ISSN: 0067-2904

Diversity of Hard Ticks (Acari, Ixodidae) Infestion in Arabian Camel in Iraq

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Received: 3/2/2023 Accepted: 20/6/2023 Published: 30/7/2024

Abstract

A total of 1346 hard ticks (863♂ and 483 ♀) infested 104 camels, 60 alive camels with 93.33% infestation rate and 44 carcasses of camels had 79.54% infestation rate The total infestation rate was 87.5 %.

The current study results revealed ten species of hard ticks family Ixodidae Koch, 1844 related to genus *Hyalomma* as following: *H. dromedarii* Koch, 1844, *H. schulzii* Morel, 1969, *H. turanicum* Pomerantsev, 1946, *H. excavatum* Koch, 1844, *H. truncatum* Koch, 1844, *H. scupense* Schulzii, 1919, *H. marginatum* Koch, 1844, *H. anatolicum* Koch, 1844, *H. rufipes* Koch, 1844, *H. impeltatum* Schulze & Schlottke, 1930 from camel *Camelus dromedarius* Linnaeus, 1758 collected from 21 regions belonging to six provinces in middle, west and south of Iraq where camels were bred in abundance. According to the current results, camels are considered a new host for three species of genus *Hyalomma*: *H. truncatum*, *H. marginatum rufipes*. These results may be of more importance as being the available data for risk topic about camels infested with hard ticks.

Key words: Camels, Diwania, Hard ticks, *Hyalomma*, Iraq.

تنوع القراد الصلب (Acari, Ixodidae) المعزول من الجمال العربية في العراق

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الخلاصة

بلغ عدد القراد الصلب 1346 (863 ذكور و 483 اناث) تم عزلها من مجموع 104 من الجمال، 60 من الجمال الحية بمعدل اصابة 93.33٪ و 44 جثة للجمال المذبوحة بمعدل اصابة 79.54٪، بلغ مجموع الإصابة الكلي 87.5٪.

اشارت نتائج الدراسة الحالية الى أن عشرة أنواع من القراد الصلب من عائلة Ixodidae تنتمي إلى جنس *Hyalomma* على النحو التالي:

H. dromedarii, H. schulzii, *H. turanicum, H. excavatum*, *H. truncatum, H. scupense*, *H. marginatum, H. anatolicum , H. rufipes, H. impeltatum* التي تتطفل على الجمال قد تم جمعها من 21 منطقة تكثر فيها تربية الجمال وتنتمي إلى ست محافظات في وسط وغرب وجنوب العراق. طبقا للنتائج الحالية تعتبر الجمال مضيفًا جديدًا لثلاثة أنواع من القراد الصلب من جنس *Hyalomma* ، وهي: *H.*

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truncatum، *H. marginatum* و *H. rufipes*. قد تكون هذه النتائج أكثر أهمية من البيانات المتاحة سابقا لموضوع خطر اصابة الجمال بالقراد الصلب.

Introduction

Camels in Iraq are one-humped mammals that are commonly distributed in certain regions like middle, west and south. Around 58,000 camels are owned in Iraq [1].
Camels are infected by diseases and parasites like other mammals [2, 3]. Camels are infested by ticks, mites and flies [4]. Hard tick's infestation causes various health issues with main clinical signs of reproductive failure and infertility among camels, and abortion in high rates that may reach up to70% in some areas [5, 6].

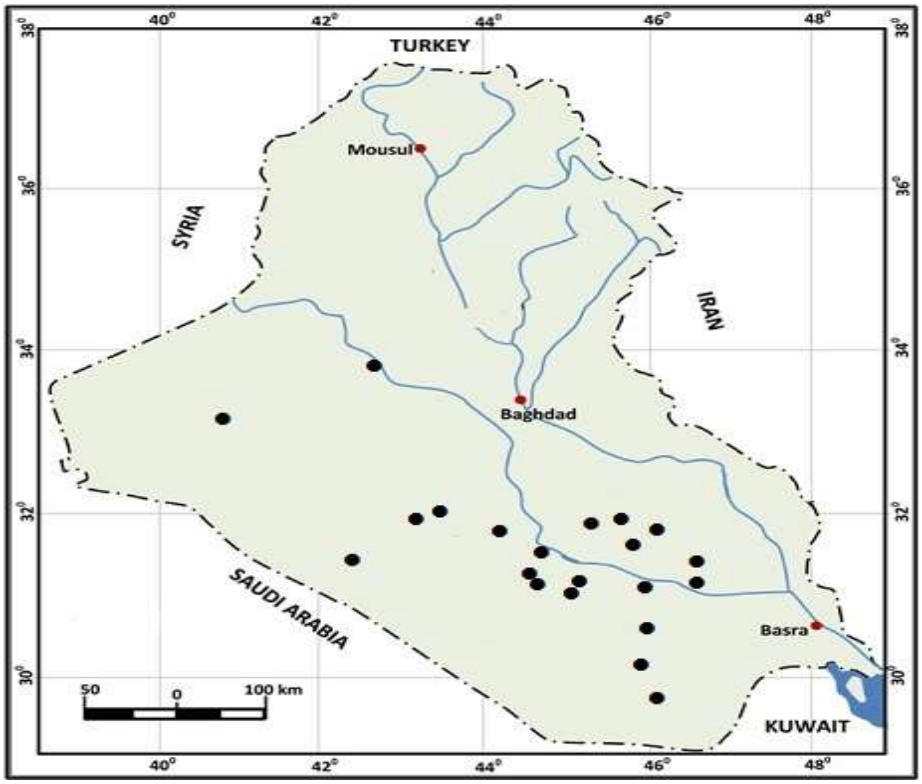
Hard ticks are considered blood-feeding parasites of all mammals which are distributed worldwide and cause disturbance among animals, skin injury, anemia, and sometimes ticks paralysis that leads to death [7]. Heavy ticks' infestation may cause high rates of mortality and morbidity in camels and other animals [8]. Hard ticks especially *Hyalomma* sp. is recorded as vector of the viral disease Crimean-Congo Hemorrhagic Fever (CCHF) in camels [9].

This study aimed to diagnose the species of hard ticks that infest camels in the central, western and southern Iraq where camels are found in abundance.

Materials and Methods

Collection of Samples: A total of 104 camel were tested to isolate hard ticks; 60 of them alive camels (with the camel's owners' agreement) and 44 carcasses of camels from abattoirs (37 Al Najaf abattoir and 7 Al Nassryia abattoir) from April 2019 till September 2022. All samples of hard ticks were initially kept in sterile tubes containing alcohol ethanol 70% and were then transferred to the laboratory of INHM (Iraq Natural History Research Center and Museum) for diagnosis. Hard ticks' samples were placed in 10% KOH to be more transparent for 2-3 days. Later they were examined by dissecting under a microscope (2X and 4X). Samples were first photographed by digital camera. The morphological study was carried out according to the diagnostic characteristics included in the approved taxonomic keys [10, 11].

Study Area: Regions of collection (21 regions) were distributed among six provinces in middle, west and south of Iraq as following:
1 - Shithatha and Jofrat Shithatha (Kerbala province) middle of Iraq.
2 - Al-Rahalia, Afak, Al-Daghara, Al-Shanafiya, Al-Saniya, AL-Hamza, Shamiya, Al-Sadeer, AL-Dewaniya, Said Dikheel (Al-Qadissyia province) south of Iraq.
3 - Al- Najaf abattoir (Al-Najaf province) south of Iraq.
4 - Al-Samawa dessert (Al-Muthanna province) south of Iraq.
5 - Al-Nasirya abattoir, Tal AL-Laham and Basia (Dhi Qar province) south of Iraq.
6 - Haditha, Nukhaib, Al-Rutba (Al-Anbar province) west of Iraq. (Map 1).



Map 1: Geographical distribution of collected hard ticks samples from camels in Iraq.

Results

Hard ticks infested camels all over their bodies including face, chest, axillary, udder, anus, testes and legs.

A total of 1346 hard ticks (863♂ and 483 ♀) infested 104 camels, 60 of them were alive camels with an infestation rate of 93.33% and 44 carcasses of camels with 79.54% infestation rate. Total of infestation rate was 87.5% (Table 1).

The current study results revealed ten species of hard ticks family Ixodidae Koch, 1844 related to genus *Hyalomma* as following: *H. dromedarii* Koch, 1844, *H. schulzii* Morel, 1969, *H. turanicum* Pomerantsev,1946, *H. excavatum* Koch, 1844, *H. truncatum* Koch, 1844, *H. scupense* Schulzii, 1919, *H. marginatum* Koch, 1844, *H. anatolicum* Koch, 1844, *H. rufipes* Koch, 1844, *H. impeltatum* Schulze & Schlottke, 1930 from camels. *H. dromedarii* had the highest infestation rate (53.34%), while *H. impeltatum* was found to have the lowest infestation rate (0.29%) (Table 2).

Table 1: Total hard ticks infestation in camels in Iraq.

Camels' Samples	No. of Tested Camels	No. of Infested Camels	%
Alive Camels	60	56	93.33
Carcass of Camels	44	35	79.54
Total	104	91	87.5

Table 2: *Hyalomma* species diagnosed in camels in Iraq

	Species of *Hyalomma*	No. of Males	No. of Females	Total	%
1	*H. dromedarii*	404	314	718	53.34
2	*H. schulzii*	269	115	384	28.52
3	*H. turanicum*	119	21	140	10.40
4	*H. excavatum*	23	6	29	2.15
5	*H. truncatum*	15	9	24	1.78
6	*H. scupense*	12	6	18	1.33
7	*H. marginatum*	13	3	16	1.18
8	*H. anatolicum*	3	5	8	0.59
9	*H. rufipes*	3	2	5	0.37
10	*H. impeltatum*	2	2	4	0.29
	Total	863	483	1346	

The morphological study of the ten species of the genus *Hyalomma* was carried out according to the diagnostic characteristics including cervical fields depression, conscutum coloured, lateral grooves, posterior ridges, central festoon, posteromedial groove, paramedian grooves, spiracle areas, adanal plates shape and subanal plates (Figures 1-10).

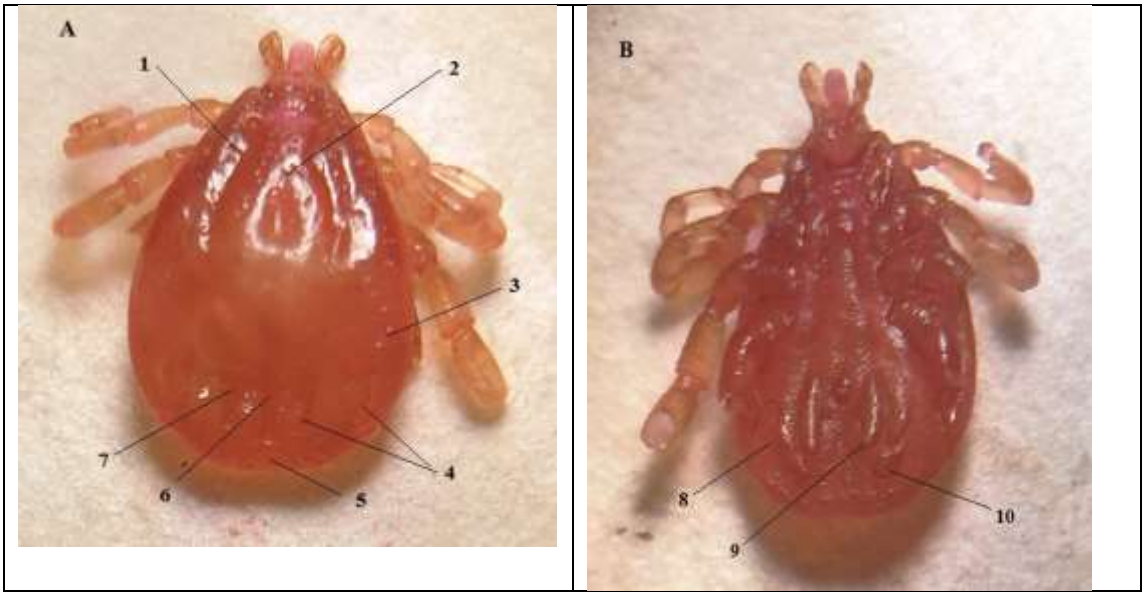


Figure 1: A. Dorsal view of male *H. dromedarii*, 1. The upper folds are clear. 2.Dark scutum. 3. Short lateral grooves. 4. Four lower ridges 5. Middle festoon pale color. 6. Posteromedial grooves present. 7. Paramedian grooves large. B. Ventral view 8. spiracle areas have sparse setae. 9. Round ends of adanal plates. 10. Subanal plates distinct.

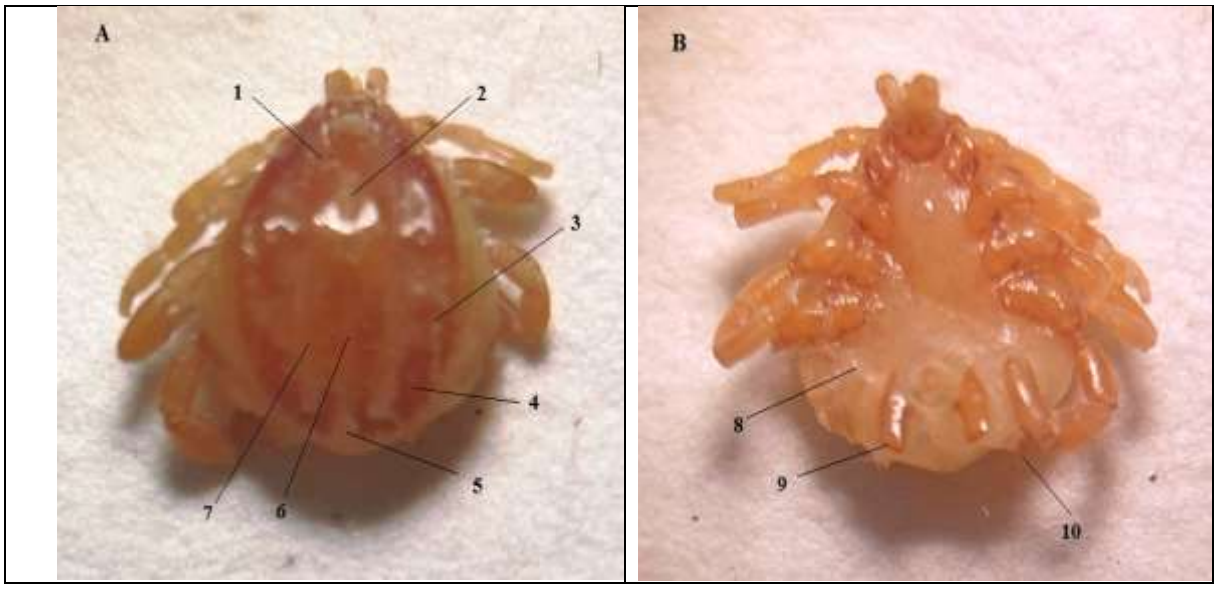


Figure 2: A. Dorsal view of male *H. schulzii* 1. The upper folds are clear. 2.Pale scutum. 3. Short lateral grooves. 4. Two lower ridges. 5. Middle festoon pale color. 6. Posteromedial grooves present (long and narrow). 7. Paramedian grooves large. B. Ventral view. 8. Spiracle areas have sparse setae. 9. Square ends of adanal plates. 10. Subanal plates distinct and large.

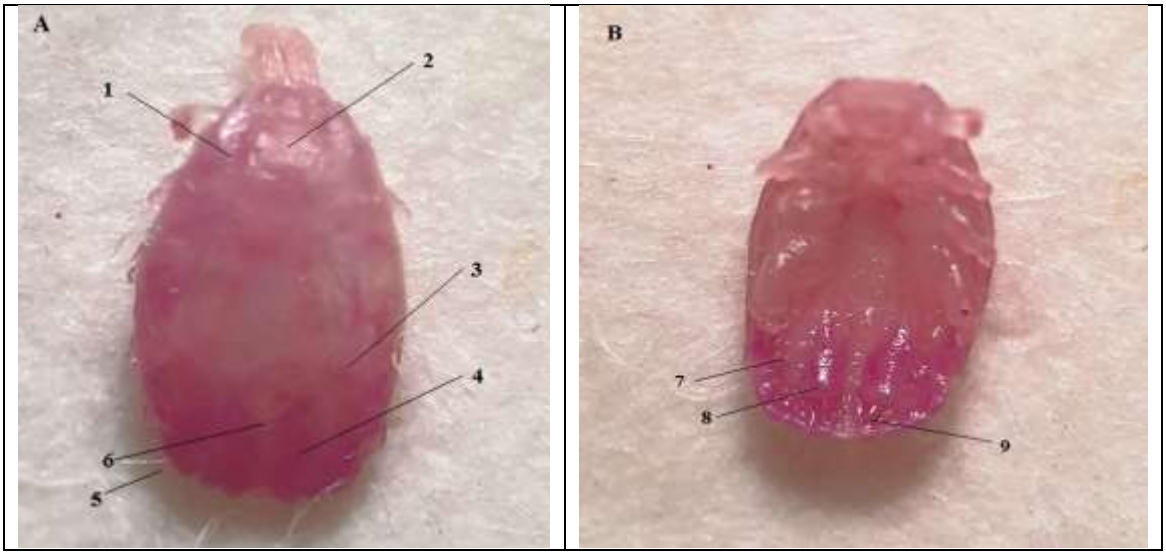


Figure 3: A. Dorsal view of male *H. turanicum* 1. The upper folds are clear. 2. Dark scutum. 3. Short lateral grooves. 4. Two lower ridges; caudal depression present (but shallow). 5. Paramedian grooves absent. 6. Posteromedial grooves present (narrow and shallow). B. Ventral view 7. Space between spiracle and plate. 8. Round ends of adanal plates. 9. Subanal plates distinct.

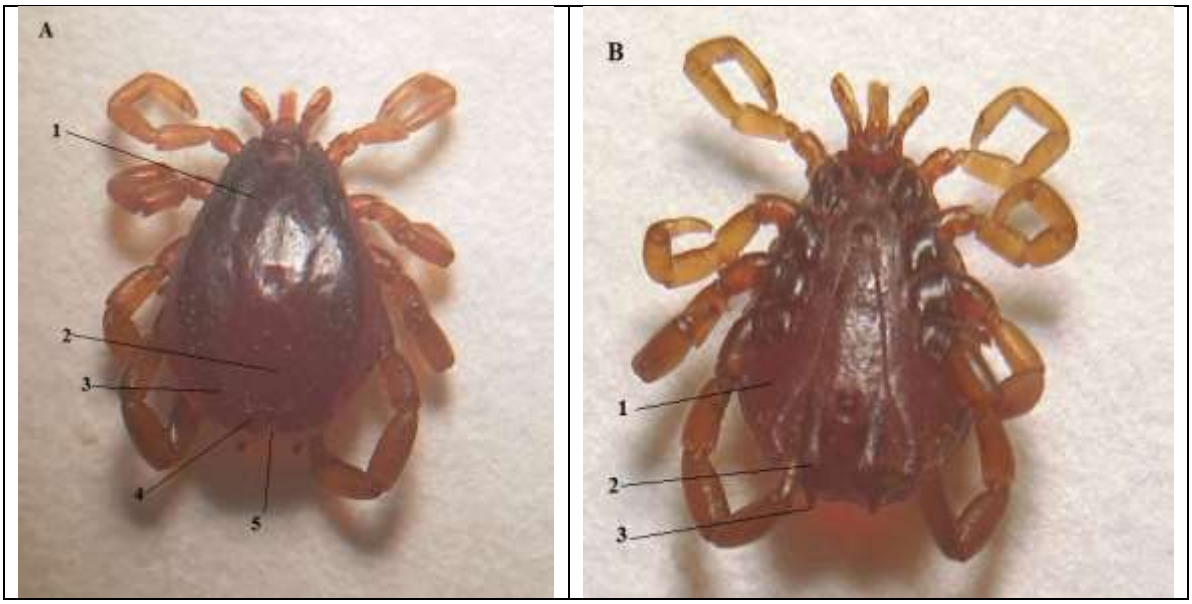


Figure 4: A. Dorsal view of male *H. excavatum* 1. The upper folds are clear. 2. Posteromedial grooves present. 3. Short lateral grooves. 4. Paracentral festoons joined anteriorly. 5. Middle festoon pale. B. Ventral view 1. Space between spiracle and plate. 2. Square ends of adanal plates. 3. Subanal plates distinct.

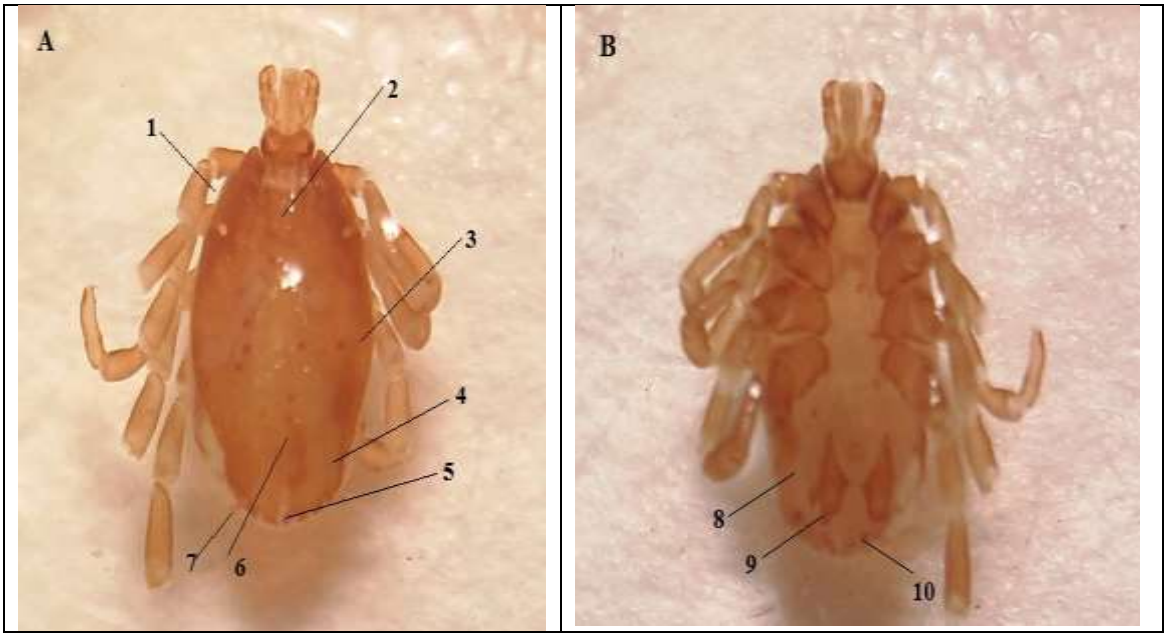


Figure 5: A. Dorsal view of male *H. truncatum* ,1. The upper folds are not clear. 2. Smooth and shiny scutum. 3. Long lateral grooves. 4. Two lower ridges; caudal depression present and deep. 5. Middle festoon dark color. 6. Posteromedial grooves absent. 7. Paramedian grooves absent. B. Ventral view 8. Space between Spiracle and plate. 9. Square ends of adanal plates. 10. Subanal plates distinct but small.

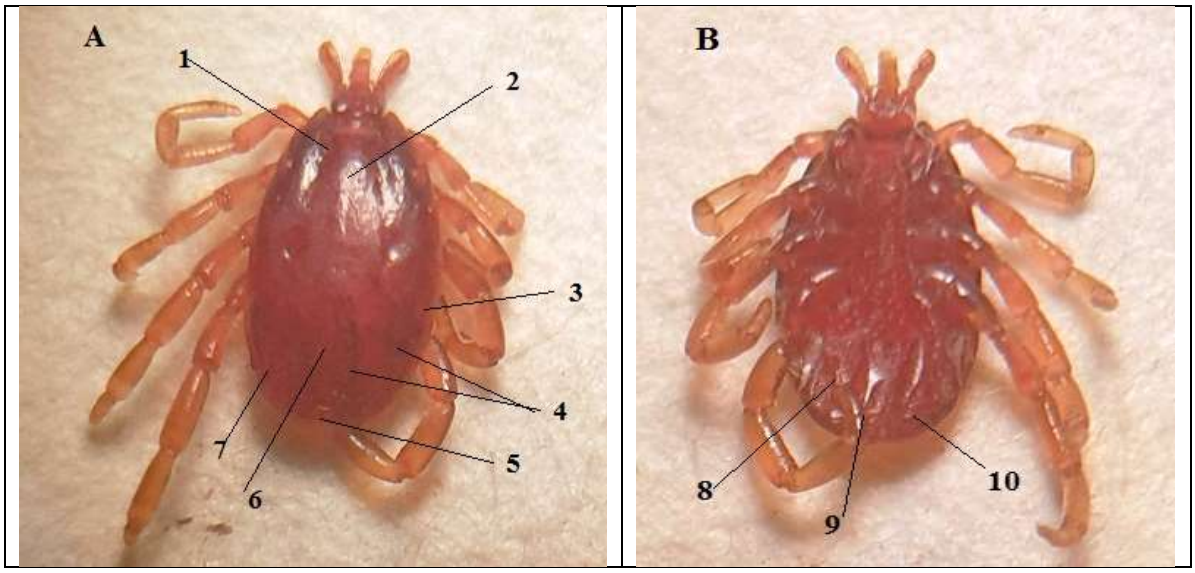


Figure 6: A. Dorsal view of male *H. scupense*, 1. The upper folds are clear (but small). 2. Dark scutum. 3. Long lateral grooves. 4. Four lower ridges. 5. Middle festoon pale color. 6. Posteromedial grooves present. 7. Paramedian grooves large. B. Ventral view 8. Space between spiracle and plate. 9. Square ends of adanal plates. 10. Subanal plates distinct.

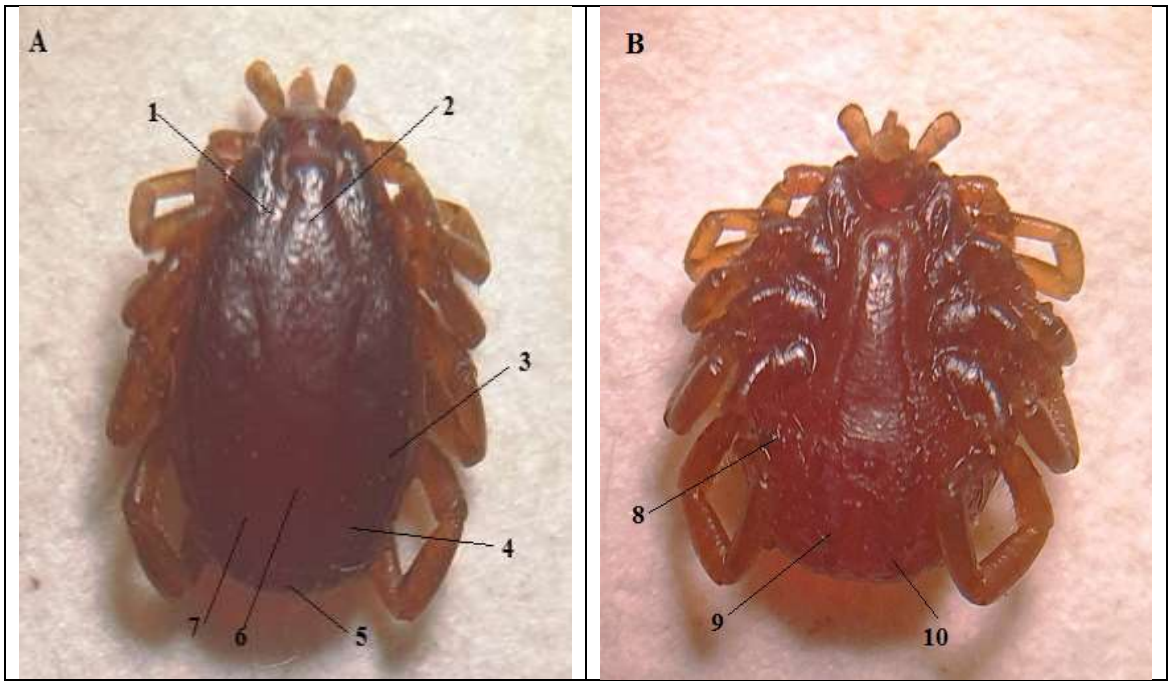


Figure 7: A. Dorsal view of male *H. marginatum* ,1. The upper folds are clear. 2. Dark scutum. 3. Long lateral grooves. 4. Two lower ridges; caudal depression present (but shallow). 5. Middle festoon dark color. 6. Posteromedial grooves present. 7. Paramedian grooves small. B. Ventral view 8. Space between spiracle and plate. 9. Square ends of adanal plates. 10. Subanal plates distinct but small.

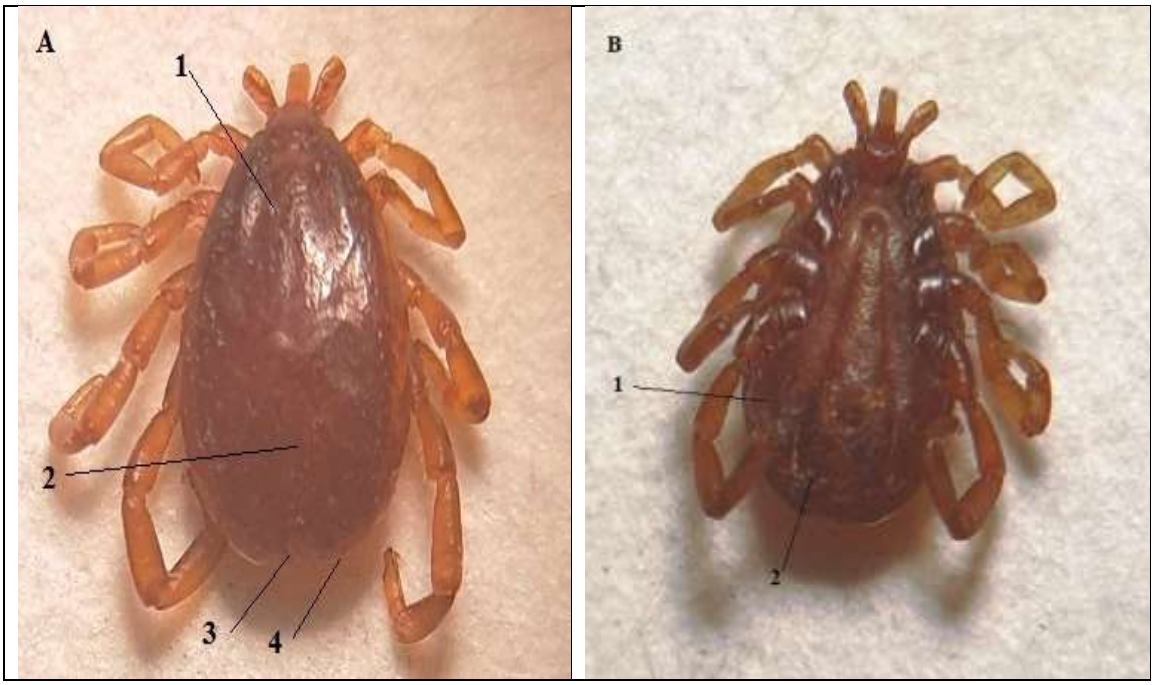


Figure 8: A. Dorsal view of male *H. anatolicum*, 1. The upper folds are clear. 2. Posteromedial grooves present (long and narrow). 3. Middle festoon dark color. 4. Paracentral festoons separate anteriorly. B. Ventral view 1. Space between Spiracle and plate. 2. Round ends of adanal plates.

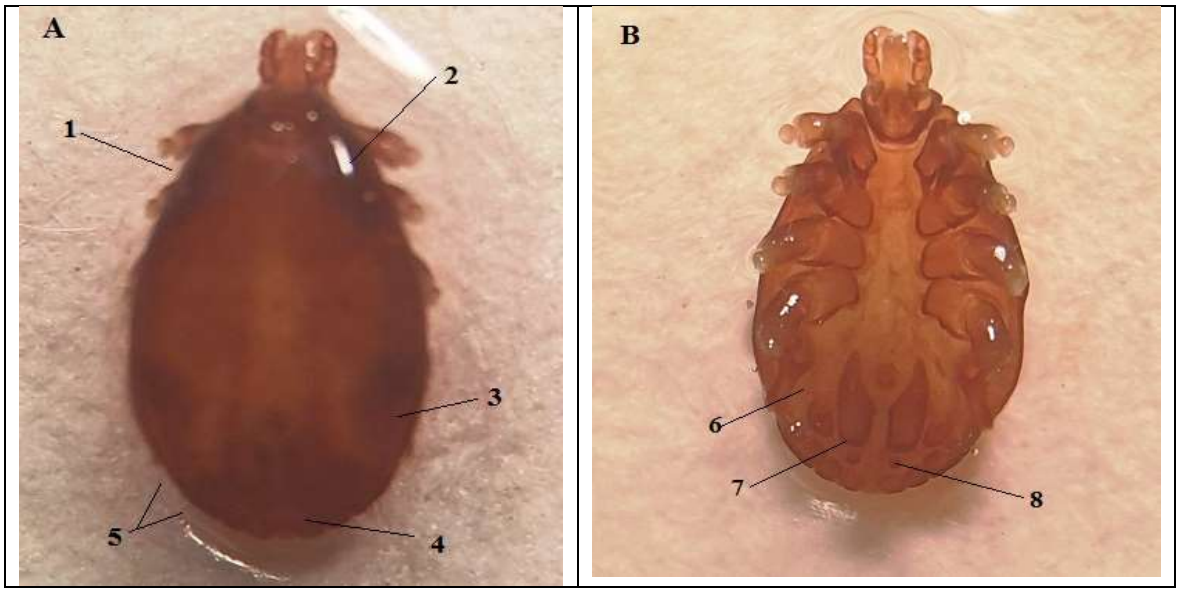


Figure 9: A. Dorsal view of male *H. rufipes*, 1. The upper folds are not clear. 2. Dark scutum. 3. Short lateral grooves. 4. Lower ridges absent; caudal depression absent. 5. Posteromedial grooves absent; Paramedian grooves absent. B. Ventral view 6. Space between spiracle and plate. 7. Square ends of adanal plates. 8. Subanal plates distinct.

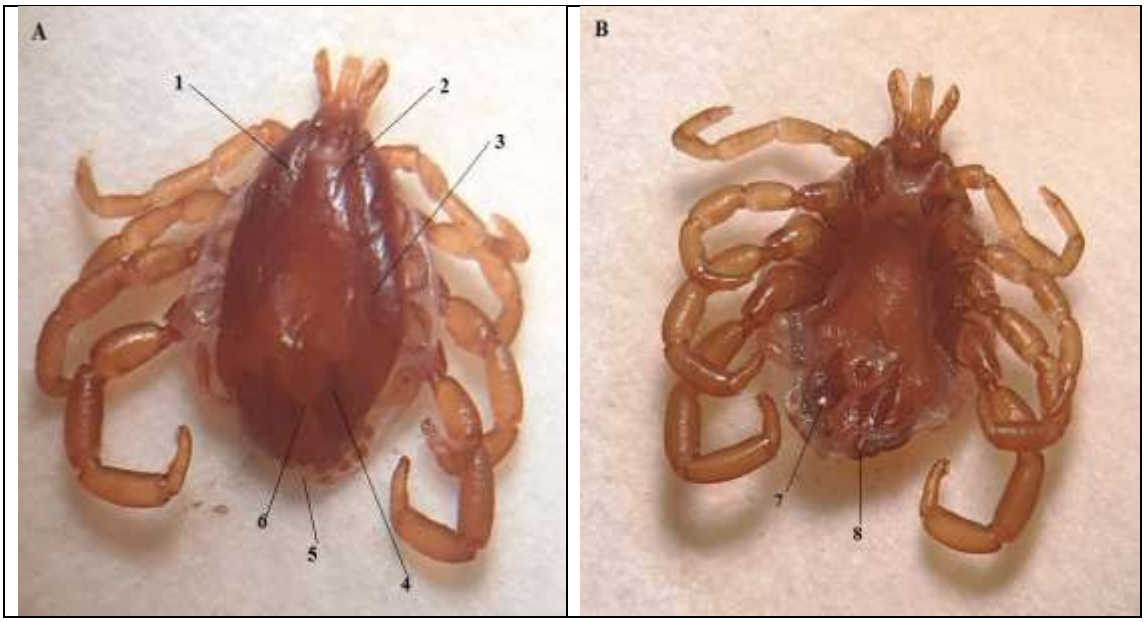


Figure 10: A. Dorsal view of male *H. impeltatum*, 1. The upper folds are clear. 2. Dark scutum. 3. Long lateral grooves. 4. Two lower ridges. Caudal depression present. 5. Middle festoon pale color. 6. Posteromedial grooves present. B. Ventral view 7. Square ends of adanal plates. 8. Subanal plates distinct.

Discussion

The current study found total infestation rate of 87.5 % of hard ticks which agrees with Hussein & AL-Fatlawi [12] who revealed 83% total infestation rate in camels of Al-Qadysia city. However, it disagrees with Abdul Al- Rahman *et al*., [13] who revealed 98.43 % total infestation rate among camels of Al-Muthanna province in Iraq. This difference in results may be due to the wide geographical area for sampling which included six provinces of Iraq.

The current study recorded ten species of hard ticks in camels in Iraq. Whereas previously Mohammed [14] had recorded six species of hard ticks in Iraq: *H. dromedarii, H. schulzii, H. turanicum, H. excavatum, H. anatolicum* and *H. impeltatum*. However, Hussein & Al-Fatlawi [12] and Abdul Al-Rahman *et al*., [13] revealed *Hyalomma* spp. and *Boophilus* spp. in camels of Al-Qadysia and Al-Muthanna provinces respectively. While Shubber [15] recorded seven species of *Hyalomma* that infested camels included *H. anatolicum, H. dromedarii, H. excavatum, H. scupense, H. turanicum, H. impeltatum* and *H. schulzii* in the middle and south of Iraq. More than Mohammed [16] recorded five species: *H. anatolicum, H.* excavatum, *H. turanicum, H. dromedarii* and *H. schulzei* in camels in Iraq. Therefore, it is of importance to note that the other three *Hyalomma* species discovered in the current study have never been observed in camels in Iraq because camels are thought to be a new host for these species: *H. truncatum* (Koch, 1844), *H. marginatum* (Koch, 1844) and *H. rufipes* (Koch, 1844).

From previous references in the world, Elghali and Hassan, [17] recorded five species of *Hyalomma* that infested camels in north of Sudan: *H. dromedarii, H. impeltatum, H. truncatum, H. anatolicum* and *H. marginatum.*

More of that, Fard *et al*., [18] revealed four species of *Hyalomma* that infested camels in southeast of Iran were *H. dromedarii, H. excavatum, H. anatolicum* and *H. marginatum.* In central Tusinia, Ghabri *et al*., [19] revealed four species of *Hyalomma.* However, in the United Arab Emirates (UAE), Al-Deeb [20] revealed only one specie, *H. dromedarii*, that infested the camels.

The current study recorded that *H. dromedarii* was more dominant (53.34%) than other species. This result agrees with Ghashghaei *et al*., [21] from southeast of Iran and with Perveen [22] from the Middle East and North African (MENA) countries. Also in Algeria, 25.7% camel females had aborted because of ticks infestation of the species *Hyalomma dromedarii* (90.9%) and *Hyalomma impeltatum* (5.37%) [23]. Generally, all animals could be infested by one or two species of hard ticks [24]. The current results may be more important available data for risk topic about hard ticks infestation in camels.

Conclusion

This comprehensive survey provides basic data on the infestation of camels by hard ticks' species in the 21 regions of West, Center and Southern Iraq distributed over six provinces where camels are in found in abundance.

The current study results revealed ten species of hard ticks: *H. dromedarii, H. schulzii, H. turanicum, H. excavatum, H. truncatum, H. scupense, H. marginatum, H. anatolicum, H. rufipes* and *H. impeltatum*. As camels have been thought of as novel hosts for hard ticks, the results of the current investigation led to the discovery of three new species (*H. truncatum, H. marginatum,* and *H. rufipes*).

Acknowledgement

The authors would like to thank the scientific team in the Vertebrates lab of Iraq Natural History Research Center and Museum (INHM) for helping in collecting the samples.

Conflict of Interest

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

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