

**ВИДОВОЕ РАЗНООБРАЗИЕ ИКСОДОВЫХ КЛЕЩЕЙ (ACARI, IXODIDAE) В
ЖАМБЫЛСКОЙ ОБЛАСТИ РЕСПУБЛИКИ КАЗАХСТАН**

**С.А. Кенесары¹, А.М. Абдыбекова¹, З.З. Саякова¹, А.А. Жаксылыкова¹, А.С. Елубаева¹,
Э.А.Кыдырханова¹, Б.М. Абдималик²**

¹ ТОО «Казахский научно-исследовательский ветеринарный институт», г. Алматы,
Казахстан

² НАО «Казахский агротехнический университет им. С.Сейфуллина», г. Астана,
Казахстан

kenesary0200@mail.ru

**SPECIES DIVERSITY OF IXODID TICKS (ACARI, IXODIDAE) IN
ZHAMBYL REGION OF THE REPUBLIC OF KAZAKHSTAN**

**S.A. Kenesary¹, A.M. Abdybekova¹, Z.Z. Sayakova¹, A.A. Zhaksylykova¹,
A.S. Yelubayeva¹, E.A. Kydyrkhanova¹, B.M. Abdimalik².**

¹ «Kazakh Scientific Research Veterinary Institute» LLP, Almaty, Kazakhstan

² «S.Seifullin Kazakh Agro Technical University» NP JSC, Astana, Kazakhstan

**КАЗАКСТАН РЕСПУБЛИКАСЫНЫН ЖАМБУЛ ОБЛУСУНДАГЫ
ИКСОДДУК КЕНЕЛЕРДИН (ACARI, IXODIDAE) ТҮРДҮК АР ТҮРДҮҮЛҮГҮ**

**С.А Кенесары¹, А.М. Абдыбекова¹, З.З. Саякова¹, А.А. Жаксылыкова¹, А.С.
Елубаева¹, Э.А.Кыдырханова¹, Б.М. Абдималик².**

¹ ТОО «Казак илим-изилдөө ветеринардык институту», Алматы, Казахстан

² НАО «С.Сейфуллин атындагы Казак агротехникалык университети», Астана,
Казахстан

Аннотация: В результате сборов и изучения иксодовых клещей на территории Жамбылской области в 2023-2024 гг. было выявлено 14 видов клещей семейства Ixodidae: *Dermacentor marginatus*, *D. niveus*, *Haemaphysalis erinacei turanica*, *H. erinacei taurica*, *H. punctata*, *Hyalomma anatolicum*, *H. asiaticum*, *H. scurpense*, *H. turanicum*, *Ixodes stromi*, *I. Persulcatus*, *Rhipicephalus pumilio*, *Rh. annulatus*, *Rh. turanicus*, *Rh. schulzei*.

Всего за период исследований было осмотрено 131 животных, в том числе домашних животных: верблюды – 4 головы, крупный рогатый скот – 93 головы, мелкий рогатый скот – 30 голов. Из диких животных нами были отловлены и осмотрены желтый суслик – 1, лесная мышь – 3. Обследованы пастбища в окрестностях населенных пунктов и 2 норы грызунов. В общей сложности было собрано 1983 экз. клещей, в том числе с домашних животных – 1334, с диких животных – 24 экз., с пастбищ на флаг – 613 экз., из нор грызунов – 12 экз.

Результаты наших исследований показывают разнообразие иксодофауны Жамбылской области и дают основу для дальнейших исследований клещей. Эти данные могут помочь в разработке эффективных методов борьбы с клещами и профилактики заболеваний, которые они переносят.

Ключевые слова: иксодовые клещи, паразиты, численность, распространение, кровепаразитарные болезни.

Аннотация: Натыйжада, жыйымдарды жана иликтөө иксоддук кенелердин; аймагында Жамбылской облусунун 2023-2024-жылдардагы билинген 14 түрлөрүн кенелердин кенелердин тукуму Ixodidae: *Dermacentor marginatus*, *D. niveus*, *Haemaphysalis erinacei turanica*, *H. erinacei taurica*, *H. punctata*, *Hyalomma anatolicum*,

H. asiaticum, H. scupense, H. turanicum, Ixodes stromi, I. persulcatus, Rhipicephalus pumilio, Rh. annulatus, Rh. turanicus, Rh. schulzei.

Изилдөө мезгилинде жалпысынан 131 жаныбар, анын ичинде үй жаныбарлары: төө – 4 баш, бодо мал – 93 баш, майда мүйүздүү мал – 30 баш текшерилген. Жапайы жаныбарлардан биз сары гофер – 1, токой чычкан – 3 кармашып, карап чыктык. Калктуу конуштардын жанындагы жайыттар жана кемирүүчүлөрдүн 2 чуңкуру изилденди. Жалпысынан 1983 кене чогултулган, анын ичинде үй жаныбарларынан – 1334, жапайы жаныбарлардан – 24, жайыттардан желекке – 613, кемирүүчүлөрдүн чуңкурларынан – 12 нуска.

Биздин изилдөөлөрдүн натыйжалары Жамбыл облусунун иксодофаунасынын ар түрдүүлүгүн көрсөтүп, кенелерди андан ары изилдөө үчүн негиз берет. Бул маалыматтар кенелерди көзөмөлдөө жана алар алып жүргөн оорулардын алдын алуу боюнча эффективдүү ыкмаларды иштеп чыгууга жардам берет.

Негизги сөздөр: *иксод кенелери, мителер, саны, таралышы, кан паразиттик оорулар.*

Abstract: *As a result of collections and study of ixodid ticks in the territory of Zhambyl region in 2023-2024, 14 species of ticks of the Ixodidae family were identified: Dermacentor marginatus, D. niveus, Haemaphysalis erinacei turanica, H. erinacei taurica, H. punctata, Hyalomma anatolicum, H. asiaticum, H. scupense, H. turanicum, Ixodes stromi, I. Persulcatus, Rhipicephalus pumilio, Rh. annulatus, Rh. turanicus, Rh. schulzei. A total of 131 animals were examined during the study period, including domestic animals: camels - 4 heads, cattle - 93 heads, small cattle - 30 heads. Among wild animals we captured and examined 1 yellow gopher and 3 wood mice. Pastures in the vicinity of settlements and 2 rodent burrows were examined. A total of 1983 tick specimens were collected, including 1334 specimens from domestic animals, 24 specimens from wild animals, 613 specimens from pastures on the flag, and 12 specimens from rodent burrows.*

The results of our studies show the diversity of ixodofauna of Zhambyl oblast and provide a basis for further studies of ticks. These data can help in the development of effective methods of tick control and prevention of diseases they carry.

Key words: *ixodid ticks, parasites, abundance, distribution, blood-parasitic diseases.*

Ixodid ticks inhabit almost the entire territory of Kazakhstan, but the greatest diversity of species is characteristic of the southern and southeastern regions of the republic. These areas are endemic for such diseases as tick-borne encephalitis, Crimean-Congo hemorrhagic fever, tularemia and other infections transmitted by ticks to humans [1-6]. In addition, the southern regions of Kazakhstan are unfavorable for blood-parasitic diseases of domestic animals such as anaplasmosis, babesiosis, theileriosis, etc. [7-11].

Annually, ticks are collected and analyzed for infectious diseases by sanitary epidemiologists, anti-plague and veterinary services. Over the last fifty years, economic changes in the republic have significantly affected the fauna and abundance of ticks, which emphasizes the importance of studying and systemizing this species. The study of ticks in foci of especially dangerous infections is particularly relevant. Identification of ixodofauna species is complicated by the presence of migratory animals that bring new species into the territory of the republic, the extremely small number of entomologists and the limited number of modern identifiers. One of the key aspects in the study of ticks is differentiation of species based on morphological characters, which is sometimes a significant difficulty and requires special skills.

Zhambyl region and adjacent territories belong to endemic zones where ixodid ticks, which serve as vectors of Crimean-Congo hemorrhagic fever virus and tularemia, etc., are

widespread. [12-15]. Five genera of ixodid ticks are known to inhabit the territory of Zhambyl region: *Dermacentor*, *Ixodes*, *Haemaphysalis*, *Hyalomma* and *Rhipicephalus* [16-18]. Ticks of these genera are unevenly distributed within the region and some of them play an important role in the transmission and spread of pathogens. Despite the importance of ixodid ticks as vectors of human and animal pathogens, their fauna and distribution in Zhambyl region are insufficiently studied.

Material and methods

Collections of ixodid ticks on the territory of Zhambyl region in Moiynqum, Merki, Baizaq, Qorday, Talas, Zhualy, Sarysu, Zhambyl, Turar Ryskulov districts and Taraz city in 2023-2024 served as material (Fig. 1). Ticks were collected from domestic animals using tweezers in compliance with all safety measures. Also in settlements ticks were collected in farmyards and facilities for keeping livestock, in the vicinity of settlements in pastures were collected from vegetation using a cloth flag.

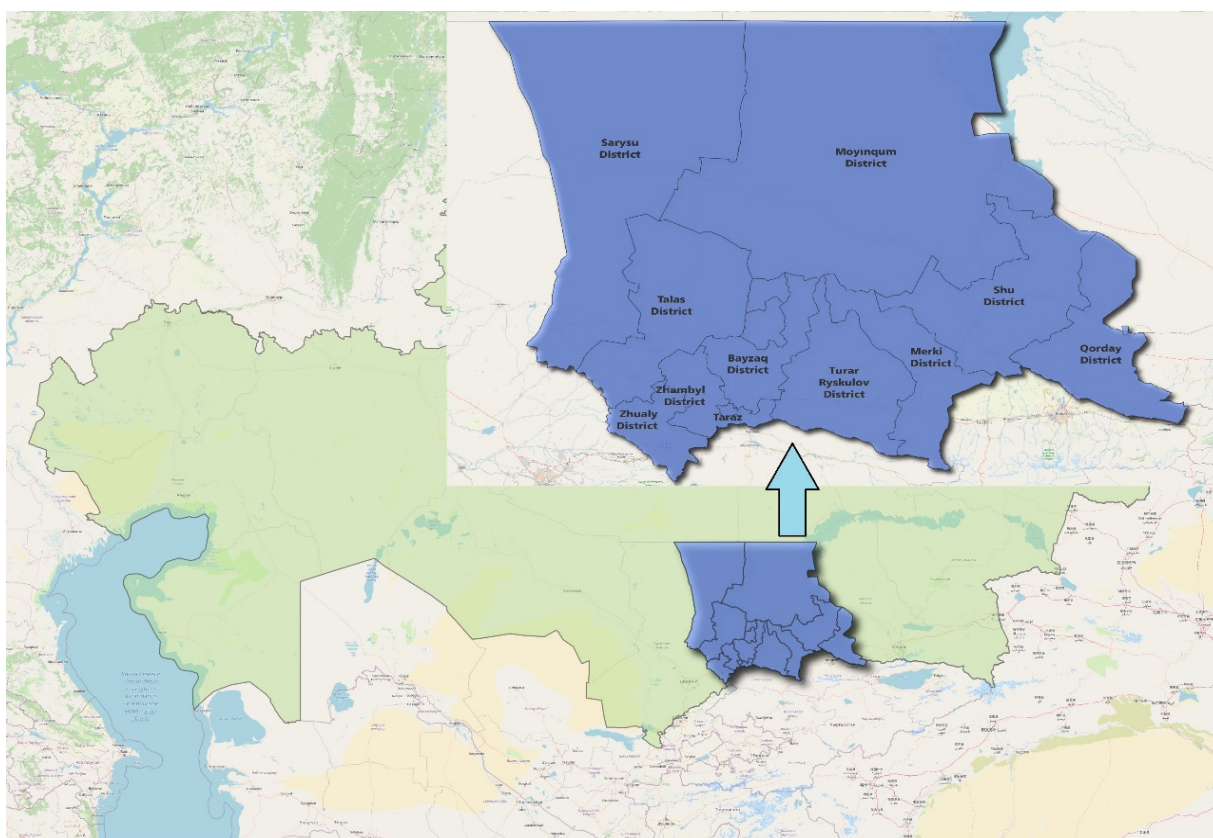


Fig.1. Locations of research in Zhambyl region

Species identification was carried out in laboratory conditions under a stereoscopic microscope using identification keys [19, 20, 21]. In addition, we studied the collection materials of the Institute of Zoology of the Ministry of Education and Science of the Republic of Kazakhstan.

A total of 131 animals were examined during the study period, including domestic animals: camels - 4 heads, cattle - 93 heads, small cattle - 30 heads. Among wild animals we captured and examined 1 yellow gopher and 3 wood mice. Pastures in the vicinity of settlements and 2 rodent burrows were examined. A total of 1983 ticks were collected, including 1334 specimens from domestic animals, 24 specimens from wild animals, 613 specimens from pastures on the flag, and 12 specimens from rodent burrows.

Results

During the examination of domestic animals, we collected 1334 ticks, including 25 ticks from camels, 829 ticks from cattle, and 480 ticks from small cattle.

Of the four camels examined in May 2024, ticks were found on all of them (OI - 100%), but in small numbers (AI - 6.25 specimens). We found 3 species of ticks on camels: *H. anatolicum* (6 exemplars), *Hyalomma asiaticum* (7 exemplars), *H. scupense* (12 exemplars), among which *H. scupense* dominated in numbers.

In cattle ticks were also found on all examined animals (OI - 100%). 829 specimens of ticks belonging to 8 species were collected from the examined cows: *Dermacentor marginatus* - 12 specimens, *D. niveus* - 18 specimens, *Hyalomma anatolicum* - 364 specimens, *H. asiaticum* - 25 specimens, *H. scupense* - 202 specimens, *Haemaphysalis punctata* - 24 specimens, *Rhipicephalus annulatus* - 156 specimens, *Rh. rumilio* - 28 specimens. *Hyalomma anatolicum* dominated in numbers.

480 specimens of ticks of 6 species were picked off small horned cattle: *Dermacentor niveus* - 8 specimens, *Hyalomma anatolicum* - 233 specimens, *H. asiaticum* - 7 specimens, *H. scupense* - 6 specimens, *Rhipicephalus annulatus* - 189 specimens, *Rh. turanicus* - 37 specimens.

On the yellow gopher, ticks of only one species, *Rhipicephalus schulzei* (3♀♀, 3♂♂), were found, and on the wood mouse, 11 nymphs and 6 larvae of *Hyalomma turanicum* and 1 ♀ *I. stromi* were found. Twelve specimens of *Haemaphysalis erinacei* were extracted from rodent burrows. And *Dermacentor niveus* - 286 exemplars, *Haemaphysalis punctata* - 87 exemplars, *Haemaphysalis erinacei taurica* - 1♀, *Hyalomma anatolicum* - 9 exemplars, *H. asiaticum* - 13 specimens, *H. scupense* - 37 specimens, *H. turanicum* - 60 specimens, *Ixodes persulcatus* - 1 specimen, *Rhipicephalus pumilio* - 82 specimens, *Rh. turanicus* - 37 specimens were collected on the flag from pastures in the vicinity of settlements. The dominant in number on the pasture were ticks *Dermacentor niveus*.

Thus, we found 15 species of ticks in Zhambyl region. The species composition in different districts of the region differed significantly. The largest number of species was found in Moynqum district - 10 species (Table 1).

Table 1. Distribution of ixodid ticks by districts of Zhambyl region

№	Collection site	Tick species	Number of ticks
1	Moynqum district	<i>Dermacentor niveus</i>	275
		<i>Haemaphysalis erinacei turanica</i>	12
		<i>H. erinacei taurica</i>	1
		<i>H. punctata</i>	87
		<i>Hyalomma anatolicum</i>	114
		<i>H. asiaticum</i>	32
		<i>H. scupense</i>	110
		<i>Rhipicephalus pumilio</i>	44
		<i>Rh. turanicus</i>	31
		<i>Rh. schulzei</i>	6
	Total:	9 species	
2	Merki district	<i>Dermacentor marginatus</i>	6
		<i>Hyalomma anatolicum</i>	220
		<i>H. turanicum</i>	32
		<i>H. asiaticum</i>	6
		<i>H. scupense</i>	105
		<i>Rhipicephalus pumilio</i>	66
	Total:	6 species	
3	Qorday district	<i>Rhipicephalus turanicus</i>	26
	Total:	1 species	
4	Talas district	<i>Dermacentor niveus</i>	31
		<i>Hyalomma anatolicum</i>	33

	Total:	2 species	
5	Taraz city	<i>Hyalomma anatolicum</i>	6
		<i>H. asiaticum</i>	7
		<i>Hyalomma scupense</i>	12
		<i>Rhipicephalus turanicus</i>	11
	Total:	4 species	
6	Zhualy district	<i>Hyalomma anatolicum</i>	44
		<i>H. turanicum</i>	24
	Total:	2 species	
7	Bayzaq district	<i>Dermacentor niveus</i>	8
		<i>Hyalomma anatolicum</i>	108
		<i>H. scupense</i>	18
		<i>Rhipicephalus annulatus</i>	168
	Total:	4 species	
8	Turar Rysqulov district	<i>Hyalomma turanicum</i>	27
		<i>Ixodes stromi</i>	1
		<i>I. persulcatus</i>	1
		<i>Rhipicephalus annulatus</i>	13
	Total:	4 species	
9	Sarysu district	<i>Dermacentor niveus</i>	6
		<i>Haemaphysalis punctata</i>	12
		<i>Hyalomma anatolicum</i>	30
	Total:	3 species	
10	Zhambyl district	<i>Dermacentor marginatus</i>	6
		<i>Haemaphysalis punctata</i>	12
		<i>Hyalomma anatolicum</i>	57
		<i>H. asiaticum</i>	7
		<i>H. scupense</i>	12
		<i>Rhipicephalus annulatus</i>	153
		<i>Rh. turanicus</i>	6
	Total:	7 species	

In Moynqum district, species of ixodid ticks *Dermacentor niveus*, *Haemaphysalis erinacei turanica*, *H. erinacei taurica*, *H. punctata*, *Hyalomma anatolicum*, *H. asiaticum*, *H. scupense*, *Rhipicephalus pumilio*, *Rh. turanicus*, *Rh. schulzei* were found. *Dermacentor niveus* ticks were dominant in numbers on all examined animals.

In Merki district, *Dermacentor marginatus*, *Hyalomma anatolicum*, *H. turanicum*, *H. asiaticum*, *H. scupense*, *Rhipicephalus pumilio* were found. *Hyalomma anatolicum* ticks were dominant in terms of numbers.

Only one species of *Rhipicephalus turanicus* was found in Qorday district.

In Talas district *Dermacentor niveus*, *Hyalomma anatolicum* were detected. Both species of ticks dominated on all surveyed animals in terms of numbers.

In Taraz city *Hyalomma anatolicum*, *H. asiaticum*, *H. scupense*, *Rhipicephalus turanicus*. The ticks *Hyalomma scupense* and *Rhipicephalus turanicus* were dominant in numbers.

In Zhualy district *Hyalomma anatolicum*, *H. turanicum*. *Hyalomma anatolicum* ticks dominated in number.

In Baizaq district *Dermacentor niveus*, *Hyalomma scupense*, *H. anatolicum* *Rhipicephalus annulatus*. *Rhipicephalus annulatus* ticks dominated in number.

In the district named after Turar Ryskulov *Hyalomma turanicum*, *Ixodes stromi*, *I. persulcatus*, *Rhipicephalus annulatus*. *Hyalomma turanicum* ticks dominated on all surveyed animals in terms of numbers.

In Sarysu district *Dermacentor niveus*, *Haemaphysalis punctata*, *Hyalomma anatolicum*. *Hyalomma anatolicum* ticks dominated in number.

In Zhambyl district *Dermacentor marginatus*, *Haemaphysalis punctata*, *Hyalomma anatolicum*, *H. asiaticum*, *H. scupense*, *Rhipicephalus annulatus*, *Rh. turanicus*. *Rhipicephalus annulatus* ticks were dominant in terms of numbers.

Conclusion. Thus, in the course of research of ixodid tick fauna in the territory of Zhambyl region we registered 14 species of 5 genera. From ticks of the genus *Dermacentor* 2 species were found: *D. marginatus* and *D. niveus*.

Of ticks of the genus *Haemaphysalis* 2 species were found: *H. punctata* and 2 subspecies of *H. erinacei* (*H. e. turanica* and *H. e. taurica*). The genus *Hyalomma* included 4 species: *H. anatolicum*, *H. asiaticum*, *H. scupense* and *H. turanicum*. One specimen of the genus *Ixodes*: *I. stromi* and *I. persulcatus* was found in each specimen. And 4 species of ticks of the genus *Rhipicephalus* were registered: *Rh. annulatus*, *Rhipicephalus pumilio*, *Rh. schulzei* and *Rh. turanicus*. Of all detected ticks, *H. anatolicum* had the widest distribution. This species was found in settlements of 8 districts. *H. scupense* was found in settlements of 5 districts on livestock and pasture. *H. asiaticum* was detected in 4 districts located in the desert zone. *H. turanicum* was detected on livestock in settlements of 3 districts located in the foothill zone. *D. niveus* ticks were frequently caught on flagging in pastures in the vicinity of settlements of 4 districts located in the desert zone and along the floodplain of the Shu River, and *D. marginatus* in settlements of 2 districts located in the foothill zone. *H. punctata* was found in 3 districts, and both subspecies of *H. erinacei* only in Moynqum district. *Rhipicephalus pumilio* was found in the desert zone of Merki and Moynqum districts, *Rhipicephalus turanicus* was found in 2 districts and in Taraz city, *Rh. annulatus* was found in the target sites of 3 districts, and *Rh. schulzei* was taken from gophers only in Moynqum district. Ticks of the genus *Ixodes* - *I. stromi*, *I. persulcatus*, were found only in the foothill zone of the district named after Turar Ryskulov.

REFERENCES

1. Kulemin M.V., Abuova G.N., Sarypbekova L.L., Polukchi T.V., Aliev D.S., Sadyhova D.K., Mavzyutova G.A., Hasanova G.M. Prevalence of ticks, vectors of Congo-Crimean hemorrhagic fever virus, on the territory of Kazakhstan // Medical Bulletin of Bashkortostan. - 2023. - V. 18. - № 2(104). - P. 84-87.
2. Kulemin M.V., Rapoport L.P., Vasilenko A.V., Kobeshova Zh.B., Shokputov T.M., Sailaubekuly R., Atovullaeva L.M. Ixodes ticks of farm animals in South Kazakhstan: fauna structure, abundance, epizootologic significance // Parasitology. - 2020. - V. 54. - № 1. P. 25-31.
3. Abdallahi El Ghassem, Bedia Abdoullah, Jemila Deida, Mohamed Aly Ould Lemrabott, Mohamed Ouldabdallahi Moukah, Mohamed Salem Ould Ahmedou Salem, Sébastien Briolant, Leonardo K. Basco, Khyarhoum Ould Brahim, Ali Ould Mohamed Salem Boukhary. Arthropod-Borne Viruses in Mauritania: A Literature Review // Pathogens. – 2023. – 12 - 1370. <https://doi.org/10.3390/pathogens12111370> <https://www.mdpi.com/journal/pathogens>
4. Abdullah, D.A., Viet L.N., Mohamed S.A.et al. Ticks and associated pathogens in camels (*Camelus dromedarius*) from Riyadh Province. Saudi Arabia. Parasites Vectors – 2020. - № 13, - P. 110. Retrieved from <https://doi.org/10.1186/s13071-020-3973-y>.
5. Abdul Ghafar, Alejandro Cabezas-Cruz, Clemence Galon, Dasiel Obregon, Robin B. Gasser, Sara Moutailler and Abdul Jabbar. Bovine ticks harbour a diverse array of microorganisms in Pakistan. Parasites Vectors (2020) 13:1. <https://doi.org/10.1186/s13071-019-3862-4>.
6. Aneela A., Almutairi M.M., Alouffi A., Ahmed H., Tanaka T., da Silva Vaz I., Chang Sh.Ch., Chen Ch.Ch., Ali A. Molecular detection of *Rickettsia hoogstraalii* in *Hyalomma anatolicum* and *Haemaphysalis sulcata*: updated knowledge on the epidemiology of tick-borne *Rickettsia hoogstraalii* // Veterinary Sciences. - 2023. - T. 10. - № 10. - C. 605.
7. Applying next generation sequencing to detect tick-pathogens in *Dermacentor nuttalli*, *Ixodes persulcatus*, and *Hyalomma asiaticum* collected from Mongolia // Ticks and Tick-borne Diseases 7 June 2023
8. Arif Ciloglu, Osman Ibis, Abdullah Inci. Complete mitochondrial genome characterization and phylogenetic analyses of the main vector of Crimean-Congo haemorrhagic fever virus: *Hyalomma marginatum* Koch, 1844 // Ticks and Tick-borne Diseases 1 May 2021

9. Bedouhene A., Kelanemer R., Medrouh B., Kernif T., Saidi F., Tail G., Ziam H. Seasonal dynamics and predilection sites of ticks (Acari: Ixodidae) feeding on cows in the western parts of the Djurdjura, Algeria // *Frontiers in Tropical Diseases*. - 2022. - T. 3.
10. Adamu Haruna Mamman, Vincenzo Lorusso, Babagana Mohammed Adam, Goni Abraham Dogo, Kevin J. Bownl and Richard J. Birtles. First report of *Theileria annulata* in Nigeria: Findings from cattle ticks in Zamfara and Sokoto States // *Parasites Vectors*. – 2021. 14:242. <https://doi.org/10.1186/s13071-021-04731-4>
11. Alam Sh., Khan M., Alouffi A., Almutairi M.M., Ullah Sh., Numan M., Islam N., Khan Z., Aiman O., Zaman Safi Sh., Tanaka T., Ali A. Spatio-temporal patterns of ticks and molecular survey of *Anaplasma marginale*, with notes on their phylogeny // *Microorganisms*. - 2022. - T. 10. - № 8. - C. 1663.
12. Kazakov S. V., Pole S. B., Zhetibaev B. K., Kardasinov K. K., Gaziev B. H., Ospanov K. S., Turdymatov I. P. Species composition of ticks and its influence on the epidemic process at different sites of the natural focus of Congo-Crimean hemorrhagic fever (CCHF) in Zhambyl region Quarantine and zoonotic infections in Kazakhstan. - Almaty, 2001. - V. 4. – P. 147-149.
13. Aikimbaev A.M., Kazakov S.V., Kasymkanova L.S. Congo-Crimean hemorrhagic fever. - Almaty, 2010. - 83 p.
14. Atshabar B.B., Burdelov L.A., Izbanova U.A., Luhnova L.Yu., Meka-Mechenko T.V., Meka-Mechenko V.G., Kunica T.N., Sadovskaya V.P., Saptayev S.K., Sarmantaeva A.B., Sansyzbaev E.B., Nurmahanov T.I., Abdel Z.Zh., Kozhahmetova M.K., Ajmahanov B.K., Kuznecov A.N., Sagiev Z.A., Kulbaeva M.K., Alybaev S.D., Bekshin Zh.M., Esmagametova A.S., Zhumadilova Z.B., Kazakov S.V., Kuatbaeva A.M. Passport of Kazakhstan regions on especially dangerous infections // *Quarantine and zoonotic infections in Kazakhstan*. – 2015. – № 1(31). – 179 p.
15. Yuliya V. Perfilyeva, Zhanna A. Berdygulova, Akzhigit S. Mashzhan, Andrey V. Zhigailov, Yekaterina O. Ostapchuk, Dinara A. Naizabayeva, Alena S. Cherusheva, Akerke O. Bissenbay, Saltanat A. Kuatbekova, Nurshat Abdolla, Anna S. Nizkorodova, Maxim V. Kulemin, Zhanna Zh. Shapiyeva, Zaure Z. Sayakova, Anastasiya V. Perfilyeva, Ilyas A. Akhmetollayev, Elina R. Maltseva, Yuriy A. Skiba, Seidigapbar M. Mamadaliyev, Andrey M. Dmitrovskiy. Molecular and seroepidemiological investigation of *Coxiella burnetii* and spotted fever group rickettsiae in the southern region of Kazakhstan // *Ticks and Tick-borne Diseases*. – 14. 2023. 102240. DOI: 10.1016/j.ttbdis.2023.102240.
16. Marat Kuibagarov, Riza Makhamed, Assylbek Zhylykibayev, Maxat Berdikulov, Sarsenbay Abdrakhmanov, Mazhit Kozhabayev, Ilyas Akhmetollayev, Kasim Mukanov, Anara Ryskeldina, Yerlan Ramankulov, Alexandr Shustov, Christian Bauer, Alexandr Shevtsov. *Theileria* and *Babesia* infection in cattle – First molecular survey in Kazakhstan // *Ticks and Tick-borne Diseases* 2023. – N 14. www.elsevier.com/locate/ttbdis
17. Kopkova A.I., Belyi D.G., Zaurbekov E.D., Kazangapov K.ZH., Myrzataev ZH.K., Sayakova Z.Z., Karekina A.M. Landscape confinement of ticks *Dermacentor niveus* and *Hyalomma asiaticum* and their numbers in the natural focus of Congo-Crimean hemorrhagic fever in Zhambyl region // *Proceedings of the International Symposium "United Health - a look into the future"* October 27, 2022, Almaty. - Almaty, 2022. – P. 50-52.
18. Sarsenbayeva B.T., Qazahgapov B.Zh., Belyi D.G., Ozenbekov Sh.B., Kopkova A.I., Shonshabayeva D.T. On the fauna and ecology of ticks collected in the Moynqum steppes in the territory of Zhambyl oblast in 2002-2016 years // *Quarantine and zoonotic infections in Kazakhstan*. - 2017. - № 1-2(34-35). - P. 59-64.
19. Apanaskevich D.A. The role of preimaginal phases in the systematics of ixodid ticks of the genus *Hyalomma* Koch - vectors of pathogens: dissertation. Candidate of Biological Sciences. - St.-Petersburg, 2004. – 274 p.
20. Fedorova S. Zh. Ixodes ticks (Rarasitiformes: Ixodidae) of Kyrgyzstan: their diversity and epidemiological importance // *Izvestia HEF*. – 2012. - № 6. – C. 127-133.
21. Sayakova Z.Z. Determinator of ixodid ticks in Kazakhstan. Methodological manual. – Almaty: Kazakh University, 2020. – 144 p.