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Serological tests for lumpy skin disease in Republic of Tajikistan in 2023

Rajabmurod A. Atovullozoda¹, Irina N. Shumilova², Fedor I. Korennoy², Mulojon A. Amirbekov¹, Sulaimon Kh. Nazrullozoda¹, Rustam M. Sharipov¹, Samandar M. Kosimov¹, Olga P. Byadovskaya², Alena O. Krotova², Alexander V. Sprygin²

¹ Institute of Veterinary Medicine of the Tajik Academy of Agricultural Sciences, ul. A. Kakharova, 43, Dushanbe 734005, Republic of Tajikistan

² Federal Centre for Animal Health, ul. Gvardeyskaya, 6, Yur'evets, Vladimir 600901, Russia

ABSTRACT

Introduction. Cattle farming plays a key role in the agriculture of the Republic of Tajikistan, satisfying not only the needs for meat and dairy products. Recently, the intensification of livestock production in Tajikistan has been facing serious problems related to infectious diseases, in particular those caused by capripoxviruses, including lumpy skin disease (LSD), which causes significant economic damage and compromises animal performance and health in the region and around the world. Studying and understanding the LSD epizootology in the Republic of Tajikistan climatic environment will facilitate better disease control.

Objective. Epizootological data collection and brief description of LSD outbreaks in the Republic of Tajikistan in 2023.

Materials and methods. Traditional epizootological analysis tools were used to collect data on LSD outbreaks, as well as serological tools for the disease retrospective diagnosis.

Results. In 2023, an LSD case was first reported in the Republic of Tajikistan in the region bordering Afghanistan. Analysis of the seasonal pattern of the disease occurrence in Tajikistan demonstrated that the LSD outbreaks were most often reported in summer and autumn: from July to November. The disease spread mainly in the areas with a high concentration of livestock, in particular in the Khatlon Region. The average animal density in the Khatlon Region is 46 cattle per 1 km² and 117 sheep and goats per 1 km². The peak of LSD epidemic was recorded in September – November 2023. Morbidity and mortality varied by districts, ranging from 10 to 55% and from 2 to 15%, respectively. Tests of 216 bovine serum samples demonstrated LSD virus antibodies in 109 animals, accounting for 50.5% of the total.

Conclusion. In 2023, a range of studies was conducted and measures were taken in the Republic of Tajikistan to prevent LSD spread. To effectively control the disease, it is necessary to strengthen epizootological monitoring, carry out timely vaccination of animals and implement measures for the identification and control of potential vectors. These steps will minimize economic losses and maintain the animal health in the republic.

Keywords: lumpy skin disease (LSD), epizootology, clinical signs, diagnosis, enzyme-linked immunosorbent assay (ELISA), vaccination, CIS

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For correspondence: Alexander V. Sprygin, Dr. Sci. (Biology), Senior Researcher, Reference Laboratory for Bovine Diseases, Head of Molecular and Genetic Research Laboratory, Federal Centre for Animal Health, ul. Gvardeyskaya, 6, Yur'evets, Vladimir 600901, Russia, sprygin@arriah.ru

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Проведение серологических исследований на заразный узелковый дерматит в Республике Таджикистан в 2023 г.

Р. А. Атовуллозода¹, И. Н. Шумилова², Ф. И. Коренной², М. А. Амирбеков¹, С. Х. Назруллозода¹, Р. М. Шарипов¹, С. М. Косимов¹, О. П. Бьядовская², А. О. Кротова², А. В. Спрыгин²

¹ Институт ветеринарной медицины Таджикской академии сельскохозяйственных наук (ИВМ ТАСХН), ул. А. Кахарова, 43, г. Душанбе, 734005, Республика Таджикистан

² ФГБУ «Федеральный центр охраны здоровья животных» (ФГБУ «ВНИИЗЖ»), ул. Гвардейская, 6, мкр. Юрьевец, г. Владимир, 600901, Россия

РЕЗЮМЕ

Введение. Скотоводство играет ключевую роль в сельском хозяйстве Республики Таджикистан, обеспечивая не только потребности в мясных и молочных продуктах. В последнее время интенсификация животноводческой деятельности в Таджикистане сталкивается с серьезными проблемами, связанными с инфекционными заболеваниями, в частности вызываемыми капripоксвирусами, в том числе заразным узелковым дерматитом крупного рогатого скота, который наносит значительный экономический ущерб и ставит под угрозу продуктивность и здоровье животных в регионе и во всем мире. Изучение и понимание эпизootологии заразного узелкового дерматита крупного рогатого скота в климатических условиях Республики Таджикистан позволит улучшить контроль за заболеванием.

Цель исследования. Эпизootологическое описание и краткая характеристика вспышек заразного узелкового дерматита крупного рогатого скота в Республике Таджикистан в 2023 г.

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Материалы и методы. В работе использованы классические методы эпизоотологического анализа по сбору данных о вспышках заразного узелкового дерматита крупного рогатого скота, а также серологические методы для ретроспективной диагностики заболевания.

Результаты. В 2023 г. в Республике Таджикистан впервые был зарегистрирован случай заболевания крупного рогатого скота заразным узелковым дерматитом в районе, граничащем с Афганистаном. Анализ сезонности проявления данного заболевания в Таджикистане показал, что вспышки заразного узелкового дерматита крупного рогатого скота происходили чаще всего в летне-осенний период: с июля по ноябрь. Болезнь преимущественно распространилась в регионах с высокой концентрацией скота, в частности в районах Хатлонской области. Средняя плотность животных в Хатлонской области составляет 46 голов крупного рогатого скота на 1 км² и 117 голов мелкого рогатого скота на 1 км². Пик эпизоотии заразного узелкового дерматита крупного рогатого скота был зафиксирован в сентябре – ноябре 2023 г. Заболеваемость и смертность варьировали по районам от 10 до 55% и от 2 до 15% соответственно. При исследовании 216 проб сывороток крови крупного рогатого скота антитела к вирусу заразного узелкового дерматита были обнаружены у 109 животных, что составило 50,5% от общего числа.

Заключение. В 2023 г. в Республике Таджикистан был проведен комплекс исследований и предприняты меры по предупреждению распространения заразного узелкового дерматита крупного рогатого скота. Для эффективной борьбы с заболеванием необходимо усилить эпизоотологический мониторинг, проводить своевременную вакцинацию животных и внедрять меры по идентификации потенциальных переносчиков и их контролю. Эти шаги позволяют минимизировать экономические потери и сохранить здоровье скота в республике.

Ключевые слова: заразный узелковый дерматит, эпизоотология, клинические признаки, диагностика, иммуноферментный анализ, вакцинация, СНГ

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Для корреспонденции: Спрыгин Александр Владимирович, д-р биол. наук, старший научный сотрудник референтной лаборатории болезней крупного рогатого скота, заведующий лабораторией молекулярных и генетических исследований, ФГБУ «ВНИИЗЖ», ул. Гвардейская, 6, мкр. Юрьевец, г. Владимир, 600901, Россия, sprygin@arriah.ru

INTRODUCTION

Lumpy skin disease (LSD, Neethling virus infection) is a viral transmissible disease of cattle characterized by fever, damage to the lymphatic system, edema of subcutaneous tissue and internal organs, formation of skin nodules, damage to the eyes and mucous membranes of the respiratory and digestive systems, loss of productive performance and body weight [1]. The disease causative agent is a DNA-containing virus of the genus *Capripoxvirus*, family *Poxviridae*, which is closely related to sheep pox virus and goat pox virus [2].

Lumpy skin disease virus (LSDV) spread outside the disease outbreak is possible in two ways. Firstly, the infected animals demonstrating clinical signs and being in the incubation period are active shedders of the pathogen in an unapparent form [3]. In this case, subclinically infected animals serve not only as an active source of infection, but also as an important factor in the virus spread over long distances, which is most often associated with cattle driving or illegal transportation by road vehicles [4]. It should be noted that LSD causes major economic losses, such as a sharp decline in milk production, reduced milk and raw hide quality, loss of body weight, abortions, infertility in bulls and reduced fertility in cows. As a result, trade relations are prohibited, which negatively affects the economies of countries focused on exporting animal products [5].

It is assumed that the main factor of the disease agent transmission is blood-sucking insects and ticks [6], although it has now been experimentally proven that mosquitoes of the genus *Aedes*, flies (for example, *Stomoxys calcitrans* and *Biomyia fasciata*) and ticks (*Rhipicephalus appendiculatus* and *Amblyomma hebraeum*) are capable of participating in the virus spread [7]. The importance of

various arthropod vectors may vary in climatically different regions depending on their abundance and trophic behavior, however, no relative entomological studies from different geographical and climatic zones have been described. The virus transmission via contaminated semen is possible [8].

Direct contact was not previously considered an effective route of the infection transmission [9], however, given the disease epizootological profile, when the outbreaks can be reported in early spring or autumn in the absence of flight activity of blood-sucking insects, alimentary and air-borne routes of the infection are feasible, since a diseased animal sheds the virus with the nasal discharge and scabs from the necrotized nodes [10]. Evidence of the contact virus transmission has been obtained in a number of studies involving experimental infection of susceptible animals [11].

In the past, the LSD distribution range was limited only to South Africa. However, by 1956, the disease quickly spread to Central and East Africa. The first case of LSD infection outside the African continent was reported in Israel, which marked the beginning of the intercontinental spread of the disease [12, 13, 14, 15, 16]. The disease with characteristic signs was detected in Albania, Greece, Georgia, Iran, Macedonia, Bulgaria, Turkey and other countries of the world with numerous outbreaks being reported in recent years [17, 18, 19]. In the CIS countries (Fig. 1), LSD was officially reported in Azerbaijan (2014), Armenia (2015), Russia (2015), Kazakhstan (2016) [20, 21, 22].

Since 2019, LSD has begun to spread in Southeast Asian countries such as Thailand, Vietnam, India, Pakistan, Indonesia, and Singapore; China, Japan, and South Korea have also reported outbreaks [15, 23, 24, 25, 26]. This created a threat of the disease cross-border transmission to the

countries of Central Asia. LSD was not reported in the Republic of Tajikistan until 2023, but the massive spread of the infection to the Asian region since 2019 has resulted in the pathogen introduction into the country [25]. In 2023, LSD was for the first time diagnosed in cattle in the border region with Afghanistan, in the Panj District of Khatlon Region, Republic of Tajikistan. The infected animals comprised 30 cattle of varying ages of the Black Pied, Carpathian, Swedish, and local breeds. The disease was observed in animals in Mehnatobod village (Sughd Region), Kahramon village (Rudaki District of Republican Subordination), in Moskovsky settlement (Hamadoni District) as well as in the villages of Farkhor District of Khatlon Region, and then it spread to other regions of the Republic, causing significant economic damage to animal farmers.

The work was aimed at the epizootological description and brief characterization of the LSD outbreaks in the Republic of Tajikistan in 2023.

MATERIALS AND METHODS

LSD epizootic situation was studied on animal farms in the southwestern and northern regions of Tajikistan (Sughd Region, Khatlon Region, and the Districts of Republican Subordination), where a combined housing-and-pasture system of cattle management is practiced.

Standard clinical, epizootological, and serological research methods were used in the study. To assess morbidity and mortality, the proportion of diseased and dead animals out of the total susceptible population in the outbreak was calculated.

Serological analysis. To make a preliminary assessment of the situation, 216 serum samples of cattle of different age groups were serologically tested. The sera were collected from animals demonstrating LSD clinical signs in the regions of the Republic located in different climatic and geographical zones (Table 1).

Double-antibody sandwich enzyme-linked immunosorbent assay (ELISA) was used in the study. The study was performed using a test system for detecting antibodies to capripoxviruses in sera or plasma of cattle, sheep, goats or other susceptible species (IDvet, France) in accordance with the manufacturer's instructions. The serum samples were collected from infected (IN) and contact animals (C1 and C2) on days 0; 42 and 60 after the start of the experiment. The results were interpreted based on optical density (OD) measured at a wavelength of 450 nm using a Sunrise microplate reader (Tecan, Switzerland). They were expressed as the ratio of the optical density of the test sample to the optical density of the positive control (S/P%), calculated as follows: $S/P\% = (OD_{\text{sample}} - OD_{\text{negative control}}) / (OD_{\text{positive control}} - OD_{\text{negative control}}) \times 100\%$. S/P ratio $\geq 30\%$ was considered positive.

RESULTS AND DISCUSSION

The Republic of Tajikistan is a landlocked state in Central Asia, characterized by a predominantly mountainous terrain. The area of the country is 142.6 thousands km², the population is 10 million people. As of 2023, the cattle population in the country amounted to 2,605 thousands (FAOstat, 2025). The first-level administrative divisions consist of five units: Sughd Region, Khatlon Region, Gorno-Badakhshan Autonomous Region, the city of Dushanbe, and the Districts of Republican Subordination.

Tajikistan is located in zones of continental, sharply continental, and mountain climate. The country's climatic

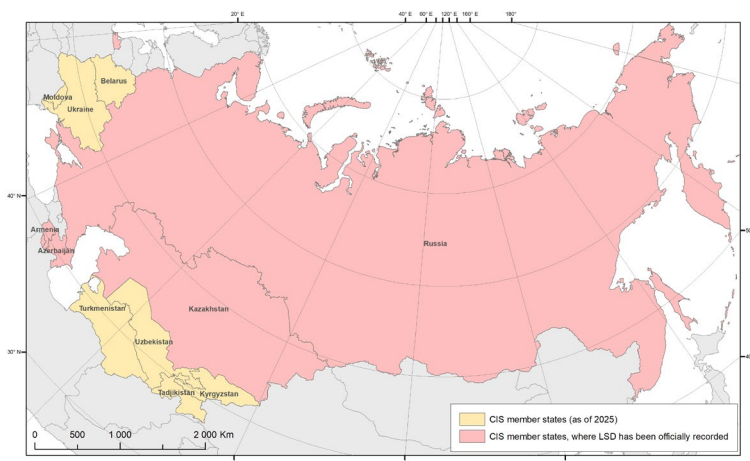


Fig. 1. CIS members, where LSD is reported

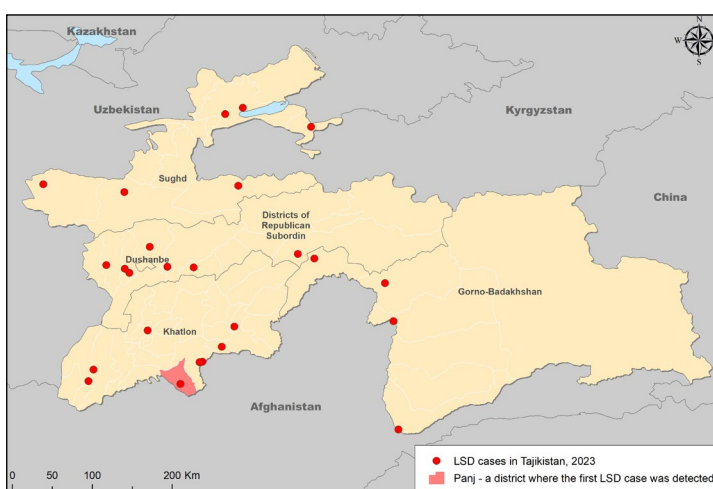


Fig. 2. LSD spread in the Republic of Tajikistan in 2023

conditions are determined by its topography, which encompasses both lowland and high mountain areas. Precipitation is distributed unevenly. The majority of the precipitation falls in winter and spring. Summer in lowland areas is dry.

The disease was first reported in the hot and arid Khatlon Region (in Panj, Farkhor and Hamadoni Districts), where high temperatures and dry climate contribute to the active reproduction of blood-sucking insects, the key virus carriers. The infection subsequently spread to other regions, including the Sughd Region, the city of Dushanbe and Districts of Republican Subordination, where the moderately warm climate, presence of pastures and water reservoirs also create conditions for the disease transmission. The location of the affected areas is shown in Figure 2.

In 2023, the majority of LSD outbreaks (14 outbreaks) were reported in the Khatlon Region, where 70% of the Republic's cattle population is concentrated. Morbidity and mortality of cattle in the Panj District reached 55 and 15%, respectively.

Analyses of LSD situation in cattle demonstrated that during the further spread of the disease across the Republic in June – August 2023, the mortality in the Faizabad District was 30–40%, and mortality – 2–3%, while in the Gissar valley they were 20 and 3%, respectively.

In the Rasht Valley, where temperate climate prevails, the disease was reported in cattle in November – December.

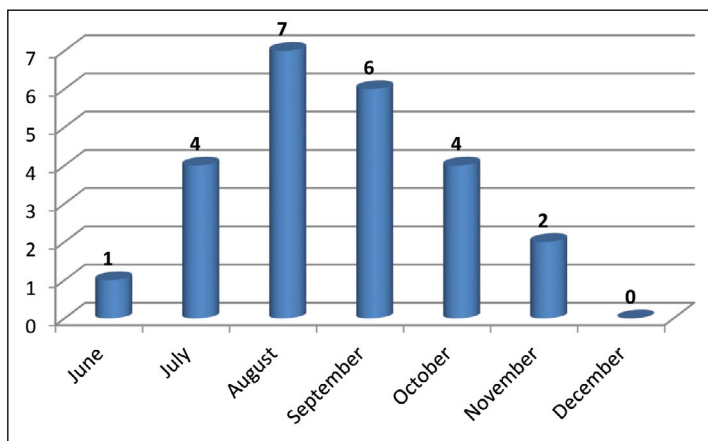


Fig. 3. Number of LSD outbreaks by month

Table 1
Regions of the republic where serological monitoring was carried out

Regions of the Republic	Type of pathological material	Number of tested samples
Khatlon Region	Serum	95
Sughd Region	Serum	58
Districts of Republican Subordination	Serum	63
Total		216



Fig. 4. Formation of nodular skin lesions on the neck and shoulder blade areas of LSD infected cattle



Fig. 6. Multiple nodular skin lesions of LSD infected cattle



Fig. 5. Erosive lesions of the tongue mucosa of LSD infected cattle

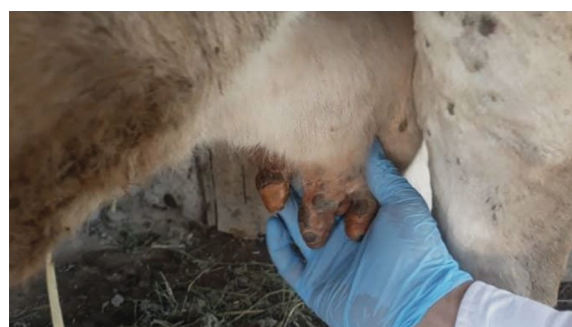


Fig. 7. Nodular and ulcerative lesions on the udder of LSD infected cattle

Table 2
LSD ELISA results

Districts	Number of kishlaks	Samples tested	Positive samples detected	Seroprevalence, %
Khatlon Region				
Panj	3	27	19	70.4
Hamadoni	4	19	11	57.9
Farkhor	4	15	9	60.0
Vose'	2	11	5	45.5
Kulob	3	8	3	37.5
Bokhtar city	3	15	8	53.3
Sughd Region				
Ayni	2	12	4	33.3
Ghafurov	3	10	2	20.0
Konibodom	1	7	2	28.6
Panjakent	1	16	7	43.8
Isfara	1	13	5	38.5
Districts of Republican Subordination				
Hisar	2	14	4	28.6
Rudaki	3	21	13	61.9
Faizabad	2	10	5	50.0
Rasht	2	18	12	66.7
Total	36	216	109	50.5

The mortality in this region did not exceed 10%, and the mortality of the infected animals amounted to 3–5%.

In northern Tajikistan, LSD was reported in Ayni, Ghafurov, Konibodom, Panjakent, and Isfara districts of Sughd Region. The cattle morbidity in these regions was 15–20%, and mortality ranged from 3 to 5%.

The disease outbreaks were less intense in the regions of the Badakhshan Mountainous Autonomous Region, which is associated with a lower activity of the insect vectors due to the specifics of the climate and terrain. Despite the fact that this area, located along the border with Afghanistan, occupies more than 43% of the territory of the Republic, it has the lowest animal population and density per 1 km².

The latest disease outbreaks in the Republic of Tajikistan were reported in December 2023 in the Districts of Republican Subordination. Overall, more than 20 outbreaks of LSD were reported during the year, most of them were detected in the summer-autumn period from July to November (Fig. 3). This may be attributed both to the activity of potential vectors and to the pasturing of livestock during this period. The peak of the LSD epizootic in cattle was recorded in September – November 2023. The information obtained is consistent with the published data [27, 28, 29].

It is important to note that, based on the field data, the incubation period for LSD was approximately 5 days and may have depended on the susceptibility of the animals [30].

Thus, the disease outbreaks were less intense in the mountainous regions of the country, where the harsh climate with low temperatures limits the insect activity. In the foothill areas and pastures, the infection could spread through livestock migration. Consequently, the combination of the hot climate, high animal density, and favorable conditions for insect reproduction have become key factors in the LSD epizootic process in Tajikistan [31].

The diseased animals demonstrated high body temperature (40.5–42.0 °C), nasal and ocular discharge, enlarged lymph nodes (especially patellar and scapular ones), refusal of food, as well as skin nodular eruptions of various

shapes and sizes (Fig. 4), and erosive lesions in the oral cavity, including the tongue (Fig. 5).

The number of nodules ranged from ten to several hundred (Fig. 6). During LSD development in lactating cows, nodules of various shapes and sizes often appeared on the udder (Fig. 7). The diseased animals quickly became emaciated and lost their dairy and meat performance for a long time [32].

When ELISA was used to test 216 samples of bovine sera from animals from Khatlon and Sughd Regions and Districts of Republican Subordination, LSDV antibodies were detected in 109 of them, which accounted for 50.5% of the total number of animals (Table 2).

The highest seroprevalence was reported in the Khatlon Region: Panj District (70.4%), Farkhor District (60.0%) and Hamadoni District (57.9%), which indicates a significant spread of infection in this area. In Sughd Region, the highest rates were detected in Panjakent (43.8%) and Isfara Districts (38.5%), and as for the Districts of Republican Subordination, high level of seroprevalence was reported in Rasht (66.7%) and Rudaki Districts (61.9%).

Thus, the study results indicate the transboundary nature of LSD and emphasize the need for further monitoring and the implementation of preventive measures to control the disease situation with the aim of reducing the economic losses.

CONCLUSION

An analysis of the LSD situation in Tajikistan in 2023 showed that the infection outbreaks had seasonal pattern, reaching the peak in the summer and autumn period (July – November). The most affected areas were Khatlon Region, Districts of Republican Subordination and Sughd Region, where the seroprevalence varied from 20.0 to 70.4%. The infection outbreaks were reported both in the backyards and on commercial farms, which indicates the need for strict veterinary control and implementation of preventive measures.

To effectively control LSD, it is necessary to strengthen epizootological monitoring, carry out timely vaccination of animals, and implement measures for the identification and control of potential vectors. These steps will allow minimizing economic losses and maintaining animal health in the Republic.

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INFORMATION ABOUT THE AUTHORS / ИНФОРМАЦИЯ ОБ АВТОРАХ

Rajabmurod A. Atovullozoda, Cand. Sci. (Veterinary Medicine), Director, Institute of Veterinary Medicine of the Tajik Academy of Agricultural Sciences, Dushanbe, Republic of Tajikistan; <https://orcid.org/0000-0002-0586-8701>, rajabmurod69@mail.ru

Irina N. Shumilova, Cand. Sci. (Veterinary Medicine), Leading Researcher, Reference Laboratory for Bovine Diseases, Federal Centre for Animal Health, Vladimir, Russia; <https://orcid.org/0000-0002-4663-3845>, shumilova@arriah.ru

Fedor I. Korennoy, Cand. Sci. (Geography), Senior Researcher, Information and Analysis Centre, Federal Centre for Animal Health, Vladimir, Russia; <https://orcid.org/0000-0002-7378-3531>, korennoy@arriah.ru

Mulojon A. Amirbekov, Dr. Sci. (Veterinary Medicine), Leading Researcher, Institute of Veterinary Medicine of the Tajik Academy of Agricultural Sciences, Dushanbe, Republic of Tajikistan; amulojon@mail.ru

Sulaimon Kh. Nazrullozoda, Cand. Sci. (Veterinary Medicine), Deputy Director, Institute of Veterinary Medicine of the Tajik Academy of Agricultural Sciences, Dushanbe, Republic of Tajikistan; <https://orcid.org/0009-0005-0536-4617>, sulaimon.habibi@mail.ru

Rustam M. Sharipov, Cand. Sci. (Veterinary Medicine), Head of Laboratory of Virology, Institute of Veterinary Medicine of the Tajik Academy of Agricultural Sciences, Dushanbe, Republic of Tajikistan; <https://orcid.org/0009-0000-8176-0682>, rustam.sh1719@mail.ru

Samandar M. Kosimov, Researcher, Laboratory of Virology, Institute of Veterinary Medicine of the Tajik Academy of Agricultural Sciences, Dushanbe, Republic of Tajikistan; <https://orcid.org/0009-0006-9855-0108>, samandar-2019@inbox.ru

Olga P. Byadovskaya, Cand. Sci. (Biology), Head of Reference Laboratory for Bovine Diseases, Federal Centre for Animal Health, Vladimir, Russia; <https://orcid.org/0000-0002-8326-7151>, bjadovskaya@arriah.ru

Alena O. Krotova, Leading Biologist, Reference Laboratory for Bovine Diseases, Federal Centre for Animal Health, Vladimir, Russia; <https://orcid.org/0000-0002-8311-4681>, krotova@arriah.ru

Alexander V. Sprygin, Dr. Sci. (Biology), Senior Researcher, Reference Laboratory for Bovine Diseases, Head of Molecular and Genetic Research Laboratory, Federal Centre for Animal Health, Vladimir, Russia; <https://orcid.org/0000-0001-5982-3675>, sprygin@arriah.ru

Атовуллозода Раджабмурод Атовулло, канд. вет. наук, директор ИВМ ТАСХН, г. Душанбе, Республика Таджикистан; <https://orcid.org/0000-0002-0586-8701>, rajabmurod69@mail.ru

Шумилова Ирина Николаевна, канд. вет. наук, ведущий научный сотрудник референтной лаборатории болезней крупного рогатого скота, ФГБУ «ВНИИЗЖ», г. Владимир, Россия; <https://orcid.org/0000-0002-4663-3845>, shumilova@arriah.ru

Коренной Федор Игоревич, канд. геогр. наук, старший научный сотрудник информационно-аналитического центра ФГБУ «ВНИИЗЖ», г. Владимир, Россия; <https://orcid.org/0000-0002-7378-3531>, korennoy@arriah.ru

Амирбеков Муложон Амирбекович, д-р вет. наук, ведущий научный сотрудник ИВМ ТАСХН, г. Душанбе, Республика Таджикистан; amulojon@mail.ru

Назруллозода Сулаймон Хабиб, канд. вет. наук, заместитель директора ИВМ ТАСХН, г. Душанбе, Республика Таджикистан; <https://orcid.org/0009-0005-0536-4617>, sulaimon.habibi@mail.ru

Шарипов Рустам Миралиевич, канд. вет. наук, заведующий лабораторией вирусологии ИВМ ТАСХН, г. Душанбе, Республика Таджикистан; <https://orcid.org/0009-0000-8176-0682>, rustam.sh1719@mail.ru

Косимов Самандар Миралиевич, научный сотрудник лаборатории вирусологии ИВМ ТАСХН, г. Душанбе, Республика Таджикистан; <https://orcid.org/0009-0006-9855-0108>, samandar-2019@inbox.ru

Бьядовская Ольга Петровна, канд. биол. наук, заведующий референтной лабораторией болезней крупного рогатого скота ФГБУ «ВНИИЗЖ», г. Владимир, Россия; <https://orcid.org/0000-0002-8326-7151>, bjadovskaya@arriah.ru

Кротова Алена Олеговна, ведущий биолог референтной лаборатории болезней крупного рогатого скота ФГБУ «ВНИИЗЖ», г. Владимир, Россия; <https://orcid.org/0000-0002-8311-4681>, krotova@arriah.ru

Спрыгин Александр Владимирович, д-р биол. наук, старший научный сотрудник референтной лаборатории болезней крупного рогатого скота, заведующий лабораторией молекулярных и генетических исследований ФГБУ «ВНИИЗЖ», г. Владимир, Россия; <https://orcid.org/0000-0001-5982-3675>, sprygin@arriah.ru

Contribution of the authors: Atovullozoda R. A. – concept development, resource provision, text preparation and editing, approval of the final version; Shumilova I. N. – text preparation and editing, approval of the final version; Korennoy F. I. – cartographic visualization, text preparation and editing; Amirbekov M. A. – conducting research; Nazrullozoda S. Kh. – conducting research, methodology development, text preparation and editing; Sharipov R. M. – conducting research; Kosimov S. M. – conducting research; Byadovskaya O. P. – text preparation and editing; Krotova A. O. – text preparation and editing; Sprygin A. V. – text preparation and editing, approval of the final version.

Вклад авторов: Атовуллозода Р. А. – разработка концепции, ресурсное обеспечение, подготовка и редактирование текста, утверждение окончательного варианта; Шумилова И. Н. – подготовка и редактирование текста, утверждение окончательного варианта; Коренной Ф. И. – картографическая визуализация, подготовка и редактирование текста; Амирбеков М. А. – проведение исследований; Назруллозода С. Х. – проведение исследований, разработка методологии, подготовка и редактирование текста; Шарипов Р. М. – проведение исследований; Косимов С. М. – проведение исследований; Бьядовская О. П. – подготовка и редактирование текста; Кротова А. О. – подготовка и редактирование текста; Спрыгин А. В. – подготовка и редактирование текста, утверждение окончательного варианта.