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Epizootic situation for infectious bovine rhinotracheitis in the Karaganda Oblast, the Republic of Kazakhstan, in 2021–2022

V. V. Kirpichenko, F. A. Bakieva, S. B. Mamanova, E. K. Ospanov, S. E. Kaimoldina
LLP "Kazakh Scientific Research Veterinary Institute" (LLP "KazNIVI"), Almaty, Republic of Kazakhstan

SUMMARY

A comprehensive serological monitoring is currently underway in the Republic of Kazakhstan to detect the circulation of the infectious bovine rhinotracheitis pathogen. To conduct a full-fledged and resultful study, the principles of sampling size representativeness provision and mathematical calculations were observed. The sampling size of the total number of epizootological units included mainly the raions and settlements in which (or near which) infectious bovine rhinotracheitis cases had been previously recorded. The sampling size of livestock population included in the study was determined in accordance with the recommendations of the World Organization for Animal Health. Thus, the study covered 7 (out of 13) raions of the Karaganda Oblast in 2021 and 2022. The other 6 raions and cities of regional significance will be included in the research in 2023. The paper presents the results of infectious bovine rhinotracheitis retrospective analysis and own studies conducted in 2021–2022. Statistical analysis and graphical visualization of investigation results were performed using Statistica, Excel, and QGIS programs. It was established that the epizootic situation for this disease was unfavourable in the Karaganda Oblast in 2021–2022. The data and results of serological studies presented by the Veterinary Control and Surveillance Committee of the Ministry of Agriculture of the Republic of Kazakhstan confirm the circulation of the infectious bovine rhinotracheitis virus in the following raions of the Karaganda Oblast: Abaisky, Aktogaisky, Bukhar-Zhyrausky, Karkaralinsky, Nurinsky and Osakarovsky.

Keywords: epizootological monitoring, infectious bovine rhinotracheitis, epizootic situation, infection outbreaks

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For correspondence: Vladimir V. Kirpichenko, Candidate of Science (Veterinary Medicine), Head of the Virology Laboratory, LLP "KazNIVI", A20C2E4 (050016), Republic of Kazakhstan, Almaty, Raiymbek av., 223, *e-mail: vlad_92reik@mail.ru*.

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Эпизоотическая обстановка по инфекционному ринотрахеиту крупного рогатого скота в Карагандинской области Республики Казахстан в 2021–2022 гг.

В. В. Кирпиченко, Ф. А. Бакиева, С. Б. Маманова, Е. К. Оспанов, С. Е. Каймолдина
ТОО «Казахский научно-исследовательский ветеринарный институт» (ТОО «КазНИВИ»), г. Алматы, Республика Казахстан

РЕЗЮМЕ

В настоящее время в Республике Казахстан проводится полноценный серологический мониторинг на предмет обнаружения циркуляции возбудителя инфекционного ринотрахеита крупного рогатого скота. Для проведения полноценного и показательного исследования соблюдались принципы обеспечения репрезентативности и математического расчета выборки. При формировании выборки среди общего количества эпизоотологических единиц большее внимание уделялось районам и населенным пунктам, в которых (или вблизи которых) ранее регистрировали случаи инфекционного ринотрахеита крупного рогатого скота. Выборка среди поголовья, вошедшего в область исследования, осуществлялась в соответствии с рекомендациями Всемирной организации здравоохранения животных. Таким образом, в область исследования в 2021 и 2022 гг. вошли 7 районов Карагандинской области из 13 возможных. Оставшиеся 6 районов и городов областного значения будут исследованы в 2023 г. В статье представлены результаты ретроспективного анализа по инфекционному ринотрахеиту крупного рогатого скота и собственных исследований, выполненных в 2021–2022 гг. С помощью программ Statistica, Excel, QGIS проведена статистическая и графическая обработка результатов исследования. При изучении эпизоотической обстановки установили, что Карагандинская область в 2021–2022 гг. была неблагополучна по заболеванию. Представленные Комитетом ветеринарного контроля и надзора Министерства сельского хозяйства Республики Казахстан данные и результаты серологических исследований подтверждают факт циркуляции возбудителя инфекционного ринотрахеита крупного рогатого скота в следующих районах Карагандинской области: Абайском, Актогайском, Бухар-Жырауском, Каркаралинском, Нуринском и Осакаровском.

Ключевые слова: эпизоотологический мониторинг, инфекционный ринотрахеит крупного рогатого скота, эпизоотическая ситуация, очаги инфекции

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Для корреспонденции: Кирпиченко Владимир Владимирович, кандидат ветеринарных наук, заведующий лабораторией вирусологии ТОО «КазНИВИ», A20C2E4 (050016), Республика Казахстан, г. Алматы, проспект Райымбека, 223, *e-mail: vlad_92reik@mail.ru*.

INTRODUCTION

Infectious bovine rhinotracheitis (IBR) is a contagious disease that may be persistent and which is characterized by lesions in the respiratory and reproductive organ systems of animals. One of the most distinctive signs of this disease is hyperemia of the mucous membranes of the muzzle and nares, also called "red nose". Such a typical manifestation of IBR is noted in most cases in young animals under 12 months [1].

The disease pathogen is a DNA-genomic bovine alphaherpesvirus 1 belonging to the *Orthoherpesviridae* family. Two subtypes of the virus have been identified to date: 1.1 and 1.2. Type 1 virus affects the respiratory organs, rarely the reproductive organs, type 2 virus causes genital infection. To date, the existence of another subtype of bovine alphaherpesvirus has been proven, but some of its features give grounds for attributing the pathogen to another type [2]. Like most respiratory pathogens, the IBR virus is shed into the external environment mainly through the organs of the respiratory system [3].

The IBR causative agent is quite resistant to environmental conditions. It remains virulent at 22 °C for 45 days, at 4 °C – for up to 7 months. Deep freezing does not affect the virus activity, the infectious titer is stable for 7–9 months. When heated above 56 °C, it dies within 7–20 minutes. The virus is inactivated when treated with chlorine, 2% formalin or sodium hydroxide solutions [2, 4].

The disease may occur in various forms: respiratory form with the upper respiratory tract lesions and genital form with lesions in external genitalia. In addition, IBR is characterized by abortions and conjunctivitis. Systemic infection is often observed in cattle infected in the late stages of pregnancy *in utero* or in neonatal calves [5, 6].

The sources of infection are diseased animals and latent virus carriers. Other than asymptomatic carriers, breeding bulls pose the greatest risk of infectious rhinotracheitis, since the pathogen is capable of transmitting from animal to animal through semen [1, 7–10].

Many researchers have noted the possibility of simultaneous presence of IBR virus and antibodies to it. Thus, the virus could be isolated from the tonsils and lymph nodes of animals with high antibody titers [1, 11–13].

IBR can be treated symptomatically, infected animals shall be isolated from the rest of the herd, a specific serum against this disease may be used.

IBR control is based on vaccination [14, 15], which is considered the most effective way of prevention. Currently, attempts are being made to use subunit, recombinant or split vaccines to reduce the spread or eradicate IBR in different countries [8, 16–23]. Along with imported medicinal products, the inactivated adsorbed vaccines (OOO "NPO Narvac") and adsorbed and emulsion vaccines (FGBI "ARRIAH") are administered in the Russian Federation. Such live vaccines as Bovi-scield Gold FP5 L5, INFORCE 3® (Zoetis Inc., USA) and others are quite popular in the European countries [24, 25].

The IBR epizootic situation in the Republic of Kazakhstan remains tense. Many regions of the country are infected. The mean seroprevalence ranges from 65 to 87% for unvaccinated animals, which clearly demonstrates the circulation of the pathogen among cattle in the Republic.

Infectious rhinotracheitis is officially included in the list of highly dangerous bovine diseases along with foot-and-mouth disease, lumpy skin disease and anthrax. The disease-induced economic losses include animal culling, decreased productivity and emergency slaughter [26–30]. No comprehensive epizootological monitoring of IBR is currently conducted in the Republic of Kazakhstan. Laboratory diagnosis is carried out only in the areas where outbreaks were previously reported. At the same time, only 5–10 samples are collected from livestock for testing, which is not indicative due to the small sampling size. In view of the above, it is an urgent and necessary task to study the disease and conduct the IBR monitoring. Rationale for the sampling size of epizootological units and susceptible livestock will allow realistic assessment of the disease situation and will make it possible to effectively implement epizootological control measures and plan the new ones.

The purpose of this study was to conduct a retrospective analysis and evaluate the current (2021–2022) epizootic situation for IBR in the Karaganda Oblast based on the sampling of epizootological units and target animals in them.

MATERIALS AND METHODS

In order to determine the IBR epizootological status of the Karaganda Oblast, it was necessary to collect and summarize the epizootological data available at present, evaluate the measures used in the disease outbreaks, as well as highlight the weak points of the veterinary measures aimed at preventing the introduction and spread of the pathogen in the country. For that, the relevant requests were sent to the Veterinary Surveillance Committee of the Ministry of Agriculture of the Republic of Kazakhstan for providing data on IBR cases reported in 2021–2022.

To assess the IBR current situation in the Karaganda Oblast, a sample of epizootological units and susceptible livestock was formed. In order to ensure the sample reliability, we followed the recommendations of the World Organisation for Animal Health (WOAH) and the "Guidelines on formation of an epizootological unit (EU) and a sample based on all epizootological units in order to conduct examination and determine the number of animals required for subsequent studies for establishment of the epizootological status of herds, economic entities and zoo habitats", developed and approved by LLP "KazNIVI" based on the WOAH provisions and recommendations.

In this study we used enzyme-linked immunosorbent assay (ELISA), a serological method of primary importance in IBR diagnosis. In addition, according to the WOAH recommendations, ELISA is determined as the most acceptable method for proving the absence or presence of the pathogen circulation in total population[1].

Other factors for selecting the diagnostic method were the relative cheapness and rapidness in comparison with the polymerase chain reaction, which is 1.5–2.0 times more expensive than ELISA, as well as with the test for pathogen isolation and differentiation in cell culture, which are time-consuming.

IDEXX IBR gB X3 Ab Test (infectious bovine rhinotracheitis) commercial diagnostic kit for IBR antibody detection (manufacturer: IDEXX Laboratories, Inc., USA) was used for testing.

RESULTS AND DISCUSSION

The Karaganda Oblast as the administrative unit of the Republic of Kazakhstan was selected for the study due to its status of a continuously infected region.

In the period from 2010 to 2012 the Karaganda Oblast was free from IBR. No pathogen circulation was detected during planned monitoring. However, in 2013 the IBR suspect cases were registered in the Subjects of the Kyzylaraisky (Aktogaisky Raion) and Zharaspaisky (Nurinsky Raion) rural districts (based on citizens' reports). Tests of samples collected from animals with the disease clinical signs demonstrated no laboratory confirmation of the diagnosis.

In 2014 no IBR cases were recorded in the Karaganda Oblast.

In 2015 the reports on IBR suspect cases in Jezkazgan were submitted again. Restrictive measures were imposed in the settlement. Same as in 2013, these cases were managed in the laboratory, and negative results were obtained. It should be noted that the spread of the pathogen that caused a respiratory animal disease in Jezkazgan was prevented.

New reports of citizens on occurrence of respiratory disease symptoms in cattle were received in 2016 from the Amanzholovsky rural district, while other settlements of the Karkaralinsky Raion were not affected. Restrictive measures introduced on the territory of this settlement made it possible to resolve the recorded outbreaks of a respiratory disease. It should be added that testing of samples from IBR suspect animals did not confirm the diagnosis. Other raions of the Karaganda Oblast remained disease-free in 2016.

In 2017 an IBR suspect case was recorded in Karaganda. According to the decision of the local executive body and the chief veterinary officer of the Karaganda Oblast, restrictive measures were administered in the infected locality, which made it possible to resolve the epizootic outbreak and prevent the spread of respiratory infection. Testing of biomaterial samples from IBR suspects in the laboratory did not demonstrate the diagnosis confirmation.

In 2018 there were no reports on IBR suspect cases in the region.

In 2019 several citizen reports on IBR suspects in several farms of the Yntalinsky rural district of the Karkaralinsky Raion were submitted. Restrictive measures were conducted in this locality in accordance with the decision of the local executive authority and the chief veterinary officer of the Karaganda Oblast. However, it was not possible to confirm the diagnosis by laboratory testing of samples from IBR suspect animals.

Such a situation may indicate an asymptomatic, or latent, form of infection in cattle in the region. Besides, the IBR pathogen persistence and the infectious process development in cattle in the herd are closely related to decreased immunity and, as a consequence, occurrence of the virus-susceptible animals.

The results of epizootological monitoring showed that in 2020 new IBR suspect cases were registered in the Karaganda Oblast in Mibulaksky (Ulytausky Raion), Akbastausky (Abaisky Raion) and Kulanotpessky (Nurinsky Raion) rural districts. Restrictive measures were implemented in these settlements.

According to the data available, 7 IBR suspect cases were registered in the Karaganda Oblast in 2021. The first one was detected on 6 January 2021 in Tasaralsky rural district of Aktogaisky Raion. However, the disease was not confirmed by laboratory tests.

A new report on IBR suspicion was received from the Ulytausky Raion on 12 March 2021. Despite the negative laboratory test results, 5 more reports on disease symptomatic manifestations were registered until November 2021 not only in the Ulytausky and Aktogaisky, but also in the Shetsky and Nurinsky Raions. In the Shetsky Raion 2,600 animals were vaccinated and the premises (4,325 m^2) where diseased animals were kept were disinfected based on the recommendations.

Taking into account the IBR current epizootic situation in 2021 the Kazakh Scientific Research Veterinary Institute conducted additional monitoring studies to confirm or rule out the possible spread of the disease pathogen. Thus, 3 raions of the Karaganda Oblast (Abaisky, Osakarovsky and Nurinsky) were subjected to study.

[1] Infectious bovine rhinotracheitis/infectious pustular vulvovaginitis. *In: WOAH. Manual of Diagnostic Tests and Vaccines for Terrestrial Animals. Chapter 3.4.11.* Available at: https://www.woah.org/fileadmin/Home/eng/Health_standards/tahm/3.04.11_IBR_IPV.pdf.

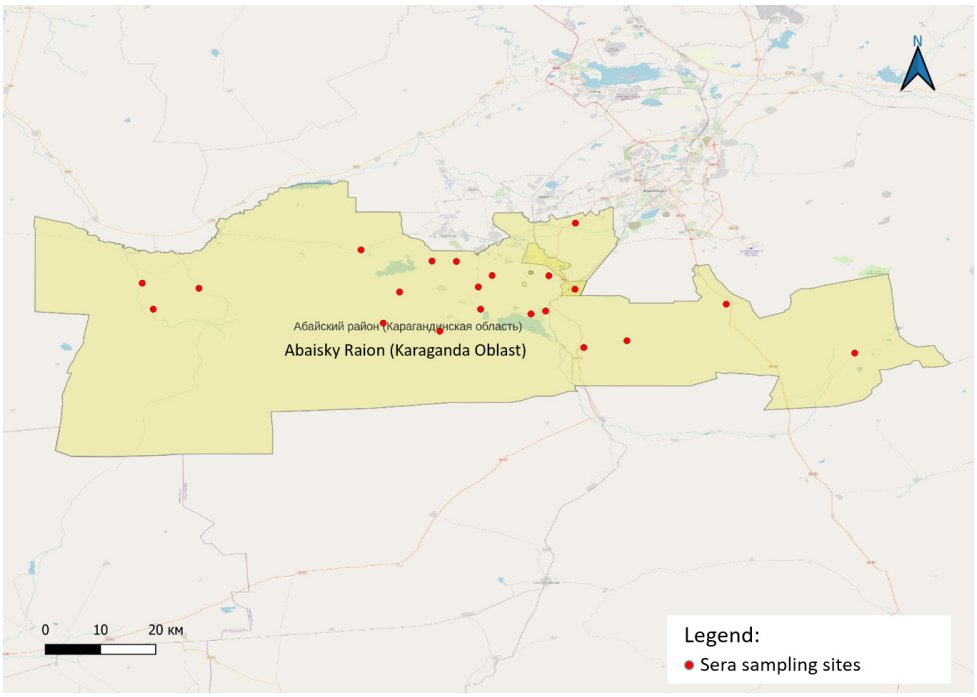

Fig. 1. Sampling sites for blood collection in the Abaisky Raion, the Karaganda Oblast (2021)

The location of epizootological units (EU) used for sampling in the Abaisky Raion is shown in Figure 1. Here, the sampled epizootological units are concentrated closer to Karaganda City, the reason for this is that there is the largest number of settlements, and, accordingly, animals, in this part of the raion. Similar trends can be seen in sampling performed in the Osakarovsky and Nurinsky Raions. Besides, the focus was made on the establishments where reports on IBR suspect cases had been previously submitted.

In order to determine seroprevalence against IBR virus, 285 sera samples were collected from non-vaccinated cattle in the Karaganda Oblast. A total of 21 epizootological units were studied in each of the 3 raions of the region. The results of the serological examination of the collected samples are shown in Figure 2.

The mean seroprevalence for non-vaccinated animals in 3 raions of the Karaganda Oblast was 79.29%. It should be noted that in the Abaisky and Osakarovsky Raions, where no IBR suspect cases were detected in 2021, the seroprevalence was 60.00 and 78.09%, respectively.

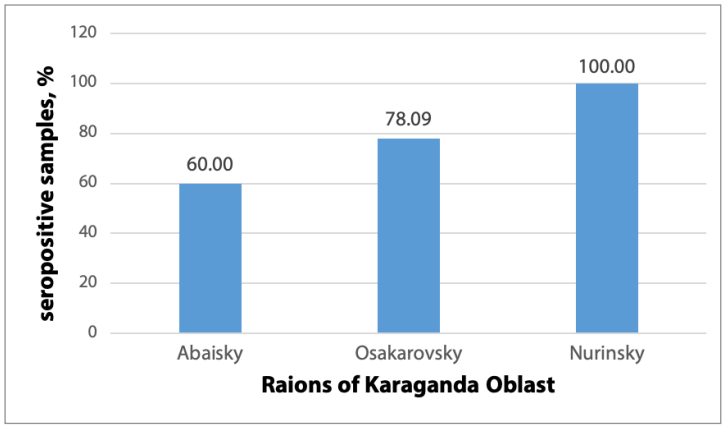

Fig. 2. Proportion of positive samples in the Karaganda Oblast by raions (2021)

Based on the plan of veterinary and preventive measures and due to the financing from the republican budget, the vaccination was carried out only in the localities that had previously submitted reports on IBR suspect cases in 2020 or 2021. The total proportion of vaccinated animals did not exceed 10–15% of the total cattle population in the raion. Cattle vaccinated with an immunoglobulin E vaccine were diagnostically tested, which made it possible to differentiate infected animals from vaccinated ones using the DIVA strategy.

Thus, the data obtained indicate a possible circulation of the IBR pathogen in some raions of the Karaganda Oblast in 2021.

In 2022, the scheduled monitoring was conducted in Bukhar-Zhyrausky, Aktogaisky and Karkaralinsky Raions of the oblast. In total, 21 epizootological units in each of the above-mentioned raions were studied and 285 bovine sera samples were tested for the presence of antibodies to the IBR virus.

The sera samples were obtained from clinically healthy non-vaccinated animals demonstrating no IBR clinical signs. The sample under study included the epizootological units where reports on IBR suspect cases had been previously submitted, as well as nearby settlements or driving areas. It should be noted that in order to achieve the maximum level of test reliability, settlements or driving areas with relative disease-freedom (IBR was never detected) were also examined for this infection.

As a result, IBR-positive animals were found in all epizootological units. The obtained data are visualized in Figure 3.

It was established that the minimum level of seroprevalence (66.66%) was noted in the Aktogaisky Raion, where animals were selected for testing from both backyards and large-scale farms of various forms of ownership.

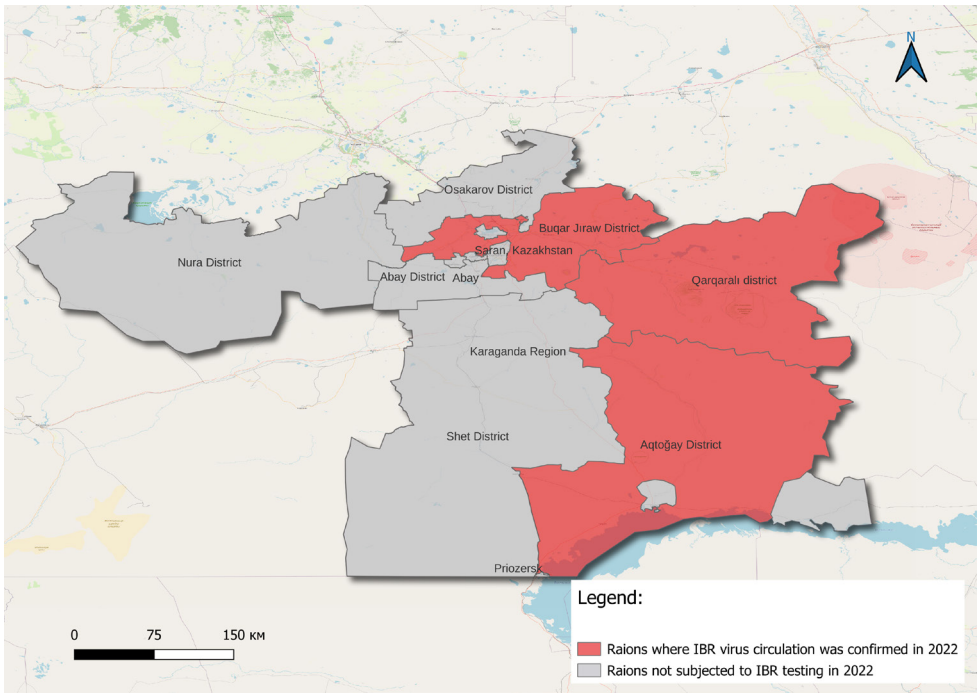

Fig. 3. Seroprevalence against IBR virus in 2022 (Karaganda Oblast)

The maximum level of 90% was recorded in the Karkaralinsky Raion. 97% of the animals tested in this area belonged to the owners who kept animals in backyards. Seroprevalence in the Bukhar-Zhyrausky Raion was 68.57%.

Considering that vaccination against IBR is carried out mainly in large-scale livestock farms and establishments, and immunization in the private sector is mainly financed from the republican budget, it can be confidently said that the chances of taking samples for testing from illegally vaccinated livestock are minimal.

In view of the above, it can be concluded that the circulation of the IBR virus was noted in all parts of the Karaganda Oblast under study in 2022.

CONCLUSION

The study of IBR epizootic situation in the Karaganda Oblast of the Republic of Kazakhstan demonstrated that the region was IBR-infected in 2021–2022. The first report on IBR possible occurrence in the oblast was received in 2013. The further spread of infection in the region was not immediate. Thus, not a single IBR suspicion case was recorded in the region in 2014. However, reports were made on possible occurrence of this infectious disease in animals in the region in 2015. The data analysis showed that since 2013 no cattle were imported from other epizootological units to the establishment where animals with IBR clinical signs were recorded. This fact may indicate a latent infection among livestock in the oblast. According to the data available, 7 IBR suspect cases were registered in the Karaganda Oblast in 2021. Testing of sera from clinically healthy and unvaccinated animals demonstrated high seroprevalence to the IBR agent in the Nurinsky, Abaiskysky and Osakarovsky Raions, where the proportion of vaccinated animals did not exceed 10–15% of the total livestock. In 2022 planned monitoring was carried out in Bukhar-Zhyrausky, Aktogaisky and Karkaralinsky Raions in the oblast, a total of 21 EUs were subjected to testing in each of the above-specified areas. The sample under study included the epizootological units with previously submitted reports on IBR suspect cases, as well as nearby settlements or driving areas. As a result, seropositive animals to the IRT causative agent were found in all EUs. Thus, the data obtained confirm the circulation of the IBR virus in the following raions of the Karaganda Oblast: Abaisky, Aktogaisky, Bukhar-Zhyrausky, Karkaralinsky, Nurinsky and Osakarovsky.

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INFORMATION ABOUT THE AUTHORS / ИНФОРМАЦИЯ ОБ АВТОРАХ

Vladimir V. Kirpichenko, Candidate of Science (Veterinary Medicine), Head of the Virology Laboratory, LLP "KazNIVI", Almaty, Republic of Kazakhstan; *https://orcid.org/0000-0002-2494-3826, e-mail: vlad_92reik@mail.ru.*

Flyura A. Bakieva, Candidate of Science (Veterinary Medicine), Head of Bacteriology Laboratory, LLP "KazNIVI", Almaty, Republic of Kazakhstan; *https://orcid.org/0000-0003-0627-2608, e-mail: flurachka-78@mail.ru.*

Saltanat B. Mamanova, Candidate of Science (Veterinary Medicine), Leading Researcher, LLP "KazNIVI", Almaty, Republic of Kazakhstan; *https://orcid.org/0000-0003-2317-8779, e-mail: sal.71@mail.ru.*

Erzhan K. Ospanov, Candidate of Science (Veterinary Medicine), Leading Researcher, LLP "KazNIVI", Almaty, Republic of Kazakhstan; *https://orcid.org/0000-0001-6903-3570, e-mail: ergan_68@mail.ru.*

Saira E. Kaimoldina, Master of Science (Veterinary Medicine), Junior Researcher, LLP "KazNIVI", Almaty, Republic of Kazakhstan; *https://orcid.org/0000-0002-7658-5805, e-mail: sayra_kaymoldina@mail.ru.*

Кирпиченко Владимир Владимирович, кандидат ветеринарных наук, заведующий лабораторией вирусологии ТОО «КазНИВИ», г. Алматы, Республика Казахстан; *https://orcid.org/0000-0002-2494-3826, e-mail: vlad_92reik@mail.ru.*

Бакиева Флюра Альбертовна, кандидат ветеринарных наук, заведующий лабораторией бактериологии ТОО «КазНИВИ», г. Алматы, Республика Казахстан; *https://orcid.org/0000-0003-0627-2608, e-mail: flurachka-78@mail.ru*.

Маманова Салтанат Бекбосыновна, кандидат ветеринарных наук, ведущий научный сотрудник ТОО «КазНИВИ», г. Алматы, Республика Казахстан; *https://orcid.org/0000-0003-2317-8779, e-mail: sal.71@mail.ru.*

Оспанов Ержан Калиолдинович, кандидат ветеринарных наук, ведущий научный сотрудник ТОО «КазНИВИ», г. Алматы, Республика Казахстан; *https://orcid.org/0000-0001-6903-3570, e-mail: ergan_68@mail.ru.*

Каймолдина Сайра Есимбаевна, магистр ветеринарных наук, младший научный сотрудник ТОО «КазНИВИ», г. Алматы, Республика Казахстан; *https://orcid.org/0000-0002-7658-5805, e-mail: sayra_kaymoldina@mail.ru.*