International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 12s,2025
https://theaspd.com/index.php

Seasonal Dynamics and Impact of Tick Infestation on Livestock in Karakalpakstan

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Abstract— *This study investigates the seasonal dynamics, distribution, and impact of tick infestation on livestock in the Nukus and Karaoyzak districts of Karakalpakstan. Despite extensive research on ectoparasites, there is limited data on tick infestation in this region. Utilizing parasitological, ecological, and phenological methods, we examined 1200 cattle and over 2400 sheep and goats from various farms. Findings revealed that 70-80% of cattle and 80-82% of sheep and goats were infected with ticks, predominantly from the genera Hyalomma and Rhipicephalus. Peak infestation occurred during the summer months, causing significant economic damage. These results highlight the need for effective tick control measures and their implementation in veterinary practices to mitigate economic losses and improve livestock health.*

Key words —*Tick infestation, Karakalpakstan, livestock farms, seasonal dynamics, Hyalomma, Rhipicephalus, ectoparasites, economic impact, veterinary medicine, tick-borne diseases, cattle, sheep, goats, zoobiocenosis, acarosis, ixodidosis.*

I. INTRODUCTION

Today, as a result of changes in the form of livestock farming, there is an increase in cases of livestock infection with various parasitic diseases and ticks. This causes a decrease in animal growth and development, reproductive ability and productivity indicators. Zoophilic insects and mites, as ecto- and endoparasites, parasitize the body of animals, birds and humans, causing parasitic diseases (entomosis and acarosis) [1]-[2]-[3] and causing significant damage to livestock farming. Milk, meat, eggs, wool. The productivity of animals and feathers decreases, the quality deteriorates, young cattle and birds (calves, lambs, goats, chicks) lag behind their peers in growth and development and die [4]- [5] - [6]- [7]. In addition, insects and ticks are extremely dangerous vector-borne diseases of humans and animals (plague, tick-borne encephalitis, tularemia, hemorrhagic fever, Termiz and Tomdi fevers, ephemeral fever, tick fever, cholera, relapsing and rash typhus, malaria, trypanosomiasis, leishmaniasis, anthrax and many others) are considered distributors and the main source of pathogens [8] - [9] - [10] - [11]

The increasing cases of livestock infection with parasitic diseases, particularly ticks, pose significant challenges to livestock farming in various regions, leading to a decline in animal growth, reproductive

ability, and productivity. This situation significantly impacts the overall economic viability of livestock farming. Ticks, as ectoparasites, not only cause parasitic diseases such as entomosis and acarosis but also serve as vectors for numerous zoonotic diseases, thereby affecting both animal and human health. Despite extensive research on ectoparasites globally and within other regions of Uzbekistan, there is a notable gap in the literature concerning the specific dynamics and impacts of tick infestation on livestock in the Karakalpakstan region. Previous studies have predominantly focused on the biological, morphological, and clinical aspects of ectoparasites, but comprehensive investigations on their seasonal dynamics, species distribution, and economic impacts in Karakalpakstan remain limited. Addressing this gap is crucial for developing effective tick control measures tailored to the region's unique ecological and climatic conditions.

This study utilized a combination of parasitological, ecological, and phenological methods to investigate the distribution, seasonal dynamics, and impact of tick infestation on livestock in the Nukus and Karaoyzak districts of Karakalpakstan. A total of 1200 cattle and over 2400 sheep and goats from various farms were examined. Ticks were manually collected and preserved in 70% ethanol for species identification, which was performed using the "Atlas of Ixodoid Ticks" and other relevant guides. Field observations were conducted from April to August, with additional surveys in March, June, July, and September to capture the seasonal dynamics. Laboratory analyses involved microscopic examinations to identify tick species and assess infestation levels. Statistical analysis of the data helped determine the prevalence rates of different tick species, their seasonal patterns, and their impact on livestock health and productivity.

The novelty of this research lies in its comprehensive approach to studying tick infestation in Karakalpakstan, an area previously underexplored in this context. By examining the seasonal dynamics, species distribution, and economic impacts of tick infestation, this study provides new insights into the specific challenges faced by livestock farmers in the region. Additionally, the research evaluates the effectiveness of various tick control measures, including pyrethroid-based treatments, offering practical recommendations for improving tick management in veterinary practices. The findings from this study are expected to contribute significantly to the existing body of knowledge on ectoparasites, particularly in the context of Karakalpakstan, and aid in the development of targeted strategies to mitigate the adverse effects of tick infestation on livestock farming.

Based on the above, the factors of tick infection in cattle, sheep and goats, the degree of seasonal infection, as well as new effective methods of protecting and treating them from these pathogens, the ecology and organism of animals, phytosources of plant origin have been determined. Research and implementation of basic (pyrethroid) drugs in veterinary medicine practice is of great importance. Also relevant is the study of tick migration (fauna, phenology), their epizootological characteristics, development, improvement and implementation of modern measures and highly effective means of combating them (disinsection, desaccharification) in livestock farms of various categories, types of property are taken into account.

The degree of knowledge of the problem. To study the epizootic state and seasonal spread of ticks in farm animals in various regions of our republic, to develop treatment and preventive measures and their application in veterinary practice among scientists of our republic, scientific research was carried out by such scientists as A.R. Ruzimurodov, U.Ya. Uzakov, A.G.Gafurov, D.A.Azimov, N.Azizov, O.S.Davidov, R.Dzhumashev, S.I.Mavlanov, F.S.Pulotov, M.Yu.Rakhimov and others. Also on a global scale - R.S. Gengrich, S.Z. Shapiro, V.P. Voigt, K. Fujisaki, A.S. Bowman, in the countries of the Commonwealth of Independent States - A.S. Biryukov, G.S. Sivkov , N.V. Solopov and others conducted extensive scientific research on the level of distribution, biology, morphology, clinical signs observed in animals with ectoparasites, treatment and prevention, but these studies were not carried out on the territory of Karakalpakstan.

The purpose of the research is to study the fauna, distribution and seasonal dynamics of ticks in farms specializing in breeding cattle, sheep and goats, in personal livestock of the population in the conditions of Karakalpakstan.

II. RESEARCH METHODS

This research investigated the distribution, seasonal dynamics, and impact of tick infestation on livestock in the Nukus and Karaoyzak districts of Karakalpakstan. The study was conducted across various livestock farms, examining 1200 heads of cattle and over 2400 sheep and goats. Ticks were collected manually from the animals and preserved in 70% ethanol for further analysis. Species identification was performed using the "Atlas of Ixodoid Ticks" by M. Kolos and other relevant guides. Observations were made from April through August, with additional surveys in March, June, July, and September, allowing for the assessment of seasonal dynamics and peak infestation periods. Samples were taken to the laboratory, where microscopic examinations were conducted to identify tick species and assess infestation levels. Data from field observations and laboratory analyses were statistically analyzed to determine the prevalence rates of different tick species, their seasonal patterns, and their impact on livestock health and productivity. The study also evaluated the effectiveness of various tick control measures, including pyrethroid-based treatments, and their implementation in veterinary practice. This comprehensive approach provided a thorough understanding of tick infestation patterns, seasonal dynamics, and the economic implications for livestock farming in Karakalpakstan. [12]-[13]-[14]-[15]-[16]-[17]-[18].

III. RESEARCH RESULTS

The research work was carried out in conditions of secondary and primary biocenosis (zoobiocenosis) in livestock farms and private farms of the population of the Nukus and Karaozak regions of the Republic of Karakalpakstan. In total, 1,200 heads of cattle and more than 2,400 heads of sheep and goats were used. As a result of scientific research and observations, it became known that in the studied areas, the seasonal movement of ticks in nature is observed starting from the second ten days of April with an increase in air temperature. During the research, Hyalomma (H.anatolicum, H.plumbeum, H.scupense, H.detritum), Rhipicephalus (Rh.bursa, Rh.turanicus), Haemaphysalis (H.sulcata, H.punctata), Dermacentor marginatus, Ixodes were studied (I.ricinus) are noted as major free-feeding zooparasites of cattle and sheep. It has been established that species belonging to the genera Hyalomma and Rhipicephalus dominate among them.

During inspections and observations in 2021, when studying the seasonal phenology of ticks, the "Dami-ata" farm in the Nukus region, the "Samanbay" mahalla and the "Nur Tilek Karaozek" farm, specializing in sheep farming in the village of the Karaozak region, were carried out, as well as during inspections and observations related to the study of the degree of infection of the existing livestock with ticks in the "Koybak" mahallas, in these mahallas ticks of the genus Hyalomma anatolicum, H.plumbeum, H.detritum, Rhipicephalus bursa, Rh.turanicus, Dermacentor marginatus were mainly found, among argasid ticks Ticks of the genus Ornithodoros (Alveonasus lahorensis) were found.

In cattle from experimental farms, during our studies in late April and May, it was noted that 128 heads or 80 percent of the 160 examined heads of cattle were infected with ixodid ticks belonging to the genus Hyalomma (H.anatolicum, H.plumbeum, H. scupense, H.detritum), Rhipicephalus (Rh.Bursa, Rh.turanicus).

In the conditions of zoobiocenoses of the Nukus and Karaozak regions among large and small ruminants, the causes of vector-borne diseases of humans and animals are ixodidosis and plague, Crimean-Congo and Asian hemorrhagic fever (black plague), tularemia, tick-borne encephalitis, piroplasmosis. At the end of March, the movement (migration) of ticks Hyalomma plumbeum, Hyalomma anatolicum, Hyalomma detritum, Rhipicephalus bursa, Rhipicephalus turanicus, which are (specific) carriers, begins. Representatives of the tick genera Dermacentor, Hyalomma, Rhipicephalus, Bovicola turned out to be dominant species in the body of farm animals in the zoobiocenoses of private (residential) and small livestock farms in the Nukus and Karaozak regions. [19]-[20]-[21]-[22]-[23]

Research work on the migration of ticks and the spread of parasitic diseases was carried out among cattle on private farms (in the care of the population) of the Nukus and Karaozak regions. During the research, it was established that in these territories the most common species of ticks belong mainly to the genera

Hyalomma (H.anatolicum, H.plumbeum, H.scupense, H.detritum), Rhipicephalus (Rh.bursa, Rh.turanicus), Haemaphysalis (H.sulcata, H.punctata), Dermacentor marginatus).
During the research conducted in the spring months (May) at the "Dami-ata" farm in the Nukus region, samples were taken from 25 goats and sheep aged 1.0 and 2.5 years on the farm to determine the degree of tick infestation, and the samples were sent to the laboratory where they were recorded. The air temperature was 35 ° C. All samples were found to be infested with mites, and their species were identified using a microscope (Figures 1-2-3).

Figure 1. The process of laboratory identification of mite species

Figure 2. Isolated mature Hyalomma anatolicum

Figure 3. Dorsal and ventral appearance of rhipicephalus progenitor

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ISSN: 2229-7359
Vol. 11 No. 12s,2025
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During studies conducted in ecotones and ecotopes, zoobiocenoses of the Nukus and Karaozak regions of the Republic of Karakalpakstan, ticks of 10 species were found among cattle and sheep (Table 1), infection with ixodidosis was detected in cattle - up to 70-80%, in sheep - 80-82%.

1-table

Types of ticks found in the Nukus and Karaozak regions of the Republic of Karakalpakstan

T.r	Identified tick species	Affected animal species	Seasons
1.	Hyalomma anatolicum	cattle, sheep	In hot seasons
2.	Hyalomma detritum		In all seasons,
3.	Hyalomma plumbeum	cattle	In hot seasons
4.	Hyalomma scupense	cattle	In hot seasons
5.	Dermacentor marginatus	cattle	In hot seasons
6.	Rhipicephalus bursa	cattle, sheep, goat	In hot seasons
7	Rhipicephalus turanicus		
8.	Haemaphysalis sulcata	cattle	In hot seasons
9.	Haemaphysalis punctata	cattle	In hot seasons
10.	Ixodes ricinus	cattle	In hot seasons

During inspections carried out in 2021-2023, when the seasonal phenology of ticks was studied, the "Dami-ata" farm in the Nukus region, the "Samanbay" mahalla and the "Nur Tilek" farm specializing in sheep breeding in the Karaozak region and the "Koybak" mahalla were examined. During the inspections, the degree of tick infestation of the existing livestock was studied; mainly ticks were registered: Hyalomma (H.anatolicum, H.plumbeum, H.detritum), Rhipicephalus (Rh.bursa, Rh.turanicus), Dermacentor (D. marginatus), from Ixodidae (I.ricinus), from argasid ticks Ornithodorus (Alveonasus lahorensis). [24]-[25]-[26]-[27] Ixodidosis, caused by ticks, is a seasonal disease and occurs in almost all animal species. Representatives of ixodid ticks begin to appear en masse on the body of cattle in early April. In June, July and August there is a tendency for them to increase (Figure 4).

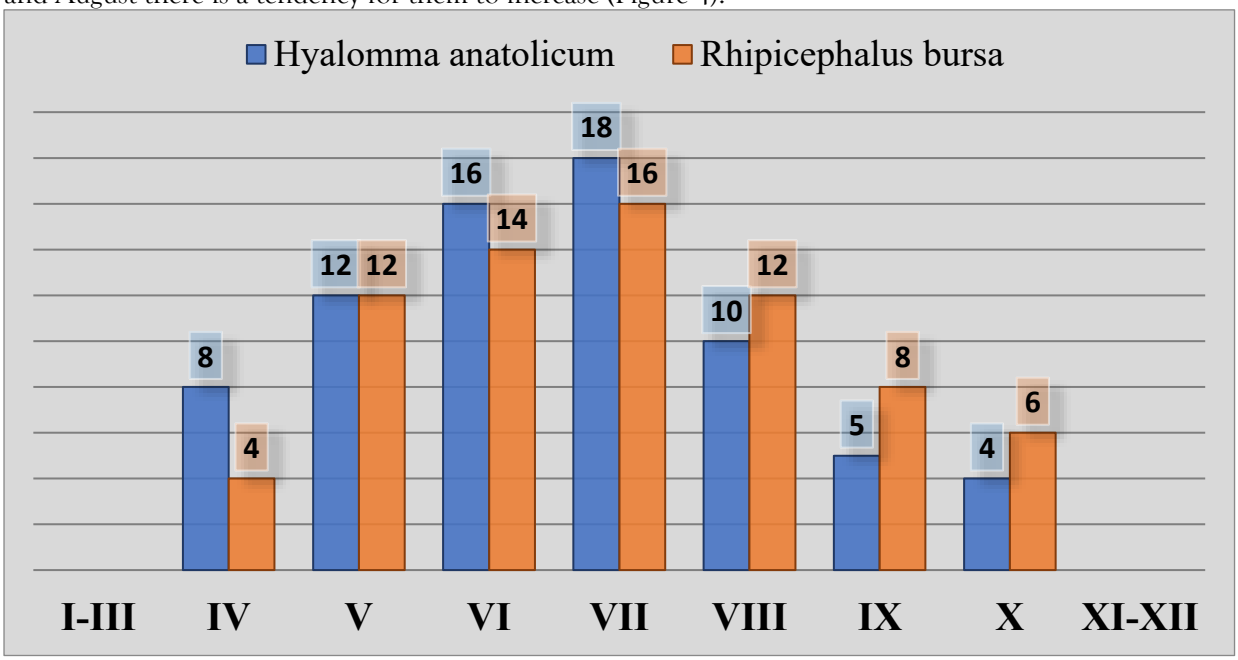

Figure 4. Dynamics of monthly infestation of dominant ixod mite species found in cattle

Figure 4 illustrates the seasonal dynamics of two tick species, Hyalomma anatolicum and Rhipicephalus bursa, in terms of their infestation levels on livestock throughout the year. The months are grouped into

periods: January-March (I-III), April (IV), May (V), June (VI), July (VII), August (VIII), September (IX), October (X), and November-December (XI-XII). The number of tick infestations recorded shows that Hyalomma anatolicum has a gradual increase starting in April with 8 infestations, peaking in July with 18, and then decreasing through October, reaching its lowest point in November-December with 4 infestations. Similarly, Rhipicephalus bursa starts with 4 infestations in April, peaks at 16 in both June and July, and then decreases to 4 in October, with a slight increase to 6 in November-December. Both species exhibit the highest infestation levels during the summer months, particularly in June and July, followed by a decline as the weather cools. This pattern indicates a strong seasonal trend, with both tick species being most active and prevalent during the warmer months.

During the spring months of our research, we took samples from 25 heads of cattle at the Dami-ata farm in the Nukus region; we detected the species Hyalomma anatolicum in 3 samples and the species Hyalomma detritum in 10 samples, or the infection was 52%.

During the research conducted in the summer months of the year (August) at the “Dami-ata” farm in the Nukus region, samples were taken from 84 heads of cattle, 30 sheep and 47 goats in order to determine the degree of tick infestation and the samples were recorded in laboratory conditions. The air temperature was 29°C. It turned out that almost all the selected animals were infected with ticks. Damage was predominantly observed using a microscope on ticks taken from 1.0 and 2.5 year old cows and calves, and the tick species identified were H.detritum, D.marginatus, R.bursa, H.anatolicum.

In the autumn months, in our research conducted at the "Dami-ata" farm in the Nukus region, 17 samples taken from 78 heads of cattle were studied and it was found that 82.3 percent of the cows and calves on the farm were infected with lice and ticks Hyalomma detritum. The dominant tick species were found on cattle bodies in early April. In June and July, an acceleration of their reproduction was observed. As a result of our scientific research, it was noted that the peak infection of cattle with ticks occurs in the summer season (Figure 5).

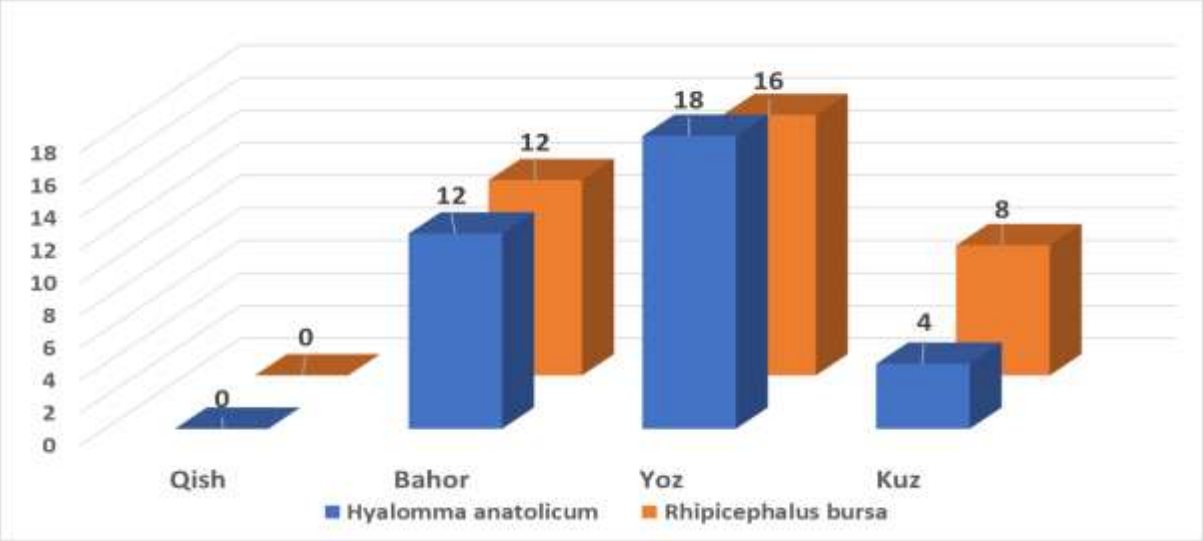

Figure 5. Seasonal dynamics of dominant ixod mite species found in cattle

Figure 5 depicts the seasonal infestation levels of two tick species, Hyalomma anatolicum and Rhipicephalus bursa, on livestock throughout different seasons of the year. The x-axis represents the four seasons: Winter (Qish), Spring (Bahor), Summer (Yoz), and Autumn (Kuz). The y-axis indicates the number of tick infestations recorded.

During the winter season (Qish), there are no recorded infestations for either Hyalomma anatolicum or Rhipicephalus bursa, both showing zero. In spring (Bahor), both tick species exhibit a significant increase, with each species reaching 12 infestations. The infestation levels peak in summer (Yoz), where Hyalomma anatolicum reaches 18 infestations and Rhipicephalus bursa reaches 16. In autumn (Kuz), the number of infestations declines, with Hyalomma anatolicum recording 4 and Rhipicephalus bursa recording 8.

The data indicates that both tick species are inactive during the winter months but become significantly active in spring, peaking in summer, and then declining in autumn. This pattern underscores the strong seasonal trend in tick activity, with the highest infestation levels occurring during the warmer months.

IV. CONCLUSIONS

The study on the seasonal dynamics and impact of tick infestation on livestock in the Nukus and Karaoyzak districts of Karakalpakstan revealed significant findings. Examination of 1200 cattle and over 2400 sheep and goats showed that 70-80% of cattle and 80-82% of sheep and goats were infested with ticks, predominantly from the genera Hyalomma and Rhipicephalus. The infestation peaked during the summer months, causing substantial economic damage to livestock farming. These results highlight the critical need for effective tick control measures and their implementation in veterinary practices to mitigate economic losses and enhance livestock health. Further research is warranted to develop and refine tick management strategies and explore the ecological and biological factors influencing tick population dynamics in this region.

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