Л.Н. Гумилев атындағы Еуразия ұлттық университетінің ХАБАРШЫСЫ.
BULLETIN of L.N. Gumilyov Eurasian National University.
ВЕСТНИК Евразийского национального университета имени Л.Н. Гумилева.
ISSN: 2616-7034. eISSN: 2663-130X

IRSTI 34.33.23
Research article

https://doi.org/10.32523/2616-7034-2025-153-4-159-172

Biological features of ixodid tick dispersal in biotopes of the West Kazakhstan region

R.N. Toleuova*[1], B.K. Essimov[1], B.Zh. Baimurzina[2], K.I. Akmetov[3], N.K. Nurusheva[4]

[1]*Abai Kazakh National Pedagogical University, Almaty, Kazakhstan*
[2]*Margulan University, Pavlodar, Kazakhstan*
[3]*Toraigyrov University, Pavlodar, Kazakhstan*
[4]*Nazarbayev Intellectual School, Astana, Kazakhstan*

*(E-mail: *raushan_gul_85@mail.ru, esimov.bolat@mail.ru, baimurzinabzh@teachers.ppu.edu.kz, kairat_akhmetov@mail.ru, nurysheva_a@ast.nis.edu.kz)*

Abstract. A biological and faunal analysis of the species distribution of Ixodid ticks in the West Kazakhstan region was carried out. The ecological features of the distribution of Ixodid mites in the biogeocenosis of the studied region, as well as their species association with certain biotopes, are studied. The highest species diversity of ticks is distinguished by the elevated steppe zone. The ixodid fauna in this zone is represented by 5 species belonging to 4 genera: *D. marginatus, D. reticulatus, H. detritum, Rh. rossicus,* and *I. persulcatus.* Mites of the genus Dermacentor prefer toinhabit areas with sufficiently moist soil, with mixed grass and meadow vegetation. *I. persulcatus* and *Rh. rossicus species* are found in forested floodplains, *Hyalomma* species are pastures. In the collected specimens of Ixodid ticks, a significant predominance of females compared to males was noted. Ticks of the genus *Dermacentor* are distributed mainly in flat steppe landscapes. Forest and forest-steppe zones are the most suitable for the ixodid family. For *Ripicephalus*, they are forest-steppe and semi-desert. Ticks of the genus *Hyalomma* are found only in areas of cattle breeding and adjacent territories.
Keywords: ixodid ticks, biogeocenosis, dominant species, biological analysis, faunal analysis

Introduction

Ixodid mites belong to the ecological group of temporary ectoparasites with long-term feeding [1-4], so the life cycle of ixodids includes four stages: egg, larva, nymph, and imago. The nature of the effects of tick bites on the skin of animals is determined by their type, the duration of suction, and the immune status of the host. Ixodid ticks are temporary ectoparasites that feed for a long time, spending a significant part of their life cycle in the external environment.

Received: 24.11.2025. Accepted: 12.12.2025. Available online: 25.12.2025.

*Corresponding authors

In addition, much attention was paid to species of epizootological and epidemiological significance. As a result of numerous studies and observations, an extensive factual material was accumulated, so there was a need to systematize and generalize it, which was implemented by a number of authors in works of a monographic nature [5-10]. A number of authors have found that ixodids contain tularemia, plague, tick-borne encephalitis, ixodic tick-borne borelliosis, and animal piroplasmidosis. For many natural focal diseases, ixodid ticks are special carriers. The range of pathogens transmitted by ixodid ticks is constantly expanding.

Currently, diseases associated with tick bites dangerous for animals and humans, are everywhere, from tropical, subtropical, and temperate zones to rural areas and large cities. The constant movement of animals and surrounding people contributes to the spread of ticks. The study of the ecological features of the distribution of ixodid ticks in the biome of West Kazakhstan, as well as the exact location of a particular biome, allows you to determine in time the places of accumulation of the most dangerous ixodid tick species. The direction of activity in determining the environmental conditions on the icon of the dependence of the problem is also important. In the Ural region of Kazakhstan, this issue deserves special attention. In this area, the different natural-geographical conditions and various autobiographies, which are characterized by the Icon of the distribution of diversity, lead to the population of social welfare, and the area of the protection of the environment is affected. The living conditions of the landscape, and ticks of the biological distribution, as well as the ticks of the species composition and specific biological communities of the relationship, for the details of the study are necessary. Based on such studies, it is possible to assess the risk of diseases of natural vectors to identify the main points of accumulation of ixodides [11-17].

In 2011, during the spring and summer period, 138 residents of the West Kazakhstan region suffered from ixodic tick bites and sought medical help. A total of 100 ticks taken from humans were tested in the laboratory for tick-borne infections, with a negative result. An annual stable circulation of Congo-Crimean hemorrhagic fever (CCGF) virus was detected in the studied region. There is a high concentration of *Hyalomma marginatum* in cattle in this area. This type of tick is the main vector of the CCGF virus in neighboring regions of Russia [3,18-20]. Interestingly, they can be attracted to human breath and its components, such as acetone, nitric oxide, and carbon dioxide, which can also be produced by plants [15, 17-23].

The study of spontaneous CCGF virus infection in various animals is carried out by enzyme immunoassay (ELISA) using the Vectorkrim-CCGF-antigen test system manufactured by Vector-Best CJSC. The detected CCGF virus should be additionally examined by real-time PCR. In the territories of Russia adjacent to the West Kazakhstan region, Congo-Crimean hemorrhagic fever virus RNA was detected in 10 samples of the *H. marginatum* tick. The 661 *H. asiaticum* mites were examined in the Zhangali region, and 8 of the 187 samples tested positive for Congo-Crimean hemorrhagic fever virus antigen (4.2%). As a result of comprehensive studies in the west of the West Kazakhstan region, the virus was detected in *H. asiaticum*. Thus, a new natural outbreak of Congo-Crimean hemorrhagic fever has also been identified in Kazakhstan.

Based on the above, the aim of this study is to conduct a comparative analysis of changes in faunal complexes of Ixodid mites in various biogeocenoses of the territory of Western Kazakhstan.

Materials and research methods

This work is based on materials obtained after field and laboratory studies in 3 administrative districts of the West Kazakhstan region (Bokeyorda, Zhanibek, and Syrym districts), including

1,825 biomass and 2,712 ticks according to a single methodology using standard flags and fibers (Figure 1). When monitoring large mammalian infections, direct collection of ticks from vertebrate hosts in the study area is the main method [21-24].

The determination of the systematic affiliation of ticks was carried out using determinants together with specialists from the Uralsk sanitary and Epidemiological laboratory, the Ural Anti-plague station, and the district sanitary and Epidemiological station.

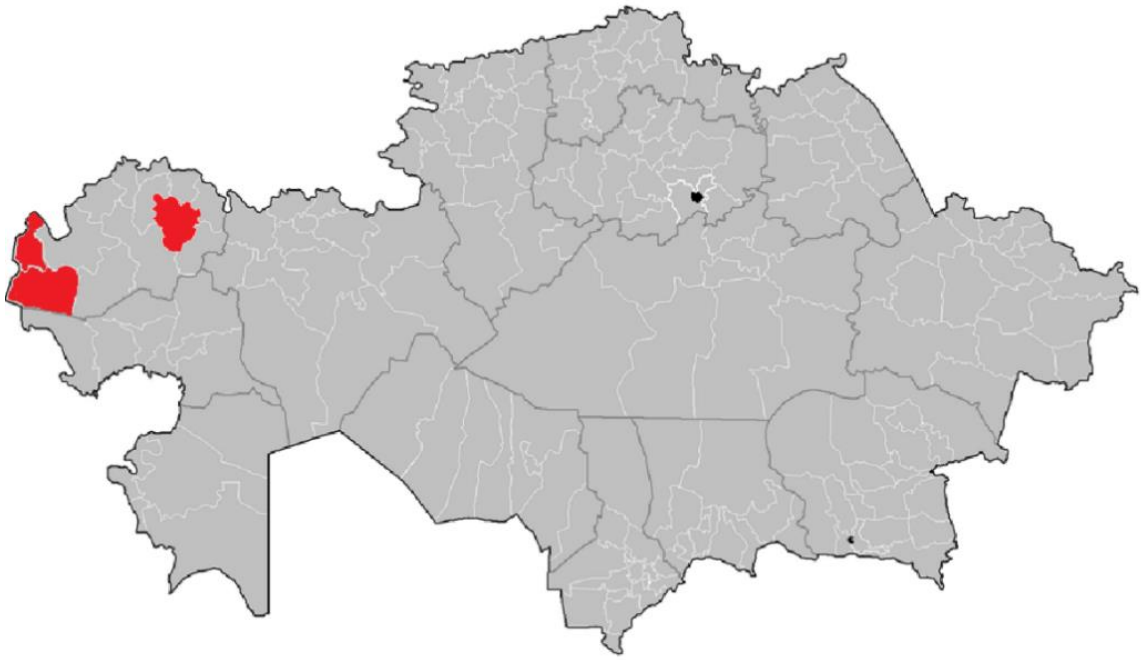

Figure 1. Research areas

From vertebrates, ticks were collected on farms and pastures. When collecting ticks, attention was paid to the places where they were concentrated in the feeder: neck, underbelly, ears, eyelids, axillary and groin areas, nipples, bottom and tail tip. Fixed ixodid ticks were removed manually with medical gloves, grabbing the base of the beak. In some cases, tweezers were used. Tear off the ticks by any means, with caution it is necessary to release movements or rotate the tick around the longitudinal axis of the body, so as not to tear the burrow. Gloves and tools are disinfected after work, and hands are treated with 70% alcohol [25-28].

The ticks collected in various biotopes were fixed with 70% alcohol. Before the study, the ticks were removed from a test tube, placed on filter paper, removed with tweezers, and examined under a magnifying glass under side lighting. The table "tick identifier of the Ixodidae family" was used to determine the genus and species of ticks.

The data obtained were processed using statistical methods. The work used standard environmental indicators (dominance index (id), indices of species diversity and wealth). Basic statistical calculations were performed using Microsoft Excel 2007 and Statgraphics 5.0.

Results

Today, the ixodofauna in western Kazakhstan biotope is represented by five species of four genera: *Dermacentor marginatus, Dermacentor reticulatus, Hyalomma detritum, Ixodes persulcatus,* and *Rhipicephalus rossicus.*

The fauna of tick species of the western region of Kazakhstan, by quantitative distribution, is very uneven. *Dermacentor* ticks (*D. marginatus* and *D. reticulatus)* occupy a dominant place in terms of abundance and appearance. *D. marginatus* species are found in all three regional settlements (49.60% in collections). Divisions of the ixodid fauna of the Kazakh Urals are formed on *D. reticulatus* (21.12% in collections). *H. detritum* species -at least than 50%.

The share of all listed types of ixodid ticks in the region is 87.90% of the total tick fauna of the studied biogeocenoses. The *Ixodes persulcatus* and *Rhipicephalus rossicus* can be considered the ixodid mite species for the fauna of the biotopes of the three studied regions, of the region 0.95% and 6.30% in the collections, respectively, the least.

The distribution of ixodid mites in different biogeocenoses is uneven and mosaic. Quantitative characteristics of the Ixodid tick fauna also depend on natural and geographical conditions. The natural and climatic conditions of the West Kazakhstan region are characterized by a high degree of mosaic landscapes, soils, vegetation cover, and economic development of the territory. The tick fauna of the southern upland Uvalisto plain forest-steppe part of the right bank of the Chagan River is represented by 3 species belonging to 2 genera. The dominant species in this zone was *D. marginatus* (ID was 84. 5%). The percentage of the 2 other species was distributed as follows: *D. reticulatus* – 14.0%, I. persulcatus – 1.4%.

Analysis of the faunal data of ixodid ticks in the West Kazakhstan region showed that the highest species diversity of ticks is found in the high steppe belt on the right bank of the Derkul River. As a result of the conducted studies, it was determined that the ixoid fauna in this zone is represented by 5 species belonging to 4 families: *D. marginatus, D. reticulatus, H. detritum, Rh. rossicus,* and *I. persulcatus.* A total of 425 tick specimens were collected. The dominant species in the study area was *D. marginatus* (ID was 42.3%). The percentage of other species had the following distribution: *D. reticulatus* – 21.7%, *H. detritum* – 12.3%, *Rh. rossicus* – 9.6%, I. persulcatus - 2.3%.

On the territory of the Bokeyorda district, in the biogeocenoses of low-mountain steppes, 4 species of ixodids were also recorded: *D.marginatus, D. reticulatus, H.detritum, Rh. rossicus. D.marginatus dominates* (ID 49,6%), D.5.3 is subdominant (ID 2%). The percentage of other species was distributed as follows: *H. detritum* – 16,4%, *Rh. rossicus* – 1,6%. Three types of ticks were found in the high-level steppe biogeocenoses of the Syrym district: *D. marginatus, D. reticulatus,* and *H.detritum.* The following species dominated: *D. marginatus* (ID 58.4%) and *D. reticulatus* (ID 40.1%). In the elevated mountainous biogeocenoses near the village of Mashtakov, only 2 species are found: *D. reticulatus* and *D. marginatus.* The territory is dominated by ticks of the *D. reticulatus* species by a large margin (ID 82.0%). The *D. marginatus* species was less common in this zone (8.4%). The biotopic distribution of ixodid ticks in the West Kazakhstan region is as follows. Forest areas and floodplains of the Chagan and Derkul Rivers were characterized by the greatest species diversity and richness. The Macintosh diversity index was 0.487 ±0.042 and 0.395 ± 0.040, respectively; the Shannon index was 1.973 ± 0.132 in forest areas and 1.841 ± 0.067 in floodplains, respectively. The species composition in forests is 4 species, in floodplains, 5 species.

The isotopic ixodic ticks of the territory are distributed in the West Kazakhstan region as follows. The Chagan River's largest forest areas of were distinguished by their diversity. The Macintosh index is 0.487 ±0.042 with composition diversity, respectively, not 0.395 ± 0.040; in the forest area, the Shannon index is 1.973± 0.132, in the floodplain, 1.841 ± 0.067, respectively. c. the species composition of the forest is 4 forces, floodplain – 5 species. According to the results of the survey, small animals had a lower occlusion rate than large animals, and their occurrence index was recorded, respectively, 91.0% and 92.3% (Table 1).

Table 1

Damage to various animal species in western Kazakhstan

Type of tested animal	Number of examined Animals	Ticks collected	Maximum number of ticks per 1 animal	Abundance index, pcs	Index of occurrence, %
Small animals	996	2960	19	2.97	91.0
Large animals	13	98	24	7.5	92.3

In addition, there are three most common species in the region: ticks – *I. persulcatus, D. reticulatus, and D. marginatus*. In addition, based on the fact of predominance of these types, we focused on the study of these three types of ixodids, which we found and are practically widespread in western Kazakhstan. The results of collecting ixodid ticks in the context of natural and climatic zones and their types are presented below in Table 2. Our observations and studies were carried out in the forest steppe zone and the steppe zone of western Kazakhstan.

Analysis of the data in Tables 1 and 2 shows that animals in forest-steppe territory are infected with three species of ixodids: *D. reticulatus* – 49.5%, *D. marginatus* – 8.6%, *I. persulcatus* – 41.9%. The maximum number of ticks found on one cattle was 24, and the maximum number of Ixodes ticks on one cattle was 19. On average, 7.5 Ixodes ticks were found per examined cattle, and 2.97 Ixodes ticks per cattle.

Table 2

Types of ixodids in different natural and climatic zones of western Kazakhstan

Natural-Climate belt	Collected ticks, pieces	Among them					
		D. reticulatus		*D. marginatus*		*I. persulcatus*	
		pieces	%, M+m	pieces	%, M+m	pieces	%, M+m
Forest-steppe	3100	1535	49,5+2,8	266	8,6±1,1	1299	41,9+2,6
Steppe	2835	1252	44,2+2,5	412	14,5±1,7	1171	41,3±2,7
Total	5935	2787	47,4±2,6	678	10,6±1,4	2470	41,6±2,7

According to Table 3, the dominant place in terms of numbers in cattle is occupied by ticks of the genus Dermacenter – *D. marginatus.* This type of tick is found in 65 percent of the cattle population. The subdominant form includes *H. detritum* (30%). Significantly fewer species were found in cattle: *D. reticulatus* (3.0%) and *Rh. rossicus* (2.0%). Ticks of the *I. persulcatus* species have not been detected on cattle.

Table 3

Collected ticks from different animals

Types of ticks	Number of ticks											
	From cattle		From horses		From sheep		From dogs		From humans		From roe	
	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%
D. marginatus	138	65	71	60,4	221	88,6	15	42,6	43	55,0	2	7,0
D. reticulatus	6	3,0	47	39,6	29	11.4	12	32,4	19	25,0	3	8,0
H. detritum	64	30	0	0	0	0	0	0	0	0	0	0
I. persulcatus	0	0	0	0	0	0	0	0	12	15,0	0	0
Rh.rossicus	6	2,0	0	0	0	0	9	25,0	4	5,0	23	85,0
Total	214	100	118	100	250	100	36	100	78	100	28	100

D.reticulatus (32.4%) and *Rh. rossicus species* (25.2%) is more common. The species *H. detritum* and *I. persulcatus* have not been found. For horses, *D. marginatus* is the dominant species (60.4%), and *D. marginatus* (42.4%) is a common species of ixodic ticks for dogs.

Subdominant *D.reticulatus* (39.6%). *Rh. rossicus, H. detritus,* and *I. persulcatus* could not be identified. Only two types of ticks have been removed from sheep: *D.marginatus* and *D.reticulatus. D. marginatus* predominates (88.6% in collections). *D. reticulatus* was significantly fewer (11.4% in collections) (Figure 2).

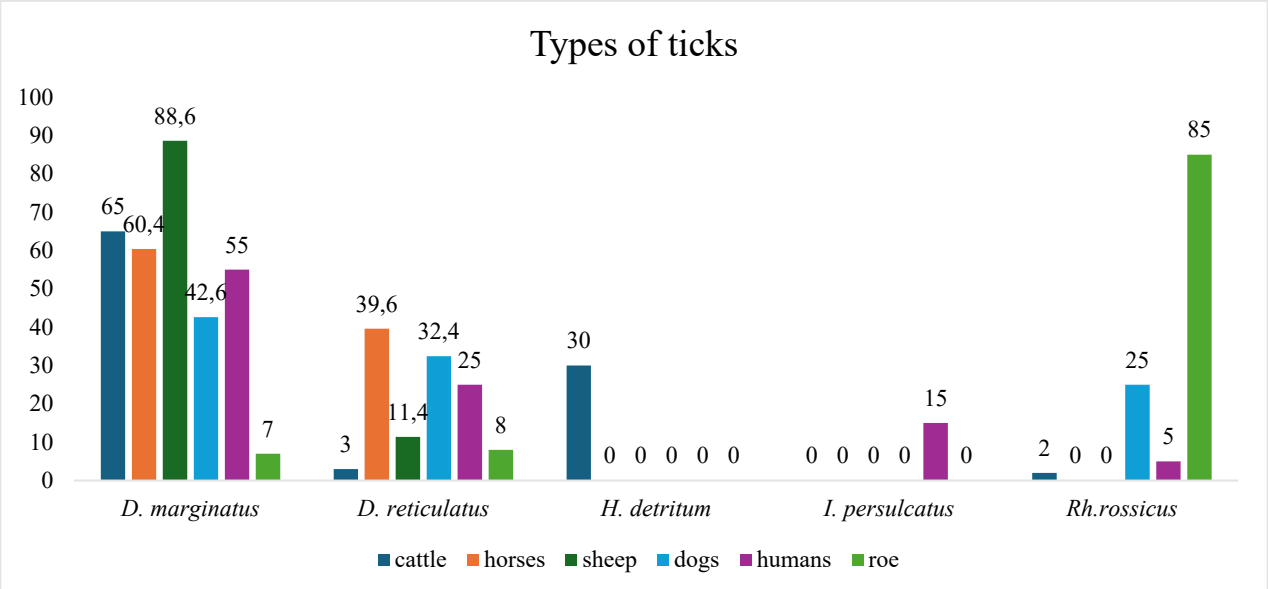

Figure 2. Specific occurrence of ticks in different hosts

Rh. rossicus is the dominant species of roe deer (85.0%). *D. marginatus (*7.0%) and the species *D. reticulatus* (8.0%) is much less common in roe deer. Humans are often the breadwinners of ixodic ticks. The species, *I. persulcatus,* was only found in human collections. Dominant type *D. marginatus* (55,0%), *D. reticulatus* – 25,0%. Ticks of the type I. persulcatus – 15.0% and *Rh. rossicus* – 5.0%.

As a result of mass parasitization of ticks of the genus Dermacentor, the amount of hemoglobin in the blood of animals decreases by 12-15%, red blood cells by 1.5 - 2 million, and leukocytosis develops with significant eosinophilia, 7-13%, which leads to exhaustion and death of animals.

When 60-100 pairs of ticks are parasitized on sheep, severe intoxication, nervous system disorders, and sometimes death are observed. Milk yields of cows can decrease by 18-20% (with mild tick damage) and 40-50% (with severe tick damage, more than 3 thousand ticks per animal). Many researchers have found that the time of falling off drunk ixodids falls on certain periods of the day. For example, female ticks Ixodes ricinus and I. persulcatus [25]. They usually finish the last stage of feeding on the night before falling off and leave the owner in the morning, when the cattle are grazing on pastures. In arid climates, the larvae, nymphs, and females of Hyalomma anatolicum fell off cattle during the summer months, and in Tajikistan at night, when the animals were resting in primitive pens. In the cracks of the mud walls of these rooms, the eggs of *H. anatolicum* molt or develop, all stages of which feed on farm animals [26].

Data on the species belonging to ixodid ticks collected from different vertebrate species in the Bokeyorda and Zhanibek districts are presented in Table 4.

Table 4

Species belonging of ixodids collected from animals

Study area	Total ticks collected, ex.	Among them					
		D. reticulatus		*D. marginatus*		*Ixodes persulcatus.*	
		Ex.	%	Ex.	%	Ex.	%
Bokeyorda	531	244	45.9	89	16.8	198	37.2
Zhanibek	2181	947	43.4	314	14.4	920	42.2
Total:	2712	1191	43,9±2,5	403	14.8±1,6	1118	41.2±2,2

As the analysis of the tabular data shows, during the study of cattle and small animals on farms, 2712 tick samples were removed, we identified them as *D. reticulatus* – 1191 samples (43.9%), *D. marginatus* – 403 samples (14.8%), and Ixodes persulcatus – 1118 samples (41.2%) (Figure 3).

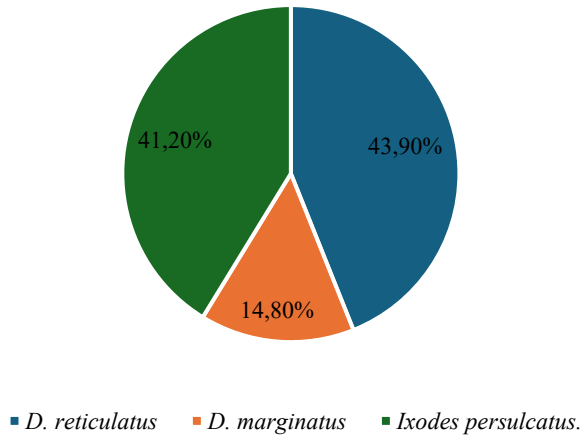

Figure 3. Species ratio of epidemiologically significant ticks

In addition, in MNT – the maximum number of ticks was 11 individuals, and in cattle the maximum was slightly higher – 14 ixodids. The tick abundance index in these animal species differed significantly from each other. Thus, the average abundance index in cattle was 5.7 individuals, while in MNT there were only 3.1 ixodids per animal studied.

After wintering, the emergence of ticks occurs gradually, so their number in pastures and, accordingly, in animals increases until the last decade of May, then reaches a certain maximum and begins to decrease. In the last days of the season, active ticks are practically not detected, and ticks of the genus Dermacentor reappear in the second half of August.

In the West Kazakhstan region, the first cases of activity of *D. reticulatus* ticks were recorded in mid-April, when adults of the parasite were caught from plants. The first peak of maximum abundance of *D. reticulatus* was recorded from April 21 to June 4, when 30 individuals were recorded per hour of flight, and the abundance index (IO) was 13.4 individuals. The second peak of activity of Dermacentor ticks was recorded later, from August 15 to October 3.

In addition, the first cases of detection of a species such as Ixodes persulcatus in nature were recorded on April 13, and the last cases of activity were recorded in the third decade of June. The highest number of ixodids in animals was recorded from May 7 to June 3, and during this period their incubation reached 77.2-100% of the population, depending on the region, with an abundance index (AI) of 14.2 individuals per animal. The maximum number of ixodids per animal reached 29 individuals. The last cases of attacks on cattle by Ixodid ticks of the Dermacentor genus were recorded on September 21, and the last ticks were removed from plants on October 7. During the observation, it was also noted that ticks attack animals only when they go out to pasture. With the increase in the number of ticks in nature, the number of their warm-blooded hosts increased.

Although some studies were conducted later, when the parasitic season of adult ticks began to decrease, we observed a high degree of damage to farm animals. Thus, the ixodid tick occurrence index in MNT was 88.6%, and ixodid tick infestation in cattle was 65.0%.

The sexual structure of the population of ixodids collected on the surface of vertebrate bodies and biogeocenoses in the West Kazakhstan is presented in Table 5.

Table 5

The ratio of males and females in the biogeocenoses of the West Kazakhstan region

Species	Total number of	Males		Females	
	1833	Ex.	%	Ex.	%
D. marginatus	670	269	40,2	401	59,8
D. reticulatus	524	169	32,4	355	67,6
I. persulcatus	228	47	20,4	181	79,6
H. detritum	215	103	48,0	112	52,0
Rh. rossicus	196	109	55,4	87	44,6

According to the table, there are significant predominance of females than males. The ratio of males and females is obviously biologically important for preserving the diversity of species in the region. This pattern is due to the desire to increase the number of offspring. A special feature is the Rh. rossicus: the females are more numerous than in the collections. Over the years of research, there has been a tendency for Ixodes ticks to change their body shape. During the dry years, various species of Ixodes mites were suppressed.

Discussion

The scientific and practical significance of the work lies in the fact that scientific research was conducted in Kazakhstan, mainly of an epizootological nature, which determined the species composition of ticks. The leading measure in the system of combating pathogens of vector-borne diseases is the destruction of their vectors, Ixodes ticks. The development of new methods for trapping ticks will help prevent economic and social damage and is aimed at improving the safety of the environment and humans. The proposed technology will use compositions of environmentally friendly products to prolong the action of drugs in order to reduce the number of treatments with acaricidal drugs and reduce the burden on the animal body and the environment.

Epidemiologically, the importance of arthropods as carriers of pathogens of infectious diseases of humans and animals is incomparably greater than their importance as parasites, and in obligate-transmissible diseases, vector ticks play a leading role. They actively participate in the mechanism of transmission of pathogens of infectious diseases, especially from protozoan, rickettsial, viral, and bacterial.

Ticks carry hemorrhagic fevers, tularemia, pyroplasmosis, and tick-borne encephalitis. The Ixodid tick order (*Ixodidae*) occupies a leading position among blood-sucking arthropods in terms of the number of transmitted diseases. Among them, there are such dangerous infections as tick-borne typhus, encephalitis, tularemia, pyroplasmosis, and hemosporidial diseases of domestic animals and humans. These ticks are under the close attention of medical and veterinary acarology and parasitology in general. Ixodes ticks are the most common carriers of dangerous encephalitis [29, 30]. The harmful effects of parasites as carriers of infectious diseases are many times greater than their actual parasitic harm. Diseases transmitted to humans and animals by tick bite are called vector-borne diseases. In this case, ticks are a kind of reservoir of infectious agents; they retain them throughout their lives and are often transmitted from generation to generation, laying infected eggs, from which infected larvae are born. Encephalitis mite is one of the most common and well-known. It is important to note that the encephalitic tick is not a separate breed (species) of arthropod insects. Any type of tick can become infected with encephalitis, so it is impossible to identify signs that determine the degree of danger. But it should be remembered that such an infection can lead to the death of a person [6,10].

The Ixodid tick order (*Ixodidae*) occupies a leading position among blood-sucking arthropods in terms of the number of transmitted diseases. Among them, there are such dangerous infections as tick-borne typhus, encephalitis, tularemia, pyroplasmosis, and hemosporidial diseases of domestic animals and humans. These ticks are under the close attention of medical and veterinary acarology and parasitology in general. Our results have shown that using this feature of tick behavior is very effective in collecting and trapping ticks and other blood-sucking insects.

Conclusion

Field trips were conducted, and new knowledge was gained about the patterns of formation of tick foci in the West Kazakhstan region, and their role in the spread of diseases carried by ectoparasites.

In Western Kazakhstan the analysis of the changes in the ixodofauna of the biogeocenoses of in the period over the past 10 years has been carried out. Changes in the species composition, dominant type, and abundance of ixodid ticks have been identified.

In the Urals, among the studied landscape zones, the mountain steppe zone was characterized by the largest number of species, diversity, and richness. The composition of the species is 5 species, which is a consequence of the significant diversity of landscape and zoological conditions in this region. However, ticks of the genus Dermacentor sharply dominated in number. Ecological and faunal analysis showed the features of the spread of Ixod ticks on the territory of Kazakhstan. In the coastal forest-steppe zones, the diversity of species is higher, and the abundance ratio of individual ixodid species was more uniform.

A relationship has been established between the species composition of Ixodes mites and the landscape conditions of the West Kazakhstan region. Ticks of the genus Dermacentor are distributed mainly in flat steppe landscapes. Forest and forest-steppe zones are the most suitable for the ixodid family. For Ripicephalus, they are forest-steppe and semi-desert. Ticks of the genus Hyalomma are found only in areas of cattle breeding and adjacent territories.

The greatest diversity of ticks was recorded in dogs (3 species); the Macintosh variety index was 0.336 ± 0.021, and the Shannon index was 1.452 ± 0.072; for cattle (4 species), the Macintosh variety index was 0.342 ± 0.04, and the Shannon index was 1.068 ± 0.032.

From an epidemiological point of view, the importance of ixodids as carriers of infectious diseases of humans and animals is incomparably higher than their parasitic significance. The harmful effects of parasites as carriers of infectious diseases are many times greater than their real parasitic harm. Based on the data obtained, it is possible to develop regional measures for the treatment and prevention of ectoparasites in animals.

Author Contributions

B.E. – concept and supervision of the work; **R.T.–** conducting the experiments; **A.N.** – discussion of the research results; **R.T.** and **B.B. –** writing the text; **K.A.–** editing the text of the article.

Conflicts of Interest

The authors declare no conflicts of interest.

Compliance with ethical standards

This article does not contain a description of studies performed by the authors involving people or using animals as objects.

References

1. Abdiyeva K, Turebekov N, Yegemberdiyeva R, et al. Vectors, molecular epidemiology and phylogeny of TBEV in Kazakhstan and central Asia. Paras. &Vect. 2020; 13(1): 504. https://doi.org/10.1186/s13071-020-04362-1

2. Maukayeva S, Karimova S. Tick-Borne Encephalitis in Kazakhstan: A case report. Erciyes Med J.2020;42(2):226-8. https://doi.org/10.14744/etd.2019.70431

3. Turebekov N, Abdiyeva K, Yegemberdiyeva R, et al. Prevalence of Rickettsia species in ticks including identication of unknown species in two regions in Kazakhstan. Paras. &Vect. 2019;12(1):197. https://doi.org/10.1186/s13071-019-3440-9

4. Chunli S, Meihua Y., Bin X. Tick Distribution and Detection of Babesia and Theileria Species in the East and South regions of Kazakhstan. Ticks Tick Borne Dis. 2021;12(6):1018-17. https://doi.org/10.1016/j.ttbdis.2021.101817

5. Myrzhieva AB, Shabdarbaeva GS, Turganbaeva G, et al. Ixodid Ticks: Epizootic Status and Methods for Tick Population Size Reduction. OnLine Journal of Biological Sciences. 2020;20: 166-75. https://doi.org/10.3844/ojbsci.2020.166.175

6. Pfäffle, M., Littwin, N., Muders, S.V., Petney, T.N.The ecology of tick-borne diseases. International Journal for Parasitology.2013; 43 (12-13):1059-77. https://doi.org/10.1016/j.ijpara.2013.06.009

7. Yashina L, Petrova I, Seregin S, et al. Genetic variability of Crimean-Congo haemorrhagic fever virus in Russia and Central Asia. J Gen Virol. 2003;84(Pt 5):1199-206. https://doi.org/10.1099/vir.0.18805-0

8. Eisen RJ, Eisen L. The Blacklegged Tick, Ixodes scapularis: An Increasing Public Health Concern. Trends Parasitol. 2018; 34:295–309. https://doi.org/10.1016/J.PT.2017.12.006

9. Mansfield KL, Jizho L, Phipps LP, et al. Emerging tick-borne viruses in the twenty-first century. Front. Cell. & Inf. Microb., 2017; 7: 298. https://doi.org/10.3389/fcimb.2017.00298

10. de la Fuente J, Antunes S, Bonnet S, et al. Tick-Pathogen Interactions and Vector Competence: Identification of Molecular Drivers for Tick-Borne Diseases. Front. Cell. & Inf. Microb., 2017; 7: 114. https://doi.org/10.3389/fcimb.2017.00114

11. Ismail N, McBride JW. Tick-Borne Emerging Infections: Ehrlichiosis and Anaplasmosis. Clin.Lab. Med. 2017; 37(2): 317-40. https://doi.org/10.1016/j.cll.2017.01.006

12. Wilson JG, Kinzer DR, Sauer JR, Hair JA. Chemoattraction in the lone star tick (Acarina: Ixodidae). I. Response of different developmental stages to carbon dioxide administered via traps. J Med Entomol. 1972; 9:245–52. https://doi.org/10.1093/JMEDENT/9.3.245

13. McMeniman CJJ, Corfas RAA, Matthews BJJ, Ritchie SAA, Vosshall LBB. Multimodal Integration of Carbon Dioxide and Other Sensory Cues Drives Mosquito Attraction to Humans. Cell. 2014; 156:1060–1071. https://doi.org/10.1016/j. cell.2013.12.044

14. Nevill EM. The role of carbon dioxide as stimulant and attractant to the sand tampan, Ornithodoroa savignyi (Audouin). Onderstepoort. J Vet Res. 1964; 31:59.

15. McMahon C, Guerin P. Attraction of the tropical bont tick, Amblyomma variegatum, to human breath and to the breath components acetone, NO and CO2. Naturwissenschaften. 2002; 89:311-15. https://doi.org/10.1007/S00114-002-0317-Z

16. Waladde SM. The sensory nervous system of the adult cattle tick Boophilus microplus (Canestrini) Ixodidae Part II. Scanning electron microscopy. Aust J Entomol. 1977; 16:73– 79. https://doi.org/10.1111/J.1440-6055.1977.TB00064.X

17. van Duijvendijk G, Gort G, Sprong H, Takken W. Behavioural responses of Ixodes ricinus nymphs to carbon dioxide and rodent odour. Med Vet Entomol. 2017; 31:220–223. https://doi.org/10.1111/MVE.12214

18. Miles VI. A carbon dioxide bait trap for collecting ticks and fleas from animal burrows. J Med Entomol. 1968; 5:491– 495. https://doi.org/10.1093/JMEDENT/5.4.491

19. Aitlessov K, Zhumabekova B, Sagyndykov U, Tuyakbayeva A, Bitkeyeva A, Bazarbaeva KZ, Mukhtarov A, Nurbekova Z, Satkanov M, Kulatayeva M, et al. Foliar Fertilization with Molybdate and Nitrate Up-Regulated Activity of Nitrate Reductase in Lemon Balm Leaves. Horticulturae. 2023; 9(12):1325. https://doi.org/10.3390/horticulturae9121325

20. Garcia R. Reaction of the winter tick, Dermacentor albipictus (Packard), to CO2. J Med Entomol.1969; 6:286. https://doi.org/10.1093/JMEDENT/6.3.286

21. Garcia R. Collection of Dermacentor andersoni (Stiles) with carbon dioxide and its application in studies of Colorado tick fever virus. Am J Trop Med Hyg. 1965; 14:1090– 1093. https://doi.org/10.4269/ajtmh.1965.14.1090

22. Healy TP, Copland MJW. Activation of Anopheles gambiae mosquitoes by carbon dioxide and human breath. Med Vet Entomol. 1995; 9:331–336. https://doi.org/10.1111/J.1365-2915.1995. TB00143.X

23. Grant AJ, O'Connell RJ. Age-Related Changes in Female Mosquito Carbon Dioxide Detection. J Med Entomol. 2007; 44:617–623. https://doi.org/10.1093/JMEDENT/44.4.617

24. Garcia R. Carbon Dioxide as an Attractant for Certain Ticks (Acarina: Argasidae and Ixodidae). Ann Entomol Soc Am. 1962; 55:605–606. https://doi.org/10.1093/AESA/55.5.605

25. Leonovich SA, Belozerov VN. Regeneration of Haller's sensory organ in the tick Ixodes ricinus L. Exp Appl Acarol. 1992; 15:59–79. https://doi.org/10.1007/BF01193968

26. Gebremedhin MB, Xu Z, Kuang C, Shumuye NA, Cao J, Zhou Y, Zhang H, Zhou J. Current Knowledge on Chemosensory-Related Candidate Molecules Potentially Involved in Tick Olfaction via Haller's Organ. Insects. 2023;14:294. https://doi.org/10.3390/INSECTS14030294

27. Josek T, Sperrazza J, Alleyne M, Syed Z. Neurophysiological and behavioral responses of blacklegged ticks to host odors. J Insect Physiol. 2021; 128:104-75. https://doi.org/10.1016/J.JINSPHYS.2020.104175

28. Keirans JE, Hutcheson HJ, Durden LA, Klompen JSH. Ixodes (Ixodes) scapularis (Acari: Ixodidae): Redescription of all Active Stages, Distribution, Hosts, Geographical Variation, and Medical and Veterinary Importance. J Med Entomol. 1996; 33:297–318. https://doi.org/10.1093/JMEDENT/33.3.297

29. Gray JS. A carbon dioxide trap for prolonged sampling of Ixodes ricinus L. populations. Exp Appl Acarol. 1985; 1:35–44. https://doi.org/10.1007/BF01262198

30. Guglielmone AA, Moorhouse DE, Wolf G. Attraction to carbon dioxide of unfed stages of Amblyomma triguttatum triguttatum Koch, under field conditions. Acarologia. 1985; 26:123–129. https://doi.org/10.2307/3281164

Батыс Қазақстан облысының биотоптарында иксодидті кенелердің таралуының биологиялық ерекшеліктері

Р.Н. Төлеуова*[1], Б.К. Есімов[1], Б.Ж. Баймұрзина[2], Қ.И. Ахметов[3], А.Қ. Нұрышева[4]

[1]Абай атындағы Қазақ ұлттық педагогикалық университеті, Алматы, Қазақстан

[2]Ә. Марғұлан университеті, Павлодар, Қазақстан

[3]Торайғыров университеті, Павлодар, Қазақстан

[4]Назарбаев зияткерлік мектебі, Астана, Қазақстан

Аңдатпа. Батыс Қазақстан облысында иксодидті кенелердің түрлерінің таралуына биологиялық және фауналық талдау жүргізілді. Зерттелетін аймақтың биогеоценоздарында иксодидті кенелердің таралуының экологиялық ерекшеліктері, сондай-ақ олардың белгілі бір биотоптармен түрлік байланысы зерттелген. Кенелердің ең жоғары түрлерінің әртүрлілігі биік дала аймағымен ерекшеленеді. Бұл аймақтағы иксодид фаунасы 4 туысқа жататын 5 түрден тұрады: *D. marginatus, D. reticulatus, H. detritum, Rh. rossicus* және *I. persulcatus.* Dermacentor тұқымдасының кенелері жеткілікті ылғалды топырақты, аралас шөпті және шалғынды өсімдіктері бар мекендеу орындарын жақсы көреді. *I. persulcatus* және *Rh. rossicus* түрлері жайылмалардағы ормандар, *Hyalomma* түрлері жайылымдарды мекендейді. Иксодидті кенелердің жиналған үлгілерінде аналықтардың еркектерге қарағанда едәуір басым екендігі байқалды. *Dermacentor* тұқымдасының кенелері негізінен жазық дала ландшафттарында таралған. Ixodidae тұқымдасы үшін орманды және орманды дала аймақтары ең қолайлы. Ripicephalus үшін олар орманды дала және шөлейт жерлер. Hyalomma тұқымдасының кенелері тек мал өсіретін аудандарда және оған іргелес аумақтарда кездеседі.

Түйін сөздер: иксодидті кенелер, биогеоценоздар, басым түрлер, биологиялық талдау, фауналық талдау

Биологические особенности распространения иксодового клеща в биотопах Западно-Казахстанской области

Р.Н. Толеуова*[1], Б.К. Есимов[1], Б.Ж. Баймурзина[2], К.И. Ахметов[3], А.К. Нурышева[4]
[1]Казахский национальный педагогический университет имени Абая, Алматы, Казахстан
[2]Павлодарский педагогический университет имени А.Маргулана, Павлодар, Казахстан
[3]Торайгыров университет, Павлодар, Казахстан
[4]Назарбаев интеллектуальная школа, Астана, Казахстан

Аннотация. Проведен биолого-фаунистический анализ распространения видов иксодовых клещей в Западно-Казахстанской области. Изучены экологические особенности распространения иксодовых клещей в биогеоценозах исследуемого региона, а также их видовая связь с определенными биотопами. Наибольшим видовым разнообразием клещей отличается возвышенная степная зона. Фауна иксодовых клещей в этой зоне представлена 5 видами, относящимися к 4 родам: *D. marginatus, D. reticulatus, H. detritum, Rh. rossicus* и *I. persulcatus.* Клещи рода *Dermacentor* предпочитают заселять участки с достаточно влажной почвой, со смешанной травянистой и луговой растительностью. Виды *I. persulcatus* и *Rh. rossicus* обитают в поймах рек, виды *Hyalomma* – на пастбищах. В собранных экземплярах иксодовых клещей отмечено значительное преобладание самок по сравнению с самцами. Клещи рода *Dermacentor* распространены преимущественно в равнинных степных ландшафтах. Лесная и лесостепная зоны являются наиболее подходящими для семейства иксодовых. Для *Ripicephalus* это лесостепь и полупустыня. Клещи рода *Hyalomma* встречаются только в местах скотоводства и на прилегающих территориях.

Ключевые слова: иксодовые клещи, биогеоценозы, доминирующие виды, биологический анализ, фаунистический анализ

Сведения об авторах:

Толеуова Раушангул Нурлановна **–** автор-корреспондент, докторант Казахского национального педагогического университета имени Абая, Достык, 13, 050010, Алматы, Казахстан.

Есимов Болат Кабдушевич **–** кандидат биологических наук, доцент Казахского национального педагогического университета имени Абая, Достык, 13, 050010, Алматы, Казахстан.

Баймурзина Баян Жумабаевна **–** магистр естественных наук, преподаватель-эксперт Высшей школы Естествознания Павлодарского педагогического университета, Олжабай батыр, 60, 140000, Павлодар, Казахстан.

Ахметов Кайрат Имангалиевич **–** PhD, ассоциированный профессор Торайгыров университета, Ломова, 64, 140008, Павлодар, Казахстан.

Нурышева Ардак Кайроллиновна **–** преподаватель Назарбаев Интеллектуальной школы, Хусеин бен Талал, 21, Z05H8H2, Астана, Казахстан.

Авторлар туралы мәліметтер:

Төлеуова Раушангүл Нұрланқызы **–** хат-хабар авторы, Абай атындағы Қазақ ұлттық педагогикалық университетінің докторанты, Достық, 13, 050010, Алматы, Қазақстан.

Есімов Болат Кабдушевич **–** биология ғылымдарының кандидаты, Абай атындағы Қазақ ұлттық педагогикалық университетінің доценті, Достық, 13, 050010, Алматы, Қазақстан.

Баймұрзина Баян Жұмабайқызы – жаратылыстану ғылымдарының магистрі, Павлодар Педагогикалық Университеті, Жаратылыстану Ғылымдары Жоғары Мектебінің сарапшы - оқытушысы, Олжабай батыр, 60, 140000, Павлодар, Қазақстан.

Ахметов Қайрат Иманғалиұлы – PhD, Торайғыров университетінің қауымдастырылған профессоры, Ломов көшесі, 64, 140008, Павлодар, Қазақстан.

Нұрышева Ардақ Қайроллақызы – Назарбаев зияткерлік мектебінің оқытушысы, Хусеин бен Талал, 21, Z05H8H2, Астана, Қазақстан.

Authors' information:

Toleuova Raushangul – Corresponding author, doctoral student at the Kazakh National Pedagogical University named after Abai, Dostyk, 13, 050010, Almaty, Kazakhstan.

Essimov Bolat – Candidate of Biological Sciences, Associate Professor, Kazakh National Pedagogical University named after Abai, Dostyk, 13, 050010, Almaty, Kazakhstan.

Baimurzina Bayan – master of Natural Sciences. teacher-expert of the Higher School of Natural Sciences, Pavlodar Pedagogical University named after A.Margulan Kazakhstan, Pavlodar, Olzhabay Batyr Street, 60, 140000 Pavlodar, Kazakhstan.

Akhmetov Kairat – PhD, Associate Professor, Toraigyrov University, 64 Lomov st., 140008, Pavlodar, Kazakhstan.

Nurysheva Ardak – teacher of Nazarbayev Intellectual school, Hussein bin Talal, 21, Z05H8H2, Astana, Kazakhstan.