European Journal of Research Development and Sustainability (EJRDS)
Available Online at: https://www.scholarzest.com
Vol. 5 No 09 September 2024
ISSN: 2660-5570

EPIDEMIOLOGY AND SPREAD OF TICKS AND HORSEFLIES IN CATTLE FARMS IN THE CITY OF SAMARRA

Athraa Hamid Jasim Al-Rahmani[1] Ashraf Jamal Mahmmoud[2] Fouad Ahmed Abdulla[3]
1,2 ,Department of Biology, College of Education for Women, Tikrit University, Iraq.
3 ,Department of Biology, College of Education, Samarra University, Iraq.
Email1: biology.insect@uosamarra.edu.iq

Article history:
Received: 6th June 2024
Accepted: 4th July 2024

Abstract:
The study aimed to determine the prevalence of Ticks and Horseflies on cattle in the Samarra district and its surrounding areas from October 2022 to October 2023. A total of 2,310 cattle was examined, with 1,487 found to be infested with ticks, representing an infestation rate of 64.372%. In contrast, 732 cattle were infested with horseflies, representing an infestation rate of 7.17%. The highest tick infestation rate was recorded in July at 100%, followed by August, September, June, and May, with rates of 90%, 84%, and declining with the decrease in temperatures entering October, November, December, and January, where the infestation rates dropped to 24.70%, 13.23%, 11.17%, and 9.25%, respectively. The results showed that the percentage of horsefly infestations over the months of the year was relatively low, with horseflies observed on the bodies of some cattle from which tick samples were isolated. The highest infestation rate was recorded in August at 3%, followed by May at 2.85%, and the lowest rate was recorded in October at 1.32%. The results indicated a higher infestation rate of hard ticks and horseflies in female cattle compared to males, with female cattle having a tick infestation rate of 68.001%, while the male infestation rate was 36.121%. The study also showed that the horsefly infestation rate in female cattle was 0.781%, compared to 0.760% in males. Additionally, the current study identified two genera of hard ticks, Hyalomma, which included species such as H. excavatum, H. anatolicum, and H. scupense. For the first time in Samarra, the species H. impeltatum, H. impressum, and H. rufipes were also identified. The genus Rhipicephalus was also identified, including the species Rh. sanguineus, which was recorded for the first time in Samarra and some surrounding areas.

Keywords: Hyalomma, H. rufipes, Tabanus, Flies

1.1. INTRODUCTION:-

Arthropods comprise more than 80% of the known animal species in the animal kingdom. Due to their activity, the ectoparasites among them have diverse direct and indirect effects on their hosts, particularly in tropical and subtropical countries, as environmental factors in these regions influence the distribution and spread of many animal species, especially ectoparasites (Katahira, *etal.*, 2021; Pedigo & Rice, 2014) .

Hard ticks are among the arthropods of medical and veterinary importance, transmitting various disease-causing microorganisms such as protozoa, viruses, and bacteria. They feed on the blood of vertebrates, and hot and humid environments help them survive, while cold and dry environments hinder their growth and development (Hurtado & Giraldo, 2018; Tenzin & Rinzin, 2023).

Ticks are obligatory blood-feeding ectoparasites that affect all terrestrial vertebrates and have the ability to transmit a wide range of pathogens to humans and animals. They have a direct impact on ruminant animals from both veterinary and economic perspectives, as they are vectors of many blood-borne protozoa in addition to toxins that cause reduced production levels and deterioration in the health condition of animals, especially the hard ticks of the genera *Hyaloma* and *Boophilus*. These are among the most important genera in cattle and buffalo fields, responsible for transmitting blood parasites such as *Babesia*, *Anaplasma*, and *Theileria* (Elhachimi, *et al.,* 2022).

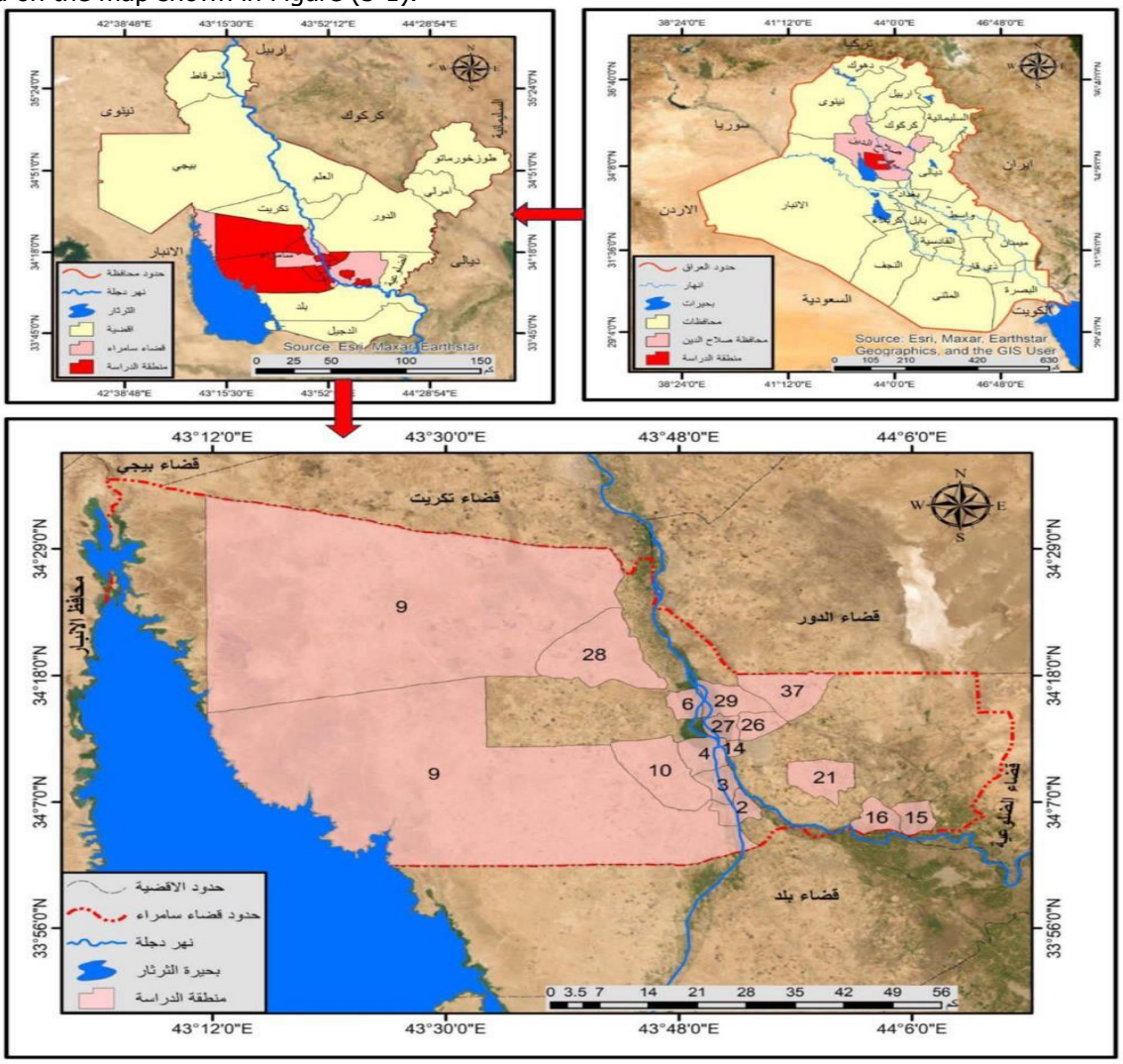
1.2-Aim of study:-

1-Investigate the prevalence of ectoparasite infestations (ticks and horseflies) that affect cattle.
2-Assess the impact of various factors such as gender, months of the year, and geographical location on the prevalence and spread of infestation over an entire year.

2-MATERIALS AND METHODS

:Field Study2- 1.

A field survey was conducted in the Samarra district and its surrounding areas on cattle from the following regions: Muayjil, Al-Rakah, Mashayhad, Al-Qal'ah, Al-Qadirah, Al-Harijiyah, Al-Jazeera, Western Samarra Island, Abu Al-Hail, Samarra Municipality, Al-Turayshah, Al-Sa'idiyah, Banat Al-Hassan, Tal Al-Aleij, Hawi Al-Bisat, Abu Tuwainah, Shanas, and Al-Rafee'. Visits were made twice a week, depending on the availability of locations where animals were present, as indicated on the map shown in Figure (3-1).



Figure(1)shows a map of Iraq, Salah al-Din Governorate, Samarra city, and its surrounding areas, with the districts from which the samples were collected marked on it.

2.2-Collection of Samples:-

2.3-Samples study:-

The current study was conducted in Samarra city and some surrounding areas from 10/10/2022 to 10/10/2023. The study included the collection of ticks, horseflies, and blood samples from both infected and healthy cattle. The specific information for each sample was recorded using the form in Appendix (4).

2.3.1. Collect samples of ticks and horse flies:- Samples of ticks and horseflies were collected from various areas of the cattle's body using medical cotton soaked in 70% ethyl alcohol. The cotton was applied to the area containing the ticks to facilitate their isolation (Soulsby, 1986). The ticks were carefully removed from the cattle's skin using a small, broad-tipped forceps to avoid damaging the mouthparts, which are essential for morphological diagnosis. The horseflies were collected using aerial nets, then placed in glass tubes containing 70% ethyl alcohol. Information related to each sample, such as the date of collection, the location of the tick or fly on the animal's body, the animal's age, and the region from which the tick or fly was collected, was recorded.

2.3.2-Samples diagnosis:- The species of ticks and horseflies listed in the table were identified at the Research Center and Natural History Museum of the University of Baghdad, according to document number 566 dated 4/4/2024 (Appendices 1, 2, 3).

2.3.3. Phenotypic Study:- The method described by Karatepe, (2017) was used, which involves removing the ticks or horseflies from the alcohol in which they were preserved, washing them with distilled water, and leaving them in the water for 5 minutes to remove alcohol and impurities. They were then allowed to dry. Subsequently, the samples were placed in plastic tubes containing 10% KOH and left for two days to soften and achieve the required transparency. The samples were then passed through increasing concentrations of ethyl alcohol (100%, 90%, 80%, 70%) for one day each. After this step, a white, gel-like substance in small amounts appeared at the bottom of the plastic tube. The

sample was placed in a funnel with filter paper to remove the alcohol and gel-like substance. The samples collected on the filter paper were then transferred to a higher concentration of alcohol. Following this, the samples were placed in xylol solution for two days and then examined under a light microscope with 40X and 10X magnification to obtain a clear image of the sample (Majeed, *et al.*, 2012).

2.4. The percentage of infection external parasites

The percentage of animals infected with external parasites in the visited sites with cattle fields was obtained by dividing the number of infected individuals by the total number of individuals, multiplied by 100, according to Reiczigel, *et al.,* (2009) using the following formula:-

Percentage of infection = (Number of infected animals / Total number of animals) × 100

3. RESULTS AND DISCUSSION:-

3.1- Epidemiology study:-

The survey study on the prevalence of ticks and horseflies was conducted among 2,310 cattle (20 males and 2,290 females) from various districts of Samarra and its neighboring areas. The study was based on visual inspections from October 10, 2022, to October 10, 2023.

3.1.1-The overall prevalence of hard ticks and horseflies: The results of the study showed that the prevalence of tick infestation in cattle reached 1,487 out of 2,310 cattle, with a percentage of 64.372%. The study also indicated that the prevalence of horsefly infestation in cattle reached 732, with a percentage of 7.17%, as shown in Table (1-3).

Table (3-1): The Overall Infestation Rate of Hard Ticks and Horseflies in Samarra City and Its Surrounding Areas.

The number of examinees	The number of infected with ticks/horseflie	The percentage of infection%
2310	1487	64.372
2310	732	7.17

Tick infestation is considered one of the most serious health problems facing both humans and animals. Ticks are among the most dangerous external parasites, feeding on the blood of mammals, birds, and reptiles, and transmitting various serious diseases, including parasitic diseases like Babesiosis, Theileriosis, and Anaplasmosis, as well as other conditions such as Lyme disease, Rocky Mountain spotted fever, and encephalitis. Previous studies have shown that tick infestation leads to a significant decline in the health of cattle, which negatively impacts their productivity and economic value. It also increases their susceptibility to tick-borne diseases (Magesa ,*etal.*, 2023).

The variation in the rates of tick infestation and prevalence is attributed to climatic factors, especially the hot months, the biological nature of the animals, and the humid climate. These factors play an important role in the spread of ticks. This is consistent with the study conducted by Hasson and Al-Zubaidi, (2014) on the infestation of cattle and buffalo with ticks in Wasit Governorate to determine the prevalence of tick infestation in cattle and buffalo in four regions of Wasit Governorate during the hot months of 2012. The overall tick infestation prevalence in cattle was 91.3%, which was significantly higher than in buffaloes, with a noticeable statistical difference (P-value ≤ 0.002). No significant statistical difference (P-Value ≥ 0.102) was observed between the overall prevalence of *Rhipicephalus* (48%), *Hyalomma* (38%), and *Boophilus* (14%) on infested cattle and buffaloes. Furthermore, no significant statistical difference (P-Value ≥ 0.143) was observed between the numbers and prevalence rates of infestation in animals recorded in the four different areas of Wasit Governorate, despite the impact of the highest and lowest infestation rates in the cities of Suwaira and Zubeidiya, respectively. The study also indicates statistically significant differences in the numbers of tick genera and the prevalence rates among animals distributed across the research months, with the highest infestation recorded in July and the lowest in May, confirming the influence of environmental factors on infestation and prevalence rates. The horsefly *Tabanus* sp. is one of the most important external parasites that negatively affect the lives of humans and livestock. The variation in its spread is attributed to climatic conditions such as temperature and humidity, which are conducive to its reproduction and spread. Studies have shown that horseflies are more active during the day in warm environments at certain temperatures, while their activity decreases in very low or very high temperatures. Scientific sources indicate that the spread of horseflies and their presence on cattle are due to the moist and warm environments preferred by horseflies, which are available in rural areas and barns. They are also attracted to places with stagnant water, such as ponds and swamps, where they lay their eggs De Oliveira Zamarchi, *et al.,* (2024). Scientific sources have indicated that female horseflies need blood meals from mammals to produce eggs, which drives them to attack cattle to obtain the necessary blood meal for their reproduction (Horvath, *et al.,* 2020). Studies have proven that horseflies prefer to be present in areas where cattle are found, as they are animals with dark bodies that retain more heat, attracting flies to them (Horvath, *et al.,* 2019).

3.1.2-Prevalence and distribution of hard ticks by the districts included in the studies in the city of Samarra and its surrounding areas, distributed by months of the year as shown in Table (3-2).

Table (3-2) Prevalence and Distribution of Hard Ticks by Included Provinces

Year Months	Geographical Location or Provinces	number of examinees	Number Of infection	The percentage of infection%
Oct.	Muayjil, Al-Rakah, Mashayhad	226	56	24.70
Nov.	Al-Qal'ah	68	9	13.23
Dec.	Al-Jazeera, Western Samarra Al-Jazeera	170	19	11.17
Jan.	Samarra Municipality	108	10	9.25
Feb.	Qadirah, Al-Harijiyah, Abu Al-Hail	87	0	0.00
Mar.	Al-Turayshah, Al-Sa'idiyah	46	10	21.73
Apr.	Al-Qal'ah ، Tal Al-Aleij	49	30	61.22
Ma.	Tal Al-Aleij ، Western Samarra Al-Jazeera	175	130	74.28
Jun.	Shanas، Hawi Al-Bisat	500	415	83
Jul.	Muayjil, Al-Rakah	300	300	100
Aug.	Al-Qal'ah، Abu Tuwainah	331	298	90
Sept.	Al-Turayshah, , Banat Al-Hassan and Al-Rafee	250	210	84

The results showed an increase in the infestation rate by ticks across different months of the year. The results of the study, as illustrated in Table (3-2), demonstrated a higher infestation rate with rising temperatures, with July recording the highest infestation rate at 100%, followed by August, September, June, May, and April, with rates of 90%, 84%, 83%, 74.28%, and 61.22% respectively. As temperatures decreased and the months of October, November, December, and January approached, a decline in infestation rates was observed, registering 24.70%, 13.23%, 11.17%, and 9.25% respectively. It was also observed that the infestation rate diminished to 0.0%. The variation in infestation rates is attributed to differences in environmental conditions throughout the year in addition to biological factors.

According to studies, ticks prefer warm and humid environments to thrive and become active. Their activity decreases with the drop in temperatures, as their life cycle requires environmental conditions of high temperature and humidity, which are conducive to egg hatching and the development of other tick stages (Ogden, *et al.,* 2014).

The findings of our study are consistent with the study conducted by Ogden, *et al.,* 2014 regarding the major factors contributing to the spread of ticks, particularly humidity. It was confirmed that ticks require a humidity level above 85% to grow and develop, and high humidity prevents tick desiccation, which helps in the survival of its various life stages. Furthermore, a temperature above 6°C to 7°C is necessary for tick activity. The study also indicated that higher temperatures accelerate the development of different tick stages and increase their behavior in searching for the

necessary host to provide them with the required blood meals for nourishment and reproduction. The study also pointed out that March and April are critical months for the transmission of tick-borne encephalitis, and favorable conditions for ticks, such as high temperatures between 9°C and 11°C and rainfall of 550 mm, lead to an increase in tick populations and their distribution and spread.

The table (3-3) shows the prevalence and distribution of horsefly *Tabanus* sp. according to the districts included in the study in the city of Samarra and the surrounding areas, distributed by months of the year.

Year Months	Geographical Location or Provinces	number of examinees	Number Of infection	The percentage of infection%
Oct.	Muayjil, Al-Rakah, Mashayhad	226	3	1.32
Nov.	Al-Qal'ah	68	0.0	0.0
Dec.	Al-Jazeera, Western Samarra Al-Jazeera	170	0.0	0.0
Jan.	Samarra Municipality	108	0.0	0.0
Feb.	Qadirah, Al-Harijiyah, Abu Al-Hail	87	0.0	0.0
Mar.	Al-Turayshah, Al-Sa'idiyah	46	0.0	0.0
Apr.	Al-Qal'ah ، Tal Al-Aleij	49	0.0	0.0
Ma.	Tal Al-Aleij ، Western Samarra Al-Jazeera	175	5	2.85
Jun.	Shanas، Hawi Al-Bisat	500	0.0	0.0
Jul.	Muayjil, Al-Rakah	300	0.0	0.0
Aug.	Al-Qal'ah، Abu Tuwainah	331	10	3
Sept.	Al-Turayshah, , Banat Al-Hassan and Al-Rafee	250	0.0	0.0

The results showed that the percentage of horsefly infestation in cattle fields, distributed over the months of the year, was relatively low. Horseflies were observed on the bodies of some cattle, from which tick samples were isolated. The percentage of cattle infested with horseflies was very low, with the highest percentage of infestation recorded in

August at 3%, followed by May, where the infestation percentage was 2.85%. The lowest infestation percentage was in October, at 1.32%. The lower rate of cattle infestation with horseflies compared to ticks may be related to the biological characteristics of both horseflies and ticks. Horseflies tend to attack animals randomly and for a short period to quickly obtain a blood meal before moving on to other animals, making it difficult for the fly to continuously infest cattle compared to ticks, which attach to the host's body for extended periods, feeding on the host's blood for several days or even weeks. This allows ticks to reproduce and spread more effectively compared to horseflies. Additionally, horseflies require environments with abundant ponds and swamps, and if such environments are not available in cattle breeding areas, it leads to a decrease in cattle infestation by horseflies. Furthermore, horseflies are active during specific periods of the year, especially during warm and humid months, unlike ticks, which can be present year-round, increasing the chances of infestation. All these factors are fundamental reasons why the rate of cattle infestation with ticks is higher compared to horseflies. The results of this current study are consistent with the findings of other studies, such as those of Buestan, *et al.,* (2024) who indicated that horseflies in the Pacific rainforest regions are more active during the wet seasons due to increased productivity in tropical forests, and their activity decreases during the dry season when climatic conditions are unsuitable for their reproduction and activity. Among the most significant environmental factors associated with their activity are high temperatures and humidity. The study also indicated that the species *T. columbensis* was the most abundant at 46.5%, with peak fly abundance in August, consistent with our study's findings that the highest abundance and infestation of cattle by horseflies occurred in August. Our study's results also agree with Lucas, *et al.,* (2020) in their study on the seasonal effect on horsefly (Tabanidae) diversity on an experimental farm in Uruguay, which lasted 20 months during which 3,666 horseflies belonging to 16 species were collected using Malaise and Nzi traps. Among the collected species, the most abundant were *T. aff. platensis* and *T. campestris*. They indicated that the horsefly season in Tacuarembó began in September and continued until May, with no flies collected during the winter season, reflecting the seasonal influence on the spread of these flies, which aligns with our study's findings.

3.1.3. Infestation Rate of Hard Ticks and Horseflies by Gender:-

The results showed a higher rate of infestation by hard ticks and horseflies in females compared to males. The infestation rate of females by ticks was 68.001% (1,329 infestations out of a total of 2,047), while the percentage of male infestations was 36.121% (95 infestations out of 263). The results also showed a higher infestation rate of horseflies in female cattle at 0.781% (16 out of 2,047) compared to males, which had an infestation rate of 0.760% (2 out of 263), as shown in Table (3-4).

Table (3-4) The Percentage of Cattle Infestation with Ticks and Horsefly *Tabanus* According to Gender

Genus ♀/♂	Number of examinees	Number Infection of Ticks	Number Infection of Horsefly	The percentage of Ticks infection %	The percentage of horsefly infection%
Males	263	95	2	36.121	0.760
Femalss	2047	1.392	16	68.001	0.781

The results of our study are consistent with the findings of Rashid, (2020) study, Phenotypic Diagnosis of Some Arthropods on Some Animals in Salahuddin," which demonstrated that the number of female ticks on cattle and sheep was higher than that of males. The reasons may be due to the preference of ticks and horseflies for female cattle compared to males, with factors such as hormones and scents secreted by females making them more attractive to ticks. Additionally, pheromones secreted by the females may play a role in attracting ticks to their host, or it could be that female cattle are more prone to tick infestation during pregnancy and lactation due to hormonal changes. Moreover, the skin of female cattle differs in thickness or chemical composition compared to that of males, making them more susceptible and attractive to ticks and horseflies. Another possible reason is that cattle graze in areas with a higher number of ticks, which aligns with scientific studies that examined the interactive effects, biological factors, human factors, and environmental factors on tick populations in Boran cattle in dry and tropical environments. These studies highlighted the importance of environmental factors, showing that different cattle breeds in dry regions such as Boran, Aberdeen, Angus, and Ankole exhibited varying levels of infestation based on sex, age, and body condition, which played a significant role in infestation. The study results indicated that cattle in poor health were more susceptible to tick infestation, and no significant differences were observed between male and female cattle regardless of the season. This contrasts with our study's findings, which confirmed a significant difference between male and female cattle depending on the study season (Chepkwony, 2021). A study published in BMC Veterinary Research also indicated that ticks and horseflies prefer infesting female cattle compared to males. It showed that female cattle were more prone to tick and horsefly infestation at a rate of 63.63% compared to males, which had an infestation rate of 50.84%. The study suggested that this preference was due to differences in the hormones and scents secreted by females, making them more attractive to ticks and horseflies (Magesa, *et al.,* 2023).

Our results also agree with the findings of Tahmaz, (2021) in the study "Investigation of External Parasites Affecting Free-Grazing Sheep in the Suburbs of Erbil Governorate with a Biochemical Study of Animals Infected with Ticks and Mites," which showed that the infestation rate of female sheep by ticks was higher than that of males, with rates of 74% and 25.9%, respectively. The highest infestation rate was recorded in April, at 42.6%.

3.1.4-Prevalence Rate by Age Category of Cattle

The study results were divided according to age category into three age groups (1-3), (4-7), and (8-12) years, as shown in Table (3-5).

Table (3-5) Prevalence Rate of Tick and Horsefly Infestation by Age Category

Age Categories	Ticks			Horse flies		
	(1-3) > year	(4-7) year	(8-12) year	(1-3) > year	(4-7) year	(8-12) year
Number of examinees	1080	980	250	1095	975	240
Number of infections	780	562	125	439	268	25
The percentage infection%	72.222%	59.38%	50%	40.091%	27.487%	10.416%

The results of the current study showed that the age groups (1-3) years recorded the highest infection rates with ticks and horseflies, reaching 72.222% and 40.09%, respectively, compared to other ages, where the rates for ages (4-7) years were 27.487% and 59.38% for ticks and horseflies, respectively. The lowest infection rate was observed in the age group (8-12) years, at 10.416% and 50%. One of the main reasons for the higher infection rates in cattle aged (1-3) years compared to other ages is that they are more susceptible to ticks, especially in the early months after birth when their immune system is not fully developed. It is worth noting that cattle are very sensitive to horsefly bites due to their thin skin, particularly calves whose skin lacks a sufficiently protective layer. As a result, horsefly bites cause open wounds and skin infections, increasing the risk of secondary infections at these ages, leading to skin irritation and recurrent inflammation.

Our study's results align with a study published in Veterinary Parasitology, which examined the impact of tick infestation on calves in their early months. The study confirmed that tick infestation causes anemia, weight loss, and stunted growth, further emphasizing the vulnerability of these animals to such parasites (Vouraki *et al.,* 2022). A study in Tanzania indicated that the highest tick infestation rate was in calves, at 51.61%, followed by adult cattle at 40.91%, with the lowest rate observed in juvenile cattle at 39.78%. Another study in India found that cattle younger than 6 months suffered the highest infestation rate, at 72.59%, while the infestation rate decreased to 55.02% in cattle older than one year, which is consistent with the results of the current study (Magesa,*etal.*,2023).

This contrasts with our study, which confirmed that age groups less than one to three years old are more prone to infestation compared to the other ages under study. Our study's results are similar to those of Al-Issawi, (2018) who conducted a survey on some types of ticks infesting cattle and their effect on pathogenic causes and some physiological parameters in Samarra city. The study found that the age of cattle plays a role in the spread of infestation, with the highest tick infestation rate at (1-2) years old, at 61.58%, and the lowest rate at (2-3) years old, at 54.73%. The infestation rate for ages (3-4) years was 37.83%. This discrepancy is due to the host's activity, as ticks do not specialize in infecting a specific age group, as they can infest a wide range of wild and domestic animals of various ages, with a prevalence rate that may reach 100% during their season of spread (Raval , 2013). According to our study, the age of cattle plays an important role in determining the rate and severity of horsefly infestation. The results showed that different age groups have varying rates of infestation, with the age group (1-3) years recording the highest rate compared to older age groups. Our study's results align with Mulandang, *et al.*, (2020) which evaluated the relative role of bloodsucking flies in the Tabanidae and Glossinidae families in transmitting the Trypanosoma parasite in drug-resistant areas in Mozambique and their distribution and spread. The study found that the *Tabanus* fly is more prevalent in open and dry areas, with both species playing a role in transmitting Trypanosoma to cattle due to their presence in environments where cattle are found.

The study also confirmed that calves are more susceptible to horsefly infestation than adult cattle due to their weak immune systems and lack of a thick layer of hair to protect them from fly bites, which aligns with our study's results. Our study's results did not align with the study by Lewis & Leprince ,(2020) in southwestern Quebec, where four types of each genus *Tabanus, Hybmitra,* and *Chrysops* were collected while feeding on cattle. The study found that *T. quinquerittatus* accounted for 75% of the horseflies collected, suggesting that older cattle may be less capable of resisting repeated infestations due to weakened immune systems and declining overall health, making them more susceptible to infestation compared to younger age groups, which did not align with our studys findings.

3.1.5-The Number of Hard Tick and Horsefly Found on Infected Cattle in Samarra and Surrounding Areas

The results of the current study for the period from 10/10/2022 to 10/10/2023 showed that the highest infestation rate was with hard ticks from the genus *Hyalomma*, with a percentage of 78.43%, which included the species *H. anatolicum, H. excavatum, H. rufipes, H. scupense, H. impressum,* and *H. impeltatum.* The lowest infestation rate was with ticks from the genus *Rhipicephalus*, specifically the species *Rh. sanguineus*, with a rate of 21.57%. The percentage of cattle infested with horseflies was 7.17%.

Table (3-6) Numbers and Types of Hard Ticks and Horseflies

Percentage%	Numbers	Species

78.43	1835	***Hyalomma***
21.57	475	***Rhipicephalus***
7.17	732	***Tabanus sp.***

Our study's findings align with the study of Rasheed, (2020) which recorded the highest prevalence of hard ticks in the city of Samarra and its surrounding areas, with the *Hyalomma* genus showing the highest percentage of 78.43%. This high prevalence is attributed to the ability of this genus of hard ticks to adapt to both high and low temperatures.

The study conducted by Grechangelini, *et al.,* (2016) indicated that tick infestation in cattle is more prevalent than horsefly infestation. For example, a study conducted in Corsica, France, found that 63% of cattle were infested with ticks, including other species such as *H.marginatum* and *Rh.bursa*. However, the study did not report similar rates of horsefly infestation.

3.1.6-Relationship between the Type of Hard Ticks and the Site of Infestation on Cattle in Samarra and Surrounding Areas

The current study's sample collection showed that ticks were found in five locations on the animal's body: the ear, udder, front and back legs, the area around the anus, and the eyes, as shown in Table (3-7).

Table (3-7): Percentage of Tick Species Infesting Different Parts of Cattle Under Study

Location	***Hyalomma***					***Rhipicephalus***				
	Ear	Udder	front and back legs	Around the anus	eyes	Around the anus	udder	eyes	front and back legs	Ear
Mashayhad	1	240	8	6	1	1	5	1	4	2
Muajil and Al Al-Rakah,	3	14	7	1	2	1	6	2	3	0.0
Al-Qal'ah,	2	15	2	4	3	0.0	15	0.0	1	2
Jazeera, Western Samarra Island	1	122	10	25	1	2	75	3	2	0.0
Samarra Municipality	2	8	6	1	4	2	2	4	5	2
Al-Qal'ah, Al-Qadirah, Al-Harijiyah Abu-Al-Hail	2	5	3	1	1	1	20	1	6	0.0
Al-Turayshah	3	175	1	0.0	2	2	15	3	4	1
Al-Sa'idiyah	2	2	9	2	1	1	6	2	11	5
Tal Al-Aleij	1	33	8	4	13	2	4	6	1	4
Shanas	1	24	2	3	15	3	3	18	2	3
Hawi Al-Bisat	2	17	4	6	1	2	4	40	25	2
Abu Tuwainah	1	20	6	2	20	5	3	3	4	0.0

Al-Rafee'	3	41	8	8	15	4	25	1	1	4
Banat Al-Hassan	2	31	2	7	1	3	2	0.0	0.0	2
The Percentage of infection	%2.7	74.7%	7.6%	7%	8%	%7.25	%46.25	21%	14.5%	6.75 %

Due to its high ability to find hiding places from unfavorable environmental conditions, and its ability to reactivate its biological functions when favorable conditions are available, the current study results showed the presence of two genera of hard ticks*: Hyalomma,* which includes the species *H. excavatum, H. anatolicum, H. scupense*, as well as the identification for the first time in Samarra of the species *H. impeltatum, H. impressun, and H. rufipes.* Also, the genus *Rhipicephalus* was identified, including the species *Rh. sanguineus*, which was identified for the first time in Samarra and some surrounding areas.

The results of this study are similar to those of many other researchers who indicated the presence of hard ticks on several hosts, including cattle, sheep, and goats, but to a lesser extent. The study found that the infection rate was 78.43%, which is close to the percentage found by Al-Isawi, (2018) with an overall tick infection rate of 71.3% for the *Hyalomma* genus and 28.61% for the *Rhipicephalus* genus, parasitizing cattle in Samarra and some surrounding areas. The lower infection rate with Rhipicephalus is attributed to its inability to withstand unfavorable environmental conditions and lack of suitable hiding places compared to the *Hyalomma* genus. For the first time in Samarra, horsefly *Tabanus* infestation on cattle was recorded at 7.17% of the total 2310 cattle examined, with 732 cattle being infected. The low infection rate with the horsefly is due to the lack of ponds and wetlands in cattle breeding areas or because its activity is seasonal, particularly in the humid and warm months, and it may also be due to a lack of host specialization.

The results in Table (3-7) showed that ticks are distributed across five locations on the cattle body: the ear, udder, front and hind legs, the area around the anus, and the eyes. The study also recorded variations in the percentage rates of *Hyalomma* ticks on different body parts, with the highest being on the udder at 74.7% for *Hyalomma* infestation and 46.25% for *Rhipicephalus* infestation, followed by the eyes in *Hyalomma* infestation, then the front and hind legs, with the area around the anus and the ear showing lower rates. These results are consistent with those of Al-Isawi, (2018) who found the highest infection rate in the udder area at 45.6%, followed by the area around the anus at 43.11%, with a lower rate in the ear at 11.2%, and no infection recorded on the legs. However, our study did record an infection rate on the front and hind legs at 7.6% for *Hyalomma* and 14.5% for *Rhipicephalus.*

The preference of ticks on the animal's body may be influenced by factors such as skin, blood vessel presence, and body temperature. Studies presented by Heylen, *et al.,* (2023) on tick-borne pathogens and the physical condition of animals in rural livestock production systems in East and West Africa, and the Organization for the Evaluation of Tick Distribution and Tick-borne Pathogens, found that ticks prefer certain areas of the body, such as the front and hind legs, armpits, sides, abdomen, and inner thigh, without mentioning the udder. This study emphasizes the need for integrated tick control strategies to reduce the harmful impact of ticks on the health of cattle and their productivity in milk and meat.

Magesa, *et al.*, (2023) also discussed the distribution of partial identity of hard ticks on animal bodies in Kilombero and Iringa regions of Tanzania, confirming that the highest tick density was in the thigh, sides, abdomen, and inner thigh areas, and noted that the species *Rh. microplus* and *Amblyomma lepidinum* were the most common in these areas. Hassan, (2015) studied the effect of some ectoparasitic insects and arachnids on certain blood parameters inCapra aegagrus (black goats) in Sulaymaniyah Governorate, recording significant statistical differences ($P<0.01$), with the highest observations of ticks in the ear area, numbering 369.

This result does not agree with the findings of our study, which showed the lowest infection rate in the ear area at 2.7% for *Hyalomma* and 6.75% for *Rhipicephalus*. However, our study's results are consistent with those of Rashid, (2020), which found that ticks concentrate in three areas on the animal's body: the udder, ear, and inner area of the hind legs, with percentages of 65%, 68.3%, 21.6%, and 45%, respectively, and did not mention the area around the anus and eyes, which had low rates in the current study sites.

Our study's results also align with Tahmaz, (2021) on tick distribution on sheep body parts in the study area, which recorded that infection concentrated in three body areas: the ear, udder, and eyelid, in the three tick species *Rh. turanicus, Rh. sanguineus,* and *Rh. prava*, showing significant differences in infection sites, with the ear area having the highest rates of 58.33%, 64.84%, and 67.54%, followed by the udder at 30.55%, 34.37%, and 29.80%, and the lowest infection rates in the eyelid area at 11.11%, 0.78%, and 2.64%. Our study results align with those of Tahmaz, (2021), confirming that the highest infection rate on the animal's body was in the udder area, which is favored by ticks due to its proximity to the ground when the animal rests or sleeps on the ground, facilitating tick access. The preference for the ear area is attributed to the presence of blood vessels close to the skin surface, providing the necessary blood supply, and the thinness of the skin layers (Brooke and Michael, 2010).

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS :-

1-The study recorded the highest rate of cattle infestation with hard ticks in July, followed by August, September, June, and April.
2-The study recorded a low percentage of cattle infestation with horseflies compared to the higher percentage of tick infestations.
3-The infestation rates of ticks and horseflies were higher in female cattle compared to males.
4-The age group of less than 3 years recorded the highest rate of infestation with ticks and horseflies compared to other age groups.
5-The highest infestation rate was with hard ticks of the genus *Hyalomma*, which included the species *H. anatolicum, H. excavatum, H. rufipes, H. scupense, H. impressum*, and *H. impeltatum*. The lowest infestation rate was with ticks of the genus *Rhipicephalus*, which included the species *Rh. Sanguineus.*
6-Two genera of hard ticks were identified*: Hyalomma*, which included the species *H. excavatum, H. anatolicum, H. scupense*, and for the first time in the city of Samarra, the species *H. impeltatum, H. impressum*, and *H. rufipes* were identified. Additionally, the genus *Rhipicephalus* was identified, including the species *Rh. sanguineus*, which was also identified for the first time in the city of Samarra and some of its neighboring areas.

RECOMMENDATIONS :-

1- Conduct a genetic study to determine the genetic proximity between tick species identified in the study districts and other Iraqi cities, and map their phylogenetic tree.
2- Conduct an epidemiological study on cattle infected with ticks in the provinces neighboring Salah al-Din Governorate.

REFERENCES:-

1. **Al-Issawi**, H. A, (2018). A survey of some types of ticks that infect cows and its effect on pathogens and some physiological parameters in Samarra city, PhD thesis, College of Education for Pure Sciences, Tikrit University.
2. **Brooke,**W.B. and Michael,R., (2010). Tick repellents:past,present,and future.Pest.Bioch.Physiol.,96:63-79.
3. **Buestán**, J., Pazmiño, A., & Vera, G. B. (2024). Richness, endemism and seasonality of horseflies (Diptera: Tabanidae) in Forests of the Equatorial Pacific Region of Ecuador.
4. **Chepkwony**, R., van Bommel, S. & van Langevelde, F., (2021). Interactive effects of biological, human and environmental factors on tick loads in Boran cattle in tropical drylands. Parasites Vectors 14.
5. **Elhachimi**, L.; Rogiers, C.; Casaert, S.; Fellahi, S.; Van Leeuwen, T.; Dermauw,W.; Valcárcel, F.; Olmeda, Á.S.; Daminet, S.; Khatat, S.E.H.,(2021). Ticks and Tick-Borne Pathogens Abound in the Cattle Population of the Rabat-Sale Kenitra Region, Morocco. Pathogens, 10.
6. **Etiang**, P., Musoba, A., Nalumenya, D. , (2024). Distribution and prevalence of ixodid tick species (Acari: Ixodidae) infesting cattle in Karamoja region of northeastern Uganda. BMC Vet Res 20, 50.
7. **Grechangelini**, S., Stachurski, F., Lancelot, R., (2016).Ticks (Acari: Ixodidae) infesting cattle and some other domestic and wild hosts on the French Mediterranean island of Corsica. *Parasites Vectors* **9**, 582.
8. **Hassan**, R. H., & Al-Zubaidi, H. H. (2014). Cattle and buffaloes tick's infestation in Wasit province districts, Iraq. Kufa. J. Vet. Med. Sci, 5(1), 31-40.
9. **Hassan**, R. M., (2013).Effect of some types of external parasitic insects and spiders on some blood parameters in black goats (Capra aegagrus) in Sulaymaniyah Governorate*. Master thesis, College of Science, Tikrit University.
10. **Heylen**, D.J.A., Kumsa, B., Kimbita, E. , (2023). Tick-borne pathogens and body condition of cattle in smallholder rural livestock production systems in East and West Africa. Parasites Vectors 16, 117.
11. **Horváth**, G., Pereszlényi Á, Egri Á, Tóth T, Jánosi IM., (2020). Why do biting horseflies prefer warmer hosts? tabanids can escape easier from warmer targets. PLoS ONE 15(5): e0233038.
12. **Horváth**, G., Pereszlényi, Á., Tóth, T., Polgár, S., & Jánosi, I. M. (2019). Attractiveness of thermally different, uniformly black targets to horseflies: Tabanus tergestinus prefers sunlit warm shiny dark targets. Royal Society Open Science, 6(10), 191119.
13. **Karatepe**,M.,Dik,B.,Karatepe,B.,(2017). Chewing lice species (phthiraptera) found on a European Shag (Phalacrocorax aristotelis)in Turkey :new records of a genus and two species for the Turkish fauna of phthiraptera.Turkish Journal of zoology ,41(3),576-582.
14. **Katahira**, H., Yamamoto, A., Masubuchi, T., Isshiki, T., Watanabe, N., & Kanaiwa, M., (2021). A report on potential effects of an ectoparasite Argulus coregoni (Crustacea: Branchiura) on ayu under rearing condition. Aquaculture, 543, 736980.
15. **Lewis**, D.,J., Leprince DJ., (2020).HORSE FLIES AND DEER FLIES (DIPTERA: TABANIDAE) FEEDING ON CATTLE IN SOUTHWESTERN QUEBEC. The Canadian Entomologist.;113(10):883-886. doi:10.4039/Ent113883-10.
16. **Lucas**, M., Krolow, T.K., Riet-Correa, F., (2020).Diversity and seasonality of horse flies (Diptera: Tabanidae) in Uruguay. Sci Rep 10, 401.

17. **Magesa**, W.S., Haji, I., Kinimi, E. , (2023). Distribution and molecular identification of ixodid ticks infesting cattle in Kilombero and Iringa Districts, Tanzania. BMC Vet Res 19, 121.
18. **Majeed**, S. A., Al-Amery, A. M. A., & Faraj, A. A., (2012). Role of hard ticks Hyalomma of some in transmission Haemoprotozoa in buffaloes of Abu-Ghraib area in Baghdad Province. Al-Anbar Journal of Veterinary Sciences, 5(1).
19. **Mulandane**, F.C., Snyman, L.P., Brito, D.R.A. , (2020).Evaluation of the relative roles of the Tabanidae and Glossinidae in the transmission of trypanosomosis in drug resistance hotspots in Mozambique. Parasites Vectors 13, 219.
20. **Pedigo**, L.P., & Rice, M.E., (2014). "Entomology and Pest Management". 6 th Edition. Pearson. ISBN: 9780133254055.
21. **Rashid**, R. G. ,(2020).Phenotypic diagnosis of the characteristics of the parasitic legs on some Salah al-Din fungus, PhD thesis, Tikrit University, College of Science, Department of Life Sciences.
22. **Raval**,S.K.,(2013),clinical studies on Epidemiology and Haemato Biochemistry of common Disease (Doctoral dissertation ,Anand agricultural University ,Anand).
23. **Sebastian**, P. A., & Gautam, R. D., (2021). Arthropoda: Diversity, Biology, and Importance. Springer.
24. **Tenzin**, J., & Rinzin, J., (2023). Efficacy of Derris acuminata Bentham for Tick Control in Dairy Cattle. *Bhutan Journal of Natural Resources and* Development, 10(2), 16-20.
25. **Vouraki**, S., Gelasakis, A. I., Papanikolopoulou, V., Papadopoulos, E., and Arsenos, G., (2022). Association of Hard Ticks (Ixodidae) Infestation with Milk Production and Udder Health of Extensively Reared Dairy Goats. Animals, 12(3), 354.