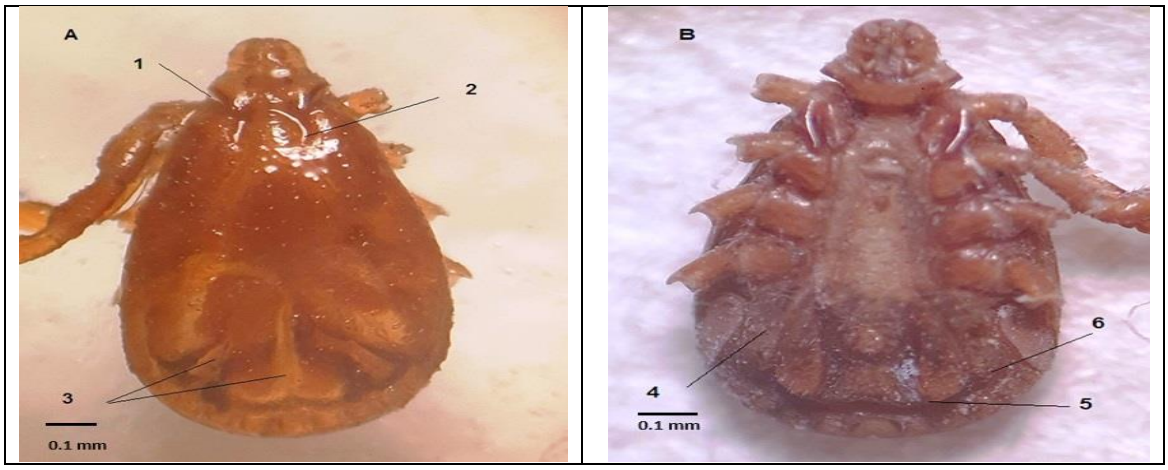

Figure 4: A. *R. pravus* male, dorsal. 1. First coxae anterior spurs visible dorsally. 2. Cervical fields depression apparent. 3.Posterior groove distinct. B. *R. pravus* male, ventral. 4. Spiracle areas have sparse setae. 5. Adanal plates shape narrow and trapezoid. 6. Accessory adanal plates small.

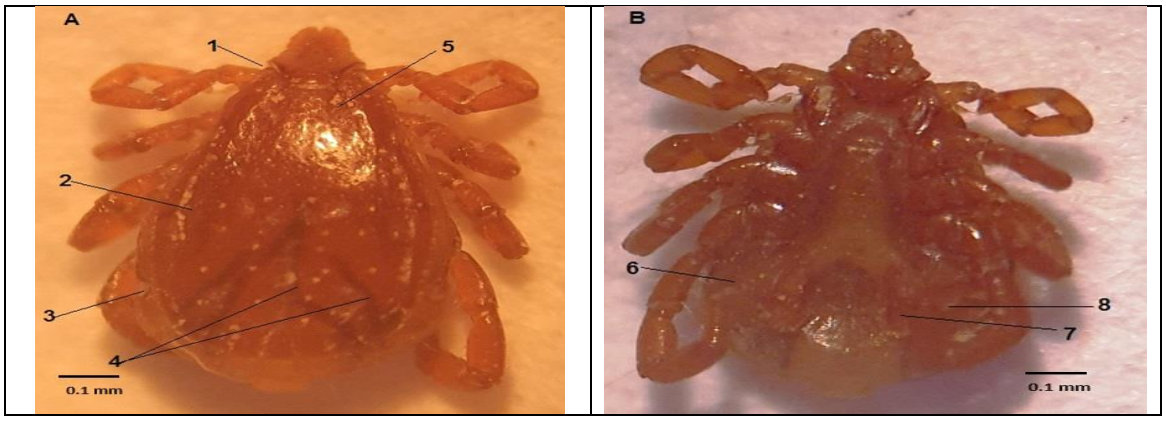

Figure 5: A. *R. leporis* male, dorsal. 1.First coxae anterior spurs not visible dorsally. 2. Lateral grooves distinct. 3.Sprical plate tails wide and visible in dorsal. 4. Posterior groove distinct. 5. Cervical fields depression not apparent. B. *R. leporis* male, ventral. 6. Spiracle areas have sparse setae. 7. Adanal plates shape broad and curved appearance. 8. Accessory adanal plates large.

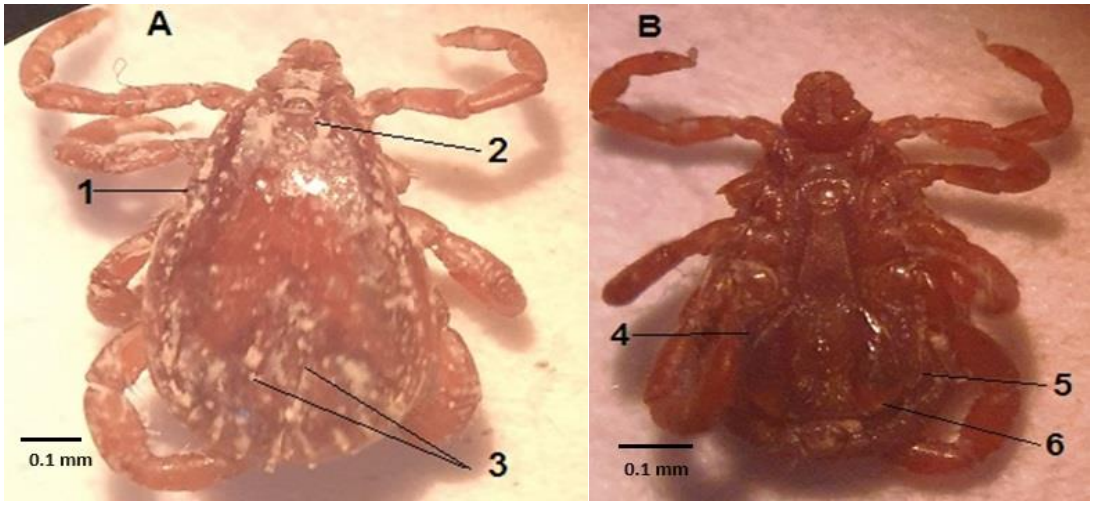

Figure 6: A. *R. appendiculatus* male, dorsal. 1. Eyes slightly convex. 2. Cervical fields depression apparent. 3. Posterior grooves distinct. B. *R. appendiculatus* male, ventral. 4. Spiracle areas have sparse setae. 5. Accessory adanal plates small. 6. Adanal plates shape as two triangles converging from the base.

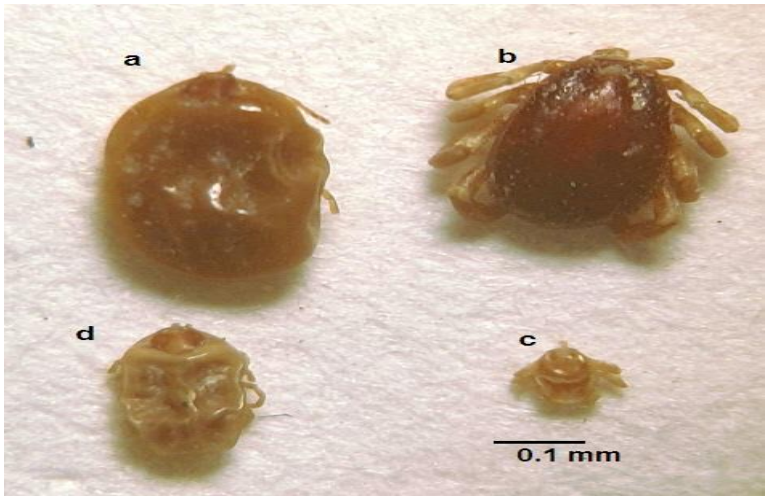

Figure 7: *Hyalomma anatolicum* in both Hare and Rabbit; a=female, b=male, c= nyph 1, d=nyph 2

Discussion

The data concerning the distribution and prevalence of ticks among both domestic and wild animals paramount importance, as it aids in predicting the occurrence of tick-borne pathogens (TBPs) in animals and viral diseases in humans.

The results of the current survey revealed a high total infestation rate of hard ticks in the Leporidae family of 45.61%, confirming rabbits' susceptibility to hard tick infestation. Previous studies have also experimentally [15] and observationally [16, 17] noted high levels of hard tick infestation in hares, likely due to hares foraging for food among plants and foliage in forestlands that are contaminated with hard ticks. The infestation rate of Hares was 100% this result agreed with [18] which revealed that the infestation rate of wild rabbits was 100%; This is an important result that indicates the extent of the spread of hard ticks in the Iraqi environment.

Distinct variations exist in the infestation patterns between hares and rabbits, likely influenced by the diverse environmental conditions in which each species resides. Domestic rabbits typically receive more attention and care compared to their wild counterparts, which could contribute to these differences. The current study revealed that Hares and Rabbits in Iraq were infested with two genera *Hyalomma* and *Rhipicephalus*, due to the abundance prevalence of these two genera in the Iraqi environment [19]. This agreed with Tan [20] who aimed to notify the presence of *Rhipicephalus* species in southeast Asia in both animals and humans. Also agreed with [21] who reviewed to Global prevalence of *Hyalomma* and *Rhipicephalus* species. Tendai and colleagues [22] reviewed assessed 46 articles that included 14 *Rhipicephalu*s sp. as potential vectors and reservoirs of various diseases over the past 22 years in sub-Saharan Africa.

These results revealed that *R. turanicus* infested both Hares and Rabbits which confirmed of high distribution of this species in the Iraqi environment, where [23] isolated it from Long Eared Hedgehogs. This result agrees with [24] who revealed to Hares infested with *R. turanicus* and *R. leporis* in Alqasim District- Babylon, Iraq. While [18] revealed that wild rabbits were infested with *R. leporis* at a rate of 75% in Iraq.
Rhipicephalus appendiculatus appeared in the current study Infest Hares as a new host, where previously [25] revealed it to infest cattle in the north of Iraq.
Kaba, [26] reviewed a significant abundance of *Rhipicephalus pravus* in the arid and semi-arid areas of Ethiopia, this indicates that it is resistant to drought.

In Iraq, *R. pravus* was recorded for the first time by [27] in Bulk sheep in Erbil province north of Iraq; then, by [28] recorded in cattle in Al Najaf Al Ashraf province, south of Iraq; the current study recorded it in Hare as a new host in Iraq.
Based on its capacity to transfer infectious agents to people, domestic animals, and wild animals, mostly via ectoparasites, the hare is one of the species thought to be important in terms of epizootiology [32].

conclusion

Basic data on the infestation of hard ticks in the Leporidae Family for both Hares and domestic rabbits from five provinces in Iraq: Baghdad, Karbala, Wasit, Mosul, and Al-Anbar. In the current study, five species of hard ticks from the genera *Rhipicephalus* and *Hyalomma* were identified: *Rhipicephalus turanicus*, *R. leporis*, *R. pravus*, *R. appendiculatus*, and *Hyalomma anatolicum*. The results indicate that hares may serve as a host for two of these species that had not been previously documented on this animal: *R. pravus* and *R. appendiculatus*. These two species are known to infest other domesticated animals such as cattle and sheep within Iraq Therefore, this result is additional data for the biodiversity of hard ticks in Iraq.

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Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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