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ВЕСТНИК ОШСКОГО ГОСУДАРСТВЕННОГО УНИВЕРСИТЕТА. СЕЛЬСКОЕ ХОЗЯЙСТВО: АГРОНОМИЯ, ВЕТЕРИНАРИЯ И ЗООТЕХНИЯ

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SEASONAL PHENOLOGY OF ECTOPARASITES IN ZOOBIOCOENOSES OF KARAKALPAKSTAN

СЕЗОННАЯ ФЕНОЛОГИЯ ЭКТОПАРАЗИТОВ В ЗООБИОЦЕНОЗАХ КАРАКАЛПАКСТАНА

КАРАКАЛПАКСТАН ЗООБИОЦЕНОЗДОРУНДАГЫ ЭКТОПАРАЗИТТЕРДИН СЕЗОНДУК ФЕНОЛОГИЯСЫ

Ainura Kamalova
Айнура Камалова
Айнура Камалова

PhD in veterinary sciences, associate professor, Nukus Branch of the Samarkand State University of Veterinary Medicine, Livestock and Biotechnologies
230102, 31 A. Utepov Str., Samarkand, Republic of Uzbekistan
к.в.н., доцент, Нукусский филиал Самаркандского государственного университета ветеринарной медицины, животноводства и биотехнологий
230102, ул. А. Утепов, 31, г. Самарканд, Республика Узбекистан
в.и.к., доцент, Самарканд ветеринардык медицина,
мал чарба жана биотехнология университетинин Нукус филиалы
230102, А. Утепов көч., 31, Самарканд ш., Өзбекстан Республикасы
https://orcid.org/0009-0000-4840-5187

Sabirzhan Mavlanov
Сабиржан Мавланов
Сабиржан Мавланов

doctor of veterinary sciences, professor, Nukus Branch of the Samarkand state university of veterinary medicine, livestock and biotechnologies
230102, 31 A. Utepov Str., Samarkand, Republic of Uzbekistan
д.в.н., профессор, Нукусский филиал Самаркандского государственного университета ветеринарной медицины, животноводства и биотехнологий
в.и.д., профессор, Самарканд ветеринардык медицина,
мал чарба жана биотехнология университетинин Нукус филиалы
230102, А. Утепов көч., 31, Самарканд ш., Өзбекстан Республикасы

Fakhridin Pulotov
Фахридин Пулотов
Фахридин Пулотов

PhD in veterinary sciences, senior researcher, veterinary research institute of Uzbekistan
123140, 77 Mirzo Ulugbek Str., Samarkand, Republic of Uzbekistan
к.в.н., с.н.с., Ветеринарный научно-исследовательский институт Узбекистана
123140, ул. Мирзо Улугбека, 77, г. Самарканд, Республика Узбекистан
в.и.к., улук илимий кызматкер, Өзбекстандын Ветеринардык илимий-изилдөө институту
123140, Мирзо Улугбек көч., 77, Самарканд ш., Өзбекстан Республикасы

Adham Ismailov
Адхам Исмоилов
Адхам Исмоилов

PhD in veterinary sciences, senior researcher, veterinary research institute of Uzbekistan
123140, 77 Mirzo Ulugbek Str., Samarkand, Republic of Uzbekistan
Кандидат ветеринарных наук, старший научный сотрудник
Ветеринарный научно-исследовательский институт Узбекистана
123140, ул. Мирзо Улугбека, 77, г. Самарканд, Республика Узбекистан
в.и.к., улук илимий кызматкер, Өзбекстандын Ветеринардык илимий-изилдөө институту
123140, Мирзо Улугбек көч., 77, Самарканд ш., Өзбекстан Республикасы

SEASONAL PHENOLOGY OF ECTOPARASITES IN ZOOBIOCOENOSES OF KARAKALPAKSTAN

Abstract

In 2023-2024, a study of the seasonal activity of ectoparasites parasitising cattle and sheep was conducted in the Nukus and Karauzak districts of the Republic of Karakalpakstan. The relevance of the study is conditioned by to the need for epizootic monitoring in an arid climate that promotes the conservation and spread of ectoparasitic forms that affect the productivity of farm animals. The purpose of the study was to determine the species composition of ectoparasites, their prevalence and seasonal phenology in the northwestern region of Uzbekistan. The methodological basis included a field collection of parasitic arthropods, followed by morphological identification using generally accepted definitions. The sample size was 3,648 animals examined in farms and private holdings. The presence of 12 ectoparasite species, mainly from the families Ixodidae, Hippoboscidae, and Trichodectidae, parasitising cattle and sheep, has been established. As a result of monitoring in 2023, species of mites of the genera Hyalomma (H. anatolicum, H. plumbeum, H. detritum, H. scupense), Rhipicephalus (Rh. bursa, Rh. turanicus), Haemaphysalis (H. sulcata, H. punctata), Dermacentor marginatus, Ixodes ricinus, and chewing lice of the genera Bovicola (B. ovis, B. bovis). The largest number of ixodid ticks was recorded from the middle of spring to the end of summer, especially in June and July, with a gradual decrease in autumn. The species Bovicola ovis demonstrated year-round activity, mainly in sheep, whereas B. bovis was more common in cattle. Seasonal dynamics indicated endemic migration of parasites, depending on temperature rise and microclimatic conditions. In addition, the relationship between the intensity of invasion and the density of livestock, the sanitary condition of the premises and the degree of anthropogenic stress on pasture ecotopes has been established. The results obtained are of practical importance for the development of seasonal schemes of antiparasitic treatments, increasing the stability of livestock and preventing vector-borne diseases in the steppe and semi-arid pastures of Karakalpakstan

Keywords: cattle breeding; sheep breeding; ixodid tick; chewing lice; bovicola; zoophilous insect

Сезонная фенология эктопаразитов в зообиоценозах Каракалпакстана

Каракалпакстан зообиоценоздорундагы эктопаразиттердин сезондук фенологиясы

Аннотация
В 2023-2024 годах в Нукусском и Караузакском районах Республики Каракалпакстан было проведено исследование сезонной активности эктопаразитов, паразитирующих на крупном рогатом скоте и овцах. Актуальность работы обусловлена необходимостью эпизоотического мониторинга в условиях аридного климата, способствующего сохранению и распространению эктопаразитарных форм, влияющих на продуктивность сельскохозяйственных животных. Целью исследования являлось определение видового состава эктопаразитов, их распространённости и сезонной фенологии в условиях северо-западного региона Узбекистана. Методологическая основа включала полевой сбор паразитирующих членистоногих с последующей морфологической идентификацией по общепринятым определителям. Объём выборки составил 3648 животных, обследованных в фермерских и частных хозяйствах. Установлено наличие 12 видов эктопаразитов, преимущественно из семейств Ixodidae, Hippoboscidae и Trichodectidae, паразитирующих на крупном рогатом скоте и овцах. В результате мониторинга в 2023 г. были выявлены виды клещей родов Hyalomma (H. anatolicum, H. plumbeum, H. detritum, H. scupense), Rhipicephalus (Rh. bursa, Rh. turanicus), Haemaphysalis (H. sulcata, H. punctata), Dermacentor marginatus, Ixodes ricinus, а также волосоедов родов Bovicola (B. ovis, B. bovis). Наибольшая численность иксодовых клещей регистрировалась с середины весны до конца лета, особенно в июне-июле, с постепенным снижением осенью. Вид Bovicola ovis демонстрировал круглогодичную активность, преимущественно у овец, тогда как B. bovis чаще встречался у крупного рогатого скота. Сезонная динамика указывала на эндемичную миграцию паразитов, зависящую от повышения температуры и микроклиматических условий. Кроме того, установлена взаимосвязь интенсивности инвазии с плотностью поголовья, санитарным состоянием помещений и степенью антропогенной нагрузки на пастбищные экотопы. Полученные результаты имеют практическую значимость для разработки сезонных схем противопаразитарных обработок, повышения устойчивости поголовья и профилактики трансмиссивных заболеваний в зоне степных и полупустынных пастбищ Каракалпакстана

Ключевые слова: скотоводство; овцеводство; иксодовый клещ; шерстеед; bovicola; зоофильное насекомое

Аннотация
2023-2024-жылдары Каракалпакстандын Нукус жана Караузак райондорунда уй жана койлордо кездешкен эктопаразиттердин сезондук активдүүлүгү изилденди. Изилдөөнүн актуалдуулугу – аймактын кургакчыл климаты эктопаразиттердин сакталып, кеңири таралышын шарттап, айыл чарба малдарынын продуктивдүүлүгүнө терс таасирин тийгизеринен улам эпизоотологиялык мониторингдин зарылдыгына байланыштуу болду. Изилдөөнүн максаты – түндүк-батыш Өзбекстан шартында эктопаразиттердин түрдүк курамын, таралышын жана сезондук фенологиясын аныктоо. Методологиялык негиз – талаа шартында паразиттик мүүнтуп буттуулардын чогултулуп, аларды классикалык морфологиялык идентификациялоо ыкмалары менен аныктоо болду. Жалпысынан 3648 баш мал фермердик жана жеке чарбаларда изилдөөгө тартылды. Изилдөөдө Ixodidae, Hippoboscidae жана Trichodectidae тукумундагы 12 түр эктопаразиттер аныкталды. 2023-жылкы байкоолордо төмөнкү кенелер катталды: Hyalomma anatolicum, H. plumbeum, H. detritum, H. scupense; Rhipicephalus bursa, Rh. turanicus; Haemaphysalis sulcata, H. punctata; Dermacentor marginatus; Ixodes ricinus, ошондой эле шерстееддер – Bovicola ovis жана B. bovis. Иксод кенелеринин эң жогорку активдүүлүгү жаздын ортосунан жайдын аягына чейин, өзгөчө июнь-июль айларында байкалды. Bovicola ovis жыл бою активдүү болуп, негизинен койлордон табылды, ал эми B. bovis көбүнчө уйлордо кездешти. Сезондук динамика паразиттердин климаттык факторлорго байланыштуу локалдык миграциясын көрсөттү. Ошондой эле инвазиянын интенсивдүүлүгү малдын тыгыздыгына, сарайлардын санитардык абалына жана жайыттарга болгон антропогендик жүктөмгө байланыштуу экени аныкталды. Изилдөөнүн жыйынтыктары Каракалпакстандын талаа жана жарым-чөл жайыт аймактарында трансмиссивдик оорулардын алдын алуу жана малдын туруктуулугун жогорулатуу максатында сезондук дарылоо схемаларын иштеп чыгууда практикалык мааниге ээ

Ачкыч сөздөр: мал чарба; кой чарба; иксод кенеси; шерстеед; Bovicola; зоофилдүү курт-кумурскалар

Introduction

The constant growth in demand for livestock products, including meat, milk, wool and leather raw materials, requires a stable and sustainable level of productivity of farm animals. One of the key factors negatively affecting the health and productivity of cattle and sheep is parasitic diseases caused by ectoparasites. In the arid climate typical of a number of regions of Uzbekistan, including Karakalpakstan, favourable conditions are created for the survival and spread of ixodid ticks and zoophilous insects. These parasites reduce body weight gain, degrade the quality of livestock products, and contribute to the spread of vector-borne infections. In this regard, there is a need for a systematic study of the seasonal activity of ectoparasites, which would allow timely prediction of epizootic outbreaks and the development of effective preventive measures.

Research by K.T. Sultankulova et al. (2022) analysed the species of ticks that parasitise cattle, sheep, and horses in various regions of Kazakhstan. The researchers established the prevalence of Dermacentor marginatus, Hyalomma anatolicum, and Hyalomma scupense, and also identified the presence of pathogens of slaughter and leather animals. Despite the revealed high degree of infection of ticks with vector-borne pathogens, the study did not analyse the seasonal dynamics of parasitisation, which limits the possibility of predicting peak periods of invasion.

Similar aspects of ectoparasite infestation in an arid climate were considered in studies conducted in Pakistan. The study by S. Shahid et al. (2022), conducted in Quetta district, analysed the infection of sheep and goats with ixodid ticks. The total invasion was 12.26%, with species Hyalomma, Rhipicephalus, and Ixodae dominating. The greatest activity of ticks was observed in summer, especially in females and animals aged 1-2 years. N. Hussain et al. (2023) covered a wider range of animals in various agroecological areas of Pakistan, including cattle, camels, horses, and dogs. 11 species of ticks were identified, and the infection rate reached 14.3%. The dominant tick genera varied depending on the host species. Both studies emphasised the seasonal activity of ectoparasites and the importance of climatic factors, but the study by N. Hussain et al. had a wider interspecific and spatial coverage. Despite similar climatic conditions, such comprehensive data on the distribution and seasonal phenology of ectoparasites on farm animals in Karakalpakstan remain limited.

Y. Li et al. (2020) conducted a comprehensive assessment of the prevalence of ticks and their pathogens in domestic animals in the Xinjiang Uygur Autonomous Region of China. The researchers identified 5,822 ticks collected from cattle, sheep, goats, camels, and horses, and identified 12 species primarily from the genera Dermacentor, Hyalomma, and Rhipicephalus. Using molecular methods, pathogens Rickettsia raoultii, Brucella spp., Anaplasma ovis, Babesia caballi, Theileria equi, and Theileria ovis were detected, with tick infection reaching 36.8%. The data obtained emphasise the importance of monitoring ectoparasites as vectors of vector-borne diseases and demonstrate significant species and pathogenic diversity comparable to the risks in regions with an arid climate, such as Karakalpakstan.

The study by K. Altay et al. (2024) was aimed at the molecular identification of tick-borne pathogens in grazing horses in Kyrgyzstan. Of the 311 animals examined, 7.4% were infected with Theileria equi, with a predominance of genotypes A and E. No other pathogens have been identified. The study highlighted the importance of species-specific monitoring of tick-borne pathogens for the control of parasitic diseases in horses in Central Asia.

Thus, given the lack of comprehensive data on the species composition, distribution, and seasonal dynamics of ectoparasites in Karakalpakstan, the need for investigating the distribution and seasonal phenology of ectoparasites in cattle and sheep farms in this region was emphasised. The purpose of this study was to identify the main types of ectoparasites, assess their seasonal activity, and analyse the influence of climatic factors on the dynamics of infestation of farm animals.

Materials and Methods

The study was conducted on the territory of the Nukus and Karauzak districts of the Republic of Karakalpakstan, characterised by an arid climate with dry, hot summers (the average temperature in July reaches +38°C) and cool winters (down to -5°C), low air humidity, and a predominance of semi-desert and desert vegetation. Coordinates of the studied areas: Nukus district – 42.4532°N, 59.6022°E; Karauzak district – 41.7300°N, 60.7500°E.

Field surveys and material collection were conducted from March to November 2023, covering the spring, summer, and autumn seasons. The objects of the study were cattle (mainly Kazakh white-headed cows and local breeds) and small cattle (sheep and goats) kept in farms (Dami-ata, Nur Tilek Karauzek) and private farms in the Kuibak and Samanbai mahallas. In total, more than 1,200 cattle and over 2,400 sheep and goats were examined. The animals varied in age (from 6 months to 6 years) and sex. All examinations were conducted with the consent of the animal owners.

Ectoparasites were collected manually and by combing using sterile tweezers and brushes. Each animal was visually examined for ectoparasites, with an emphasis on the areas of the head, neck, withers, underbelly, groin, and tail base (Catalano, 2024). The examinations were carried out twice a month in the morning, when the parasites were most active. The collection was carried out by veterinary specialists who had been trained and had experience in parasitological examinations. Special attention was paid to the presence of ticks and chewing lice in different phases of development (larvae, nymphs, imagos).

Each collected sample was placed in an individual tube with 70% ethanol. The test tubes were provided with a waterproof label indicating the sample code, the number of the farm, the date and place of collection, the type and age of the animal, and the affected body part. All data was recorded in the accounting log, eliminating the possibility of cross-contamination and losses. The samples were stored at a temperature of +4°C in the laboratory of Arachnoentomology and Acarology of the Nukus Branch of the Samarkand State University of Veterinary Medicine, Animal Husbandry, and Biotechnology.

The identification of the collected ectoparasites was carried out using classical determinants: "Atlas of Ixodid Ticks" (Ganiev & Aliverdiev, 1968), and other specialised manuals (Tsapko, 2020). Specific diagnostics was performed under an MBS-10 binocular microscope (LOMO–Leningrad Optical and Mechanical Association, USSR) and a Carl Zeiss microscope (Germany) with magnification up to 400×. Identification was carried out to the level of genus and species, considering morphological features at various stages of development.

To analyse the seasonal dynamics of infestation, a quantitative assessment was used: the number of parasites per animal, their stage of development, and frequency of occurrence. Observations were carried out monthly to identify peaks in ectoparasite activity. Generally accepted

indicators were used to assess infection: the degree of invasion (percentage of infected animals), the intensity of invasion (average number of parasites per infected animal). The data was processed using descriptive statistics with the calculation of averages, ranges, and standard deviations (Nikanorova, 2020).

All procedures were carried out in accordance with the ethical standards for the treatment of animals in force in the Republic of Uzbekistan, and in compliance with sanitary and hygienic requirements for the collection, transportation, and storage of parasitological material. The animals were not harmed, and the collection of material was carried out with minimal stress to the body.

Results and Discussion

Seasonal activation and movement of ectoparasites in the natural conditions of the Nukus and Karauzak districts began in the second ten days of April, which coincided with a steady increase in the average daily air temperature. As part of field studies conducted on farms and in private farms in these areas (including the Dami-ata farm, Samanbai mahalla, Nur Tilek Karauzek farm, and Kuibak mahalla), the species composition of ectoparasites infecting cattle and sheep was determined.

Representatives of ixodid ticks of the genera Hyalomma (H. anatolicum, H. plumbeum, H. detritum, H. scupense), Rhipicephalus (Rh. bursa, Rh. turanicus), Haemaphysalis (H. sulcata, H. punctata), Dermacentor marginatus, and Ixodes ricinus had the greatest epizootological significance. These species were active throughout the growing season, with peak numbers during the warmer months. Ticks of the genera Hyalomma and Rhipicephalus dominated among them, which indicates their high adaptability to the climatic conditions of the region.

Additionally, ectoparasites of the genus Bovicola, B. ovis in sheep (Fig. 1a) and B. bovis in cattle (Fig. 1b), were recorded in all surveyed farms. Unlike ixodid ticks, these parasites demonstrated year-round activity, which is due to the conditions of animal husbandry, especially in winter, when a warm and enclosed indoor environment promotes their reproduction. The presence of these species in all seasons indicates stable invasions that require systemic control as part of the prevention of pediculosis.

a **b**

Figure 1. Larval and imago forms of Bovicola ovis (a) and Bovicola bovis (b)
Source: photo by the authors

Figure 1 shows the stages of development of two species of chewing lice typical of farm animals in Karakalpakstan. Bovicola ovis, which parasitises sheep, and Bovicola bovis, which infects cattle, are permanent inhabitants of the skin and hair of animals. Their year-round presence confirms the stable circulation of these parasites in the livestock farms of the region. Especially

high numbers are recorded in the autumn-winter period, which is associated with a denser crowding of animals and favourable indoor temperatures.

Bovicola ovis is an obligate ectoparasite of sheep, a representative of the chewing lice group, feeding on the surface layers of the skin and epidermal scales. According to the study by A. Eshetu et al. (2017), conducted in the Vogera region (Northern Gondera zone, Ethiopia), B. ovis infection was recorded in 12.07% of the examined animals. It was found that the degree of infection significantly varied depending on the sex and physical condition of the sheep: in animals with an unsatisfactory (52.9%) and average (38.2%) body index, infection was significantly higher than in sheep with a good physique (25%). It was also noted that rams were more likely to be infected with B. ovis compared to ewes (46.5% versus 33%). Despite the fact that age did not have a statistically significant effect on infection with this type of parasite, B. ovis was often detected in mixed infestations together with Melophagus ovinus.

Pediculosis in cattle caused by lice of the genus Bovicola bovis is a serious veterinary problem affecting the health and productivity of animals. The study by F. McKiernan et al. (2021) revealed a high level of lice infestation in beef cattle herds in Ireland, with resistance to deltamethrin, one of the widely used pyrethroid insecticides, being reported for the first time. The researchers noted that such resistance reduces the effectiveness of traditional control measures, exacerbating stress and skin damage in animals, which negatively affects productivity and well-being. These data confirm the importance of monitoring resistance and finding new methods to control ectoparasites, which is especially important in the conditions of cattle grazing similar to the region under study. The results obtained complement the knowledge about the biology and epidemiology of Bovicola bovis, which must be considered when developing strategies for the prevention and treatment of pediculosis in different climatic zones. Summary data on the species composition, distribution, and seasonal activity of ectoparasites are presented in Table 1.

Table 1. Ectoparasite species found in the territory of the Nukus and Karauzak districts of the Republic of Karakalpakstan

No.	Types of ectoparasites	Infected animal species	Seasons
1.	*Hyalomma anatolicum*	bovine cattle	in the warmer months in winter
2.	*Hyalomma detritum*		
3.	*Hyalomma plumbeum*	bovine cattle	in the warmer months nymph
4.	*Hyalomma.scupense*	bovine cattle	in the warmer months
5.	*Dermacentor marginatus*	bovine cattle	in the warmer months
6.	*Rhipicephalus bursa*	bovine cattle	In all seasons, larva and nymph in winter
7	*Rhipicephalus turanicus*		
8.	*Haemaphysalis sulcata*	bovine cattle	In the warmer months
9.	*Haemaphysalis punctata*	bovine cattle	In the warmer months
10.	*Hyalomma anatolicum*	sheep	In the warmer months
11.	*Bovicola ovis*	sheep	In all seasons
12.	*Bovicola bovis*	bovine cattle	In all seasons

Source: compiled by the authors

Based on the data presented in Table 1, it can be concluded about the pronounced seasonal activity of most ectoparasite species found in the Nukus and Karauzak districts of Karakalpakstan. The predominance of ixodid mites of the genus Rhipicephalus (Fig. 2) and Hyalomma (Fig. 3) in the warm season indicates a high dependence of these species on climatic factors, in particular, temperature and humidity, which create favourable conditions for their active development, mating,

and attacking their hosts. Ectoparasites were detected in cattle individually, in late March and early April. And in June and July, the process of their reproduction accelerated. Special attention should be paid to the species Rhipicephalus bursa, which, unlike most other species, remains active in all seasons, including winter, which indicates its high adaptability to the extreme conditions of the region and the presence of stable larval and nymph stages. The constant presence in the populations of Bovicola ovis (Fig. 1a) and Bovicola bovis (Fig. 1b), recorded in sheep and bovine cattle, respectively, throughout the year is explained by the conditions of animal husbandry – crowding, poor ventilation, and the presence of wool, which promotes the reproduction and shelter of these parasites. Such year-round circulation leads to chronic skin lesions, decreased productivity and overall stability of animals, and increases the risk of secondary bacterial infections. Thus, the established structure and seasonal dynamics of infection indicate the need for timely and differentiated antiparasitic treatment of animals, considering the species-specific features of ectoparasites.

Figure 2. Dorsal and abdominal mite species of the genus Rhipicephalus
Source: photo by the authors

Figure 3. Morphological features of ixodid mites of the genus Hyalomma identified in farm animals
Source: materials from free online sources

The morphological features of ixodid mites, shown in Figures 2 and 3, allow for a more detailed understanding of the adaptation mechanisms of these species to a parasitic lifestyle. The visible differences in the structure of the shield, chelicerae, and legs reflect the specifics of the mites' fixation on the host's body and penetration into the skin. The presence of dense chitinous

integument in representatives of the genus Hyalomma and a pronounced oral apparatus in Rhipicephalus indicates a high degree of adaptability to blood-sucking in the conditions of pastoral cattle breeding typical for the region. Such morphological features contribute to long-term attachment to the host, which increases the likelihood of transmission of vector-borne diseases. The visual representation of the parasite structure supports the results of field observations and highlights the need to take biological characteristics into consideration when developing regional schemes for the prevention and control of ectoparasites.

As a result of the analysis of the seasonal dynamics of ectoparasite infection in sheep and goats in the farms of the population of the Kuibak mahallas of Karauzak district and Samanbai of Nukus district, it was found that the level of infection of sheep in winter is at an average seasonal level, peaking in spring and summer, and decreasing to minimum values in the autumn months. These data reflect the pronounced seasonal activity of ectoparasites, which is determined both by the climatic conditions of the region and by the biological characteristics of the parasitic species. The greatest intensity of infection is observed in the warm season, which coincides with peak numbers of ticks and other parasites, while in the cold season their activity decreases significantly, with the exception of some species adapted to winter conditions. The obtained results emphasise the need for comprehensive monitoring and application of differentiated measures for the prevention of parasitic diseases in farms of Karakalpakstan.

The data obtained on the seasonal phenology of ectoparasites of cattle and sheep in the districts of Karakalpakstan are consistent with the results presented in the study by S.I. Mavlanov et al. (2025), who also studied the seasonal activity and infection rate of animals with ticks. Both studies confirmed that tick activity peaks in the summer months, with Hyalomma and Rhipicephalus being the dominant genera. If the study by S.I. Mavlanov et al. reported an invasion rate of 70-80% in cattle and 80-82% in small cattle, whereas the present study found a slightly lower infection rate in a number of age groups, which may be conditioned by differences in animal treatment methods, microclimatic conditions, or the level of veterinary control on individual farms.

K.C. Kim (1985) emphasised the importance of adaptive mechanisms that ensure the stable coexistence of parasites and hosts, and the development of specific biological bonds. Special attention was paid to obligate parasites, including ixodid mites and lice, which allowed for a deeper understanding of their role in epizootic processes. These provisions correlate well with the results of this study of ectoparasites in Karakalpakstan, where the adaptation of ticks of the genera Hyalomma and Rhipicephalus to local climatic conditions and host biology was revealed. The concepts of coevolution presented in the book have confirmed the need to consider the evolutionary and ecological characteristics of parasites when developing effective control and prevention measures, which is especially important for arid regions with intensive pasture farming.

Ixodid mites (Ixodidae) are among the most epidemiologically significant ectoparasites affecting farm animals in various regions. L. Fedonyuk et al. (2023) showed that pronounced seasonal ixodid activity is observed in Western Ukraine, with peaks in May-June and August-September, which is directly related to temperature, humidity, and host density. The researchers also emphasised the role of climate change in prolonging the period of tick activity and increasing epizootic danger. These data confirm the need for similar regional studies in other climatic zones, including arid regions of Uzbekistan, where the epidemiological risk persists in conditions of high temperatures and grazing animals.

A. Kamalova (2023) presented an important contribution to the study of bovine ixodidosis under experimental modelling conditions. The researcher noted that with the increase in the number of imported livestock and the expansion of livestock farms in Uzbekistan, the risk of the spread of ixodid ticks increases, especially in household farms and new ecotopes. In an experiment conducted on 10 cows, it was shown that infection with ixodidosis leads to a decrease in milk yields by an average of 300 g, which highlights the economic losses associated with the parasitic load. The study highlighted not only the productive, but also the clinical consequences of infection (itching, anxiety, decreased general condition), thereby confirming the need for preventive monitoring and the development of new means to combat ixodidosis in agricultural regions.

N. Choubdar et al. (2021) conducted a comprehensive assessment of the microbiota of the Hyalomma anatolicum mite using a new generation of culture and sequencing. A high species diversity of bacteria was revealed, differing in stages of development, sex, and organs of ticks. Bacillus subtilis dominated at all stages, which indicates possible transovarial transmission, and its presence on both ticks and livestock skin indicates a cutaneous origin. The NGS (Next Generation Sequencing) method showed the predominance of Francisella spp. and possible inhibition of Rickettsia, which is important for assessing the vector role of the tick.

The study by P. Biglari et al. (2018), conducted in the central part of Iran, found that Hyalomma anatolicum is the dominant tick species (38.83%) in cattle, sheep, and goats. The total infection rate of the animals was 18.53%, and the species composition included six species of ixodid ticks. These results are comparable to the data obtained in Karakalpakstan (2023-2024) in this study, where the predominance of H. anatolicum was also noted, but a greater species diversity (12 species) was revealed and a clear seasonal trend was traced. Thus, both studies confirmed the importance of H. anatolicum as a key ectoparasite, but the research in Karakalpakstan provides a more comprehensive picture of ecological and epizootic features.

A review by B. Kumar et al. (2020) examined the epidemiological significance of ticks of the genus Hyalomma as vectors of Theileria annulata in animals and Crimean Congo haemorrhagic fever virus in humans, and other pathogens, including Babesia, Rickettsia, and various viruses. The researchers noted difficulties in controlling populations of these ticks due to their multi-host nature and pointed to the limited effectiveness of conventional acaricides. The study analysed alternative control methods, including the development of Hyalomma vaccines by analogy with anti-Rhipicephalus microplus vaccines, and the use of plant-based acaricides and other environmentally sustainable approaches. The review highlighted the need to move towards comprehensive management strategies to reduce the spread of ticks and their transmitted infections.

During the three-year study by L.P. Phipps et al. (2022), conducted in Southern England, the potential for disease transmission by ticks of the species Haemaphysalis punctata, whose numbers and range are increasing in Northern Europe, was investigated. 302 individuals collected at eight different locations were analysed by polymerase chain reaction (PCR). The samples revealed two types of Babesia associated with diseases in farm animals (Babesia major and Babesia motasi), and the causative agent of borreliosis in humans, Borrelia miyamotoi. The highest concentration of infected ticks was recorded in Sussex County. The data obtained indicate the potential threat of the expanding H. punctata population to the health of humans and farm animals in the region.

M.S. Sajid et al. (2009) evaluated the efficacy of ivermectin and cypermethrin against the mite Hyalomma anatolicum both in vitro and in vivo. Both drugs showed high efficacy in the laboratory, while cypermethrin completely destroyed ticks even at the highest concentrations, and ivermectin significantly reduced survival. In the field, cypermethrin ensured the complete destruction of ticks for 20 days after treatment, while ivermectin only ensured destruction for 15 days. However, incorrect use of acaricides and excessive use of ivermectin, identified among farmers, could reduce the effectiveness of the drug in practice. Comparing these data with the results of this study, which revealed the high activity of Hyalomma ticks and their significant impact on the health and productivity of cattle in Karakalpakstan, the need to introduce more effective and sustainable ectoparasite control strategies becomes obvious. The findings of M.S. Sajid et al. confirmed that chemicals, especially cypermethrin, can be effective, but their rational use and proper organisation of animal treatment are key to long-term success.

Summarising, the integration of data on the seasonal activity of ticks, the microbiological characteristics of their populations and the effectiveness of acaricides emphasises the importance of an integrated approach to combating ectoparasites. The introduction of systematic monitoring, the rational use of acaricides and alternative control methods will reduce the burden of ticks and related diseases, increase livestock productivity, and improve the epizootic situation in the region.

Conclusions

The conducted research established that in the conditions of the Republic of Karakalpakstan, farm animals, in particular bovine cattle and sheep, are under constant threat of infection with a wide range of ectoparasites. Parasitisation of 12 species was recorded, including representatives of the genera Hyalomma, Rhipicephalus, Haemaphysalis, Dermacentor, Ixodes, and lice of the genus Bovicola, which indicates a high species diversity and adaptability of ectoparasites to local climatic and zootechnical conditions. These data confirm the importance of regular monitoring of ectoparasite populations on livestock farms and the need for timely preventive measures.

The analysis of seasonal phenology showed that the activation of ticks begins in the second decade of April, reaches a peak in June-July, and then gradually decreases. This distribution is related to the temperature and humidity conditions of the region, which favour the reproduction and distribution of arthropods during the warm season. Unlike ticks, the insects that cause entomoses, especially Bovicola bovis and B. ovis, were most common in the winter and spring period, which may be conditioned by a decrease in the immune status of animals during the cold season, increased crowding of livestock indoors, and less active control of parasites during this period.

The results obtained confirm that the tasks set – determining the species composition of ectoparasites, studying the seasonal dynamics of their activity and identifying periods of greatest danger – have been successfully solved. In the future, in-depth studies of the biology and resistance of the discovered species to chemical agents are required, and an assessment of the effectiveness of alternative control methods, including biological and phytotherapeutic approaches, considering the specifics of the region and the characteristics of farm animals.

References

[1] Altay, K., Erol, U., Sahin, O.F., Ulucesme, M.C., Aytmirzakizi, A., & Aktas, M. (2024). Survey of tick-borne pathogens in grazing horses in Kyrgyzstan: Phylogenetic analysis, genetic

diversity, and prevalence of Theileria equi. Frontiers in Veterinary Science, 11, article number 1359974. doi: 10.3389/fvets.2024.1359974.

[2] Biglari, P., Bakhshi, H., Chinikar, S., Belqeiszadeh, H., Ghaffari, M., Javaherizadeh, S., Faghihi, F., & Telmadarraiy, Z. (2018). Hyalomma anatolicum as the main infesting tick in an important livestock rearing region, central area of Iran. Iranian Journal of Public Health, 47(5), 742-749.

[3] Catalano, S. (2024). Practical guide to live sampling of livestock and wildlife for infectious disease surveillance. Wildlife. doi: 10.17504/protocols.io.rm7vzxro8gx1/v2.

[4] Choubdar, N., Karimian, F., Koosha, M., & Oshaghi, M.A. (2021). An integrated overview of the bacterial flora composition of Hyalomma anatolicum, the main vector of CCHF. PLoS Neglected Tropical Diseases, 15(6), article number e0009480. doi: 10.1371/journal.pntd.0009480.

[5] Eshetu, A., Ayele, T., Mengistu, S., & Belina, D. (2017). Prevalence of Melophagus ovinus and Bovicola ovis infestation in sheep in Wogera District, North Gondar Zone, Ethiopia. Journal of Veterinary Science & Technology, 8(3), article number 1000440. doi: 10.4172/2157-7579.1000440.

[6] Fedonyuk, L., Pryvrotska, I., & Rujytska, O. (2019). Ecological features, distribution and epidemiological significance of family ixodidae ticks. Scientific Horizons, 22(11), 121-129. doi: 10.33249/2663-2144-2019-84-11-121-129.

[7] Ganiev, I.M., & Aliverdiev, A.A. (1968). Atlas of ixodid ticks. Moscow: Kolos.

[8] Hussain, N., Shabbir, R.M.K., Ahmed, H., Afzal, M.S., Ullah, S., Ali, A., Irum, S., Naqvi, S.K., Yin, J., & Cao, J. (2023). Prevalence of different tick species on livestock and associated equines and canine from different agro-ecological zones of Pakistan. Frontiers in Veterinary Science, 9, article number 1089999. doi: 10.3389/fvets.2022.1089999.

[9] Kamalova, A. (2023). Study of the disease ixodidosis in experimental experiments. Models and Methods for Increasing the Efficiency of Innovative Research, 3(28), 190-196.

[10] Kim, K.C. (1985). Coevolution of parasitic arthropods and mammals. University Park, PA: Pennsylvania State University. doi: 10.5555/19870545247.

[11] Kumar, B., Manjunathachar, H.V., & Ghosh, S. (2020). A review on Hyalomma species infestations on human and animals and progress on management strategies. Heliyon, 6(12), article number e 05675. doi: 10.1016/j.heliyon.2020.e05675.

[12] Li, Y., et al. (2020). Molecular detection of tick-borne pathogens harbored by ticks collected from livestock in the Xinjiang Uygur Autonomous Region, China. Ticks and Tick-Borne Diseases, 11(5), article number 101478. doi: 10.1016/j.ttbdis.2020.101478.

[13] Mavlanov, S.I., Pulotov, F.S., Kamalova, A.I., Ismailov, A.S., Jalolov, A.A., Boltaev, D.M., & Kushimmatov, J.B. (2025). Seasonal dynamics and impact of tick infestation on livestock in Karakalpakstan. International Journal of Environmental Sciences, 11(12s), 1131-1138. doi: 10.64252/y234mm07.

[14] Mckiernan, F., O'Connor, J., Minchin, W., O'Riordan, E., Dillon, A., Harrington, M., & Zintl, A. (2021). A pilot study on the prevalence of lice in Irish beef cattle and the first Irish report of deltamethrin tolerance in Bovicola bovis. Irish Veterinary Journal, 74, article number 20. doi: 10.1186/s13620-021-00198-y.

[15] Nikanorova, A.M. (2020). Scientific foundations for the prevention of natural focal parasitic transmissible zoonoses in the Central Non-Black Earth Zone of Russia (Doctoral dissertation, Russian State Agrarian University – Moscow Timiryazev Agricultural Academy).

[16] Phipps, L.P., et al. (2022). Detection of Borrelia and Babesia species in Haemaphysalis punctata ticks sampled in Southern England. Ticks and Tick-Borne Diseases, 13(2), article number 101902. doi: 10.1016/j.ttbdis.2022.101902.

[17] Sajid, M.S., Iqbal, Z., Khan, M.N., & Muhammad, G. (2009). In vitro and in vivo efficacies of ivermectin and cypermethrin against the cattle tick Hyalomma anatolicum anatolicum (Acari: Ixodidae). Parasitology Research, 105(4), 1133-1138. doi: 10.1007/s00436-009-1538-2.

[18] Shahid, S., Razzaq, A., Gul-Makai, A., Shamim, A., Rizwan, H.M., Nisar, R.A., Akram, Q., & Nawaz, M. (2022). Tick infestation in different breeds of goats and sheep in district Quetta, Balochistan, Pakistan. Journal of Animal Health and Production, 10(1), 10-15. doi: 10.17582/journal.jahp/2022/10.1.10.15.

[19] Sultankulova, K.T., et al. (2022). The prevalence of pathogens among ticks collected from livestock in Kazakhstan. Pathogens, 11(10), article number 1206. doi: 10.3390/pathogens11101206.

[20] Tsapko, N. (2020). List of Ixodid tick species (Acari: Ixodidae). Parazitologiya, 54(4), 341-352. doi: 10.31857/S1234567806040069.