

Study of the Prevalence of Hard Ticks on Sheep in Mosul City, Iraq

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Abstract

Background: Ticks are important arthropods that infect small ruminants and are a source of concern, especially in areas that depend economically on animal products. Hard ticks are very important vectors for the transmission of blood parasites such as *Babesia* and *Theileria*. Important genera of ticks in sheep include *Hyalomma* and *Rhipicephalus*. **Methods:** Tick samples were collected from sheep from different areas of Mosul city. Hard ticks are diagnosed by studying morphological characteristics using a dissecting microscope and making permanent slides after passing tick samples through increasing concentrations of ethyl alcohol. **Results:** The results of this study showed that the total infestation rate of hard ticks in sheep in Mosul city was 19.25%. Two genera of ticks were identified: *Hyalomma* (*Hyalomma anatolicum anatolicum* and *Hyalomma anatolicum excavatum*) and the genus *Rhipicephalus* (*Rhipicephalus turanicus*). The highest rate of tick infestation was observed in females (25.59%), while in males, the rate was 12.16%. The highest rate of tick infection occurred in sheep aged 1–3 years, reaching 28.44%. This study showed that the highest rate of tick infection in sheep was during the summer months (June, July and August), reaching 42.42%, 63.88% and 36.11%, respectively, followed by the autumn months (September, October and November), reaching 25.71%, 22.85% and 11.42%, respectively. No ticks were observed on sheep during the winter months. **Conclusion:** In this study two genera of ticks were identified, a significant difference in the rate of ticks presence between the winter and summer months, female and males of sheep and also among age groups of sheep.

Keywords: Diagnosis, hard ticks, morphology, prevalence, species

INTRODUCTION

Ticks are arthropods that infect large numbers of mammals, they infest on different species of hosts(1). Ticks are causing direct and indirect effects on host such as sucking blood and toxic secretion(2) Ticks act as a vector of different pathogens including: haemoprotozoan, bacteria and viruses(3). Ticks involve two famous families including of ticks: Ixodidae and Argasidae(4). The genera of hard ticks are *Rhipicephalus*, *Boophilus*, *Hyalomma* and *Amblyomma*(5).

In Nineveh governorate, Al-Mawla and Rahimo(6) classified hard ticks parasitic on cattle, buffalo, sheep, goats, horses, camels and dogs and recorded four genera of ticks they are *Hyalomma*, *Rhipicephalus*, *Boophilus* and *Amblyomma* and referred that the genus *Hyalomma* constituted the highest percentage of infestation 46%, followed by *Rhipicephalus* 31%, *Boophilus* 17% and *Amblyomma* 6%. In Duhok city, Ismael and Omer(7) detected microscopically *Rhipicephalus* spp., *Hyalomma* spp. and *Boophilus* spp. in small ruminants.

This study was conducted to diagnose the species of ticks in sheep in different regions of Mosul city and study the morphological and biometrical characteristic of ticks.

MATERIALS AND METHODS

Ticks samples

Ticks samples were collected from both sexes and different ages of sheep the age of the animal was determined based on the teething mechanism according to the method(8), and from five region in Mosul city including: Hamam AL Alil, College of Agriculture and Forestry, Kogiali, Badush, Al-Shora from November 2023 to October 2024. The females and males of

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ticks were removed from the different parts of body of sheep (the head, the neck, the ears, hind limbs, udder, etc.) using forceps with a pointed end, using a piece of cotton moistened with 70% ethyl alcohol. The tick samples were kept in 70% ethyl alcohol.

The ticks was placed on the petri-dishes and examined by using dissecting microscope for diagnose the species of ticks according to the morphological characteristics and prepare the permanent slides from the ticks (The samples were placed in a 10% KoH solution and passed through increasing concentrations of ethyl alcohol, 30%, 50%, 70%, 90% and 100%, for half an hour for each concentration, then the samples were soaked in xylol for an hour with monitoring, finally loaded with DPX)(9).

The study also included identifying some epidemiological factors affecting the spread of ticks, such as region, months of the year, age and gender.

The results were analysed statistically using the Chi-square test.(10) The significant difference was calculated when the value of $P < 0.05$.

RESULTS AND DISCUSSION

Microscopic morphological study data of collected hard ticks from 400 sheep indicated that the number of sheep infested with ticks was 77, with a total infestation rate of 19.25% [Table 1].

This result was agreed with Hasson(11) who recorded 19.7% in sheep in Aldoura region south Baghdad, while Hasson and Al-Zubaidi(12) recorded the total rate of infestation with ticks in Wasits province was 79.71% in sheep. Yacob *et al.*(13) recorded a prevalence of 31.8% in sheep in and around Wolaita Sodo also Sertse and Wossene(14) recorded a prevalence of 22.2% in sheep in Ethiopia. Mathewos *et al.*(15) revealed that the percentage of tick species infesting sheep and goats affected by region and high prevalence was recorded 68.33% in sheep In Ethiopia also Desalegn *et al.*, (16) reported a prevalence of 89.9% in sheep.

The observed difference in tick infection rates in this study with the results of other researchers is attributed to several reasons, including the different locations for conducting research studies, climatic conditions, collection time, season, breed, age, number of samples, availability of vegetative components, exposure of ticks to natural predators such as small mammals and exposure to pathogens such as fungi, in addition to the extent of host resistance, management system and grazing(9,17).

Morphological characteristics of the hard tick species identified in the study

Three species of hard ticks have been identified according to(9).

- 1 *Hyalomma anatolicum anatolicum*: The trunk is thin at the top and rounded at the bottom, The base of the capitulum is round in shape, The coxa of the first pair of legs is branched into a thin external spur and a wide internal

one, The scutum is ornate and festoons are presence, the spiracles are comma in shape, it contains an anal shield and an anal appendage and two subanal plates that protrude outside the body, which is an important feature of this species [Figure 1]

- 2 *Hyalomma anatolicum excavatum*: The chelicerae and hypostome is longer than the length of the basal part of the capitulum, the area under the mouth and the chelicerae is longer than the length of the base of the capitulum, The base of the capitulum is round in shape, Cervical fields depression is apparent, posterior ridges number two, Caudal depression with pale centre festoon, the subanal plates correspond with the adanal plates; the subanal plates are distinct, while the adanal plates have square ends [Figure 2]
- 3 *R. turanicus*: The body consists of the hexagonal capitulum with a clear waist at its junction with the trunk, The chelicerae and hypostome are as long as the

Table 1: The overall infestation rate of sheep infected with hard ticks

Infestation rate	Number of infested sheep with tick	Number of examined sheep
19.25	77	400



Figure 1: Dorsal view of male of *Hyalomma anatolicum anatolicum*

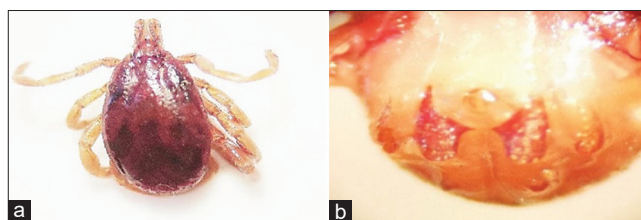


Figure 2: Male of *Hyalomma anatolicum excavatum*. (a) Dorsal view, (b) Ventral view



Figure 3: Male of *Rhipicephalus turanicus*. (a) Dorsal view, (b) Ventral view

base of the capitulum, the trunk is thin at the top and rounded at the bottom, the four coxa are slightly spaced apart from each other, the spiracles are comma in shape and the end of the body, especially in the middle is characterised by the presence of a caudal process. This is the distinctive diagnostic feature of this species [Figure 3].

In Nineveh governorate, Al-Mawla(18) recorded two species of ticks in cattle and sheep they are *Hyalomma analoticum analoticum*, *Rhipicephalus sanguineus*, in Duhok governorate, Iraq, Ismael(19) reported four species of ticks in sheep and goats including: *R. turanicus*, *R. sanguineus*, *Hyalomma analoticum* and *Hyalomma marginatum*. In Erbil province, Aziz(20) diagnosed by microscopically and molecular examination two species of ticks in sheep was *Hyalomma excavatum* and *R. sanguineus* with 29.1% and 28.3%, respectively. In Baghdad, Hasson(11) reported three genera of ticks were *Hyalomma* 70%, *Rhipicephalus* 25% and *Boophilus* 5%.

It was noted in this study that the rate of tick presence in female sheep was 25.59% higher than its rate in males 12.16%. The study also showed a significant difference in the rate of tick presence between females and males of sheep [Table 2].

Different letters indicate significant difference at $P \leq 0.05$.

These results could be attributable to that the females may feed on fields where they are in touch with other animals and they are also allowed to live for a longer period of time for birth-giving purposes and the stress in females due to milking, pregnancy and parturition, which could lead to hormonal abnormalities that decrease immunological status, potentially contributing to increased tick infestation rates in females Sajid *et al.*,(21) these results agree with the study of Ismael and Omer(7), in Duhok governorate, Iraq who referred that the prevalence of tick in females of sheep was 32.6% and 21.15% in male. In Ethiopia, Mathewos *et al.*(15) showed the reason for female animals having a higher frequency of tick infestation is unknown and may be the females live for a longer period of time for birth-giving purposes, which increases their chances of being infested with ticks than males who are primarily kept at home for fattening (meat purpose) for a short period of time. The findings of this investigation had difference with the results of Hasson(11) in Baghdad south suburb which reported that infestation rate was higher in male than female which was 14.8% and 4.9%, respectively.

The study demonstrated considerable differences in the rate of tick presence among different ages of sheep, as the rate of tick presence was higher in sheep aged 1–3 years, 3–5 years and over 5 years, reaching 28.44%, 20.35% and 21.27% respectively, compared to the rate of tick presence in sheep aged <1 year, which reached 2.59% [Table 3].

Different letters mean significant disparities among age groups of sheep at $P \leq 0.05$.

The highest incidence of tick infestation was in sheep older than 1 year, which is consistent with Mathewos *et al.*(15) In

Ethiopia showed tick infestation was more prevalent in aged animals. This could be the young animals grazed until they became stronger, lowering their odds of contracting ticks when compared to older animals maintained outside. This, in turn, adds to a lower risk of tick exposure since the number of ticks in the household is lower, and the immunity and resistance of animals play important role in infection with ticks.

The study found that the highest rate of tick presence on sheep occurred during the summer months, followed by the autumn months. No ticks were seen on sheep during the winter months and most of the spring months. A considerable variation was observed in the occurrence of ticks throughout the winter months compared to the summer months [Figure 4].

The results of our study agreed with what was recorded by Al-Mawla(18) in Nineveh Governorate, the highest occurrence of ticks occurred throughout the summer months, 46%, while

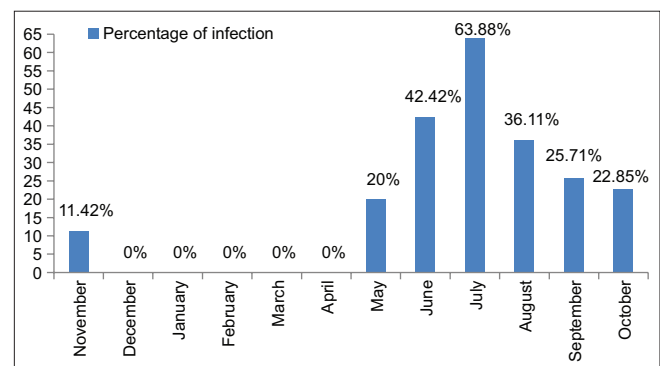


Figure 4: Demonstrates the association between the rate of tick infestation in sheep and the months of the year (November 2023–October 2024)

Table 2: The link between the rate of infestation and the tick species to the sex of sheep

The sex of sheep	The number of samples examined	Number of positive samples	The rate of infestation	P
Females	211	54 ^a	25.59	0.0001
Males	189	23 ^b	12.16	
Total	400	77	19.25	

^{a,b}different letters mean significant, difference between females and males of sheep

Table 3: The relationship of tick species infestation to the ages of the examined sheep

Age of sheep (years)	The number of examined sheep	The number of positive sheep	Infestation rate
<1	77	2 ^a	2.59
1–3	109	31 ^b	28.44
3–5	167	34 ^b	20.35
More than 5	47	10 ^c	21.27
Total	400	77	19.25

^{a,b,c}different letters mean significant difference between ages of sheep while similar letters mean no significant differences

the infection rates were low during the spring, fall and winter months. In Wasit's districts, the findings revealed two peaks of infection over the hot months of the year, Hasson and Al-Zubaidi(12). In Aldoura region south Baghdad Hasson(11) showed that occurrence of ticks was higher during the summer. In Saudi Arabia, Al-Khalifa *et al.*(22) observed that tick prevalence was higher during the summer season. Deger *et al.*(23) to the extent of the significance of the current environmental circumstances, such as temperature in the growth and reproduction of ticks because with the rise in temperature, the ability of ticks to reproduce and search increases.

Temperature, relative humidity and rainfall are the main environmental factors that effect on tick survival at various stages of their life cycle. Temperature is the primary factor that affects metabolic rate and influences both the efficiency of blood-meal utilization and the length of the pre- and oviposition periods, as well as subsequent developmental rates and embryonal egg viability. Furthermore, relative humidity controls ticks' water-balance systems. Low relative humidity stresses ticks' water balance and appears to reduce the efficiency of converting blood meal into egg biomass. Thus, the RH is regarded as a major limiting factor in the geographical distribution of certain tick species. No ticks were collected during the winter season when the temperatures are too low for it to survive(24).

CONCLUSION

It was concluded from this study that there are significant differences in tick infestation between male and female sheep, as well as between different age groups, and that the highest rate of tick presence on sheep was during the summer months.

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Conflicts of interest

There are no conflicts of interest.

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