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Epidemic situation on enzootic bovine leukosis in public and individual farms in the Republic of Dagestan

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SUMMARY
The spread of the bovine leukemia virus impedes the development of livestock production and causes considerable losses. Despite the measures implemented, the problem of bovine leukosis eradication remains relevant in different regions of Russia. The article presents data on distribution of enzootic bovine leukosis in the Republic of Dagestan. Over the past five years, the lowest level (1.02%) of leukemia virus infection in cattle in the Republic was recorded in 2020. Laboratory tests for bovine leukosis were carried out in 41 raions and 7 municipal districts: no disease was diagnosed in 12 raions and 4 municipal districts, and the animal seropositivity index in the rest of areas was less than 1%. A high level of animal infection with the leukemia virus was recorded in the following raions: Dakhadaevsky (10.3%), Shamilsky (7.9%), Tarumovsky (3.1%), Kizlyarsky (2.3%), Babayurtovsky (2.2%), as well as in the town of Yuzhno-Sukhokumsk (3.8%). In other districts, the parameter's values ranged from 1 to 2%. In total, 524,930 animal sera samples were serologically tested using the immunodiffusion method, out of which 5,362 samples were seropositive in 2020. 1,265 sera samples from animals infected with the leukemia virus were tested using the hematological method, 251 animals (19.8%) with persistent leukocytosis were identified, which is the average for the past years. Comparative analysis of the morbidity rate for bovine leukemia virus in farms of different categories showed that in public farms of the republic the percentage of infection level was higher (3.3%) than in the individual sector (0.7%). Thus, bovine leukemia infection level in the republic tends to decrease. Nevertheless, the infection and morbidity rates in cattle remain high in some raions and municipal districts, in particular, in the public sector.

Keywords: Enzootic bovine leukosis, infection level, distribution, serology, morbidity, Republic of Dagestan.

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Эпизоотическая обстановка по энзоотическому лейкозу крупного рогатого скота в общественных и индивидуальных хозяйствах Республики Дагестан

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РЕЗЮМЕ
Распространение вируса лейкоза крупного рогатого скота препятствует развитию животноводства и наносит значительный ущерб. Несмотря на принимаемые меры, проблема ликвидации лейкоза в различных регионах России продолжает оставаться актуальной. В статье представлены данные по распространению лейкоза крупного рогатого скота в Республике Дагестан. За последние пять лет наименьший процент (1,02%) инфицированности животных вирусом лейкоза в республике отмечен в 2020 г. Лабораторные исследования на лейкоз крупного рогатого скота проводились в 41 районе и 7 городских округах, в 12 и 4 из них, соответственно, заболевание не диагностировано, в остальных показатель серопозитивности животных составил менее 1%. Высокий уровень инфицированности животных вирусом лейкоза был установлен в следующих районах: Дахадаевском (10,3%), Шамильском (7,9%), Тарумовском (3,1%), Кизлярском (2,3%), Бабаюртовском (2,2%), а также в г. Южно-Сухокумске (3,8%). В остальных районах показатели находились на уровне от 1 до 2%. Всего за 2020 г. серологическим методом с использованием реакции иммунодиффузии было исследовано 524 930 проб сыворотки крови животных, из них 5362 оказались сероположительными. От инфицированных вирусом лейкоза животных гематологическим методом

исследовали 1265 проб крови, выявлено 251 животное (19,8%) с персистентным лейкоцитозом, что является средним показателем за прошедшие годы. Сравнительный анализ распространенности вируса лейкоза крупного рогатого скота в хозяйствах разных категорий показал, что в общественных хозяйствах республики процент инфицированности выше (3,3%), чем в индивидуальном секторе (0,7%). Таким образом, лейкоз крупного рогатого скота в республике имеет тенденцию к снижению. Тем не менее в некоторых районах и городских округах инфицированность и заболеваемость животных остается высокой, особенно в общественном секторе.

Ключевые слова: Энзоотический лейкоз крупного рогатого скота, инфицированность, распространенность, серология, заболеваемость, Республика Дагестан.

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INTRODUCTION

Bovine leukosis virus, or bovine leukemia virus (BLV) belongs to the genus *Deltaretrovirus* of the family *Retroviridae*. Many viruses of this family directly or indirectly (by way of malignancy or proliferation of organs with neoplastic cells) cause neoplasms or leukemias of the hematopoietic system in animals and humans. The bovine leukemia causative agent refers to exogenous viruses and causes the disease known as bovine leukosis. Due to its location-specific nature it is also called enzootic bovine leukosis.

The characteristic feature of the disease is that it mainly occurs in animals in a chronic form with no visible clinical signs. Nevertheless, bovine leukosis diagnosis is made using serological, hematological and other types of laboratory testing. The bovine leukosis is rarely clinically diagnosed in farms by veterinary specialists, and the morbidity rate in infected livestock can reach up to 3–10% depending on the epizootic tension and the animal keeping conditions.

The bovine leukemia virus is transmitted from a diseased animal to a healthy one through fluids (blood, saliva, milk, etc.) that contain cells infected with this pathogen (B-lymphocytes), and to a lesser extent – through monocytic macrophages. The transmission routes of the virus are horizontal and vertical. Cattle (cows, bulls) of different breeds and all ages (older than 5–6 months) are susceptible to the leukemia virus in natural conditions. However, in spontaneous conditions BLV can be transmitted to other species (buffalo, zebu, sheep, elk, yak, alpaca) [1–4]. As the previous study results showed, all cow breeds bred in the Republic of Dagestan (red steppe, black-and-white, Simmental, Caucasian brown, Shvitskaya, indigenous breed) of different ages are susceptible to BLV, but the highest percentage of infection was detected in animals aged 5–7 years [5].

Enzootic bovine leukosis is widely distributed in many countries (USA, Bulgaria, Uzbekistan, etc.), as well as in the Russian Federation [6–9]. The disease used to be hematologically diagnosed in the Republic of Dagestan during the Soviet times; since 1988 the serological method has been implemented in veterinary laboratories and immunodiffusion test (IDT) is used for the diagnosis. The number of infected animals detected in the Republic increased as a result of bovine leukosis serological diagnosis introduced in Dagestan. However, the failure to implement the leukosis control program, as well as the lack of health-improving and preventive measures led to increased frequency of infection in animals in the farms of the Republic [10].

In view of the above, the aim was to conduct an epizootological analysis of the enzootic bovine leukosis distribution in the Republic based on the farm status.

MATERIALS AND METHODS

The official data of the GBU RD "Republican Veterinary Laboratory", as well as the results of internal testing conducted in the Laboratory for Infectious Pathology of Livestock Animals of the Caspian Zonal NIVI within the last 10 years served the basis for the analysis of the bovine leukosis epidemic situation. A retrospective analysis was performed using hematological and serological methods. Serological diagnosis for bovine leukosis was performed using immunodiffusion test (IDT).

Diagnostic studies for enzootic bovine leukemia were conducted in accordance with the "Methodical guidelines for the diagnosis of bovine leukosis" [11], and epizootological studies were conducted in compliance with the "Methodical guidelines for bovine leukosis epizootological studies" [12].

RESULTS AND DISCUSSION

Over the past 5 years large-scale serological testing for bovine leukosis was conducted in the Republic of Dagestan using immunodiffusion test (Fig. 1). The largest number of sera samples were tested in 2019 (625,970), of which 15,578 (2.50%) were seropositive. The smallest number of studies were conducted in 2017 (7,466), when seropositive animals were detected in 577 cases (7.70%). A high level of BLV infection in cattle population was noted in 2016 – 1,433 (13.20%) sera samples out of 10,842 gave a positive result when IDT was used. Starting from 2018, the number of leukosis diagnostic tests increased after the Action Plan for Bovine Leukosis Prevention and Control in Republic of Dagestan for 2017–2020 (Order of the Government of the Republic of Dagestan No. 323-r of September 11, 2017) was adopted. Thus, 223,293 sera samples

were tested in 2018, the seropositivity of animals was 4.03% (8,998 animals). As compared to 2017, the number of serological tests for bovine leukosis in 2018 increased by almost 30 times, and the percentage of infection decreased by about 2 times. By 2020, the percentage of infection with the bovine leukemia virus was 1.02%, i.e. 5,362 out of 524,930 animals were seropositive.

As it can be seen in Figure 1, in recent years the maximum number of serological tests for bovine leukosis were performed in 2019–2020, while a high percentage of animal infection with BLV was recorded in 2016–2017. This is due to the fact that until 2018 diagnostic tests for leukosis in the Republic were carried out randomly and using small numbers of cattle kept in flat areas where transhumance is practiced.

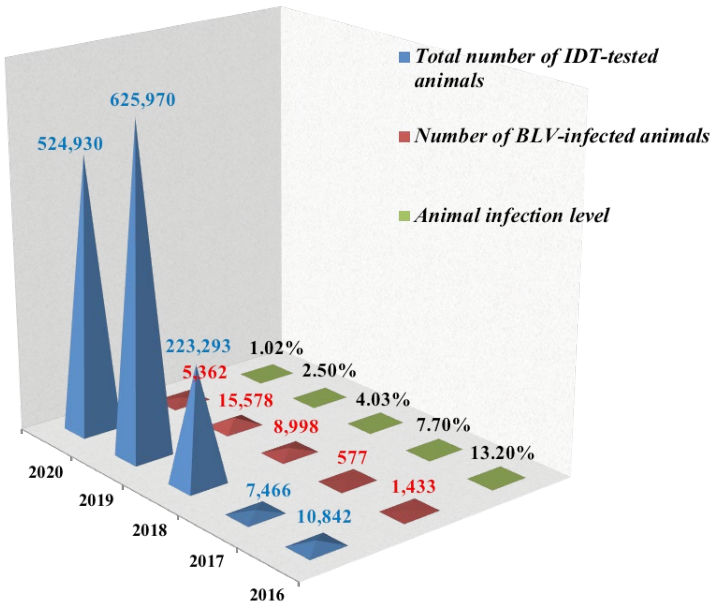

Fig. 1. Distribution of enzootic bovine leukosis in the Republic of Dagestan in 2016–2020

Рис. 1. Распространение лейкоза крупного рогатого скота в Республике Дагестан в 2016–2020 гг.

The hematological studies were conducted in the Republic to identify diseased animals among those infected with the leukemia virus over the past 10 years, which showed a high percentage of persistent leukocytosis. As it can be seen in Figure 2, the largest number of hematological tests conducted in cattle were recorded in 2019 (6,070), 2020 (1,265) and 2018 (1,202), and the lowest – in 2015 (79) and 2012 (81). A high percentage of animals with hematological disease was observed in 2011 (44.9%) and 2010 (42.8%), and a low percentage – in 2014 (16.7%) and 2015 (17.7%). Within the past 3 years the bovine leukosis morbidity was 24.3% in 2018, 24.4% – in 2019, 19.8% – in 2020. The results obtained are explained by the fact that the farms of the Republic do not carry out timely culling of infected adult livestock in case of loss of productivity, and cattle infected with the leukosis virus continue to be kept in the herd.

As it is shown in Figure 2, the bovine leukosis morbidity fluctuations over time are minimal. This is due to the fact that animals with hematological disease are not subjected to slaughter.

In the course of the epizootological analysis, the 2020 data obtained from the GBU RD "Republican Veterinary Laboratory" were analyzed (Table 1). The laboratory tests conducted in 41 raions and 7 towns of the Republic showed that bovine leukosis was detected in cattle in 29 and 3 administrative units, respectively. As it is shown in Table 1, the disease was not diagnosed in 12 raions (Akhvakhsky, Akhtynsky, Buinaksky, Dokuzparinsky, Kazbekovsky, Kaitagsky, Karabudakhkentsky, Kurakhsky, Magaramkentsky, Novolaksky, Suleiman-Stalsky and Khivsky) and in 4 towns (Makhachkala, Kaspiysk, Derbent and Dagestanskiye Ogni). A high level of BLV infection was found in the following raions: Dakhadayevsky – 10.3%, Shamilsky – 7.9%, Tarumovsky – 3.1%, Kizlyarsky – 2.3%, Babayurtovsky – 2.2%, as well as in Yuzhno-Sukhokumsk – 3.8%.

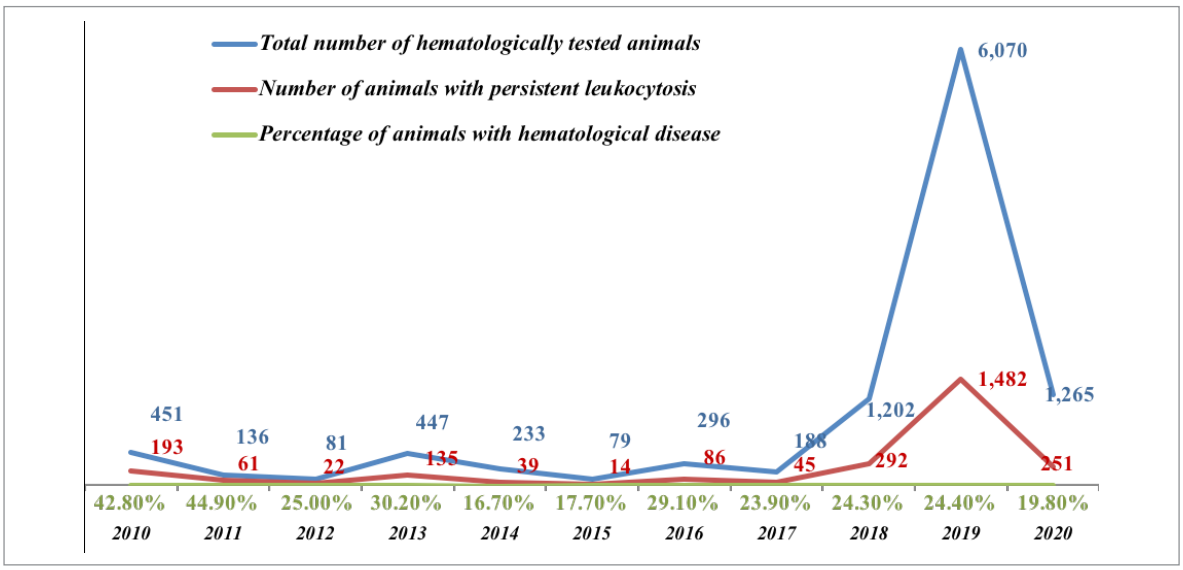

Fig. 2. Dynamics of detection of leukosis-infected animals with hematological disease in the Republic of Dagestan in 2010–2020

Рис. 2. Динамика выявления гематологически больных лейкозом животных в Республике Дагестан за 2010–2020 гг.

Table 1
Epidemic monitoring of bovine leukosis in the Republic of Dagestan in 2020 (according to the data of GBU RD "Republican Veterinary Laboratory")

Таблица 1
Эпизоотологический мониторинг лейкоза крупного рогатого скота в Республике Дагестан в 2020 г. (по данным ГБУ РД «Республиканская ветеринарная лаборатория»)

No.	Raions and municipal districts	Serological testing			Hematological testing		
		Number of animals	IDT-positive	%	Number of sera samples	Diseased animals identified	%
1	Agulsky	1,666	7	0.40	–	–	–
2	Akushinsky	35,471	131	0.37	–	–	–
3	Ahvakhsky	18,261	–	–	–	–	–
4	Akhtynsky	5,725	–	–	–	–	–
5	Babayurtovsky	12,710	284	2.20	–	–	–
6	Botlikhsky	11,378	154	1.40	–	–	–
7	Buinaksky	5,052	–	–	–	–	–
8	Gergebilsky	14,492	79	0.50	–	–	–
9	Gumbetovsky	2,834	4	0.10	–	–	–
10	Gunibsky	33,864	278	0.80	–	–	–
11	Dakhadaevsky	2,754	285	10.30	–	–	–
12	Derbentsky	13,817	31	0.20	–	–	–
13	Dokuzparinsky	2,562	–	–	–	–	–
14	Kazbekovsky	3,500	–	–	–	–	–
15	Kaitagsky	41	–	–	–	–	–
16	Kizilyurtovsky	14,159	10	0.10	–	–	–
17	Kumtorkalinsky	1,545	4	0.30	–	–	–
18	Kayakentsky	5,812	29	0.50	–	–	–
19	Karabudakhkentsky	33,310	–	–	–	–	–
20	Kizlyarsky	22,250	642	2.30	–	–	–
21	Kulinsky	18,358	135	0.70	–	–	–
22	Kurakhsky	2,855	–	–	–	–	–
23	Laksky	15,545	5	0.03	–	–	–
24	Levashinsky	16,756	145	0.90	–	–	–
25	Magaramkentsky	10,785	–	–	–	–	–
26	Novolaksky	1,494	–	–	–	–	–
27	Nogaisky	16,243	6	0.04	–	–	–
28	Rutulsky	2,776	41	1.50	–	–	–
29	Suleiman-Stalsky	3,425	–	–	–	–	–
30	Sergokalinsky	6,897	20	0.30	–	–	–
31	Tabasaransky	8,577	18	0.20	–	–	–
32	Tarumovsky	7,097	223	3.10	271	86	31.70
33	Tlyaratinsky	14,758	175	1.20	–	–	–
34	Untsukulsky	8,373	65	0.80	–	–	–
35	Khasavyurtovsky	77,467	1,368	1.80	303	59	19.50
36	Khivsky	4,893	–	–	–	–	–
37	Khunzakhsky	8,693	27	0.30	–	–	–
38	Tsumadinsky	19,622	83	0.40	–	–	–
39	Tsuntinsky	6,599	17	0.30	–	–	–
40	Charodinsky	19,280	335	1.70	685	100	14.60
41	Shamilsky	8,209	651	7.90	–	–	–
42	Kizlyar	421	4	1.00	–	–	–
43	Makhachkala	100	–	–	–	–	–
44	Kaspiysk	98	–	–	–	–	–
45	Izberbash	902	6	0.70	–	–	–
46	Yuzhno-Sukhokumsk	2,663	100	3.80	6	6	100
47	Derbent	354	–	–	–	–	–
48	Dagestankiye Ogni	487	–	–	–	–	–
	Total	**524,930**	**5,362**	**1.02**	**1,265**	**251**	**19.80**

Table 2
Distribution of bovine leukosis in individual and public farms in the Republic of Dagestan in 2020

Таблица 2
Распространение лейкоза крупного рогатого скота в индивидуальных и общественных хозяйствах Республики Дагестан в 2020 г.

No.	Raions and municipal districts	Total of animals tested for bovine leukosis					
		in individual farms			in public farms		
		Number of IDT-tested animals	IDT-positive	%	Number of IDT-tested animals	IDT-positive	%
1	Agulsky	–	–	–	1,666	7	0.40
2	Akushinsky	28,669	81	0.30	6,802	50	0.70
3	Ahvakhsky	18,261	–	–	–	–	–
4	Akhtynsky	5,725	–	–	–	–	–
5	Babayurtovsky	10,420	140	1.30	2,290	147	6.40
6	Botlikhsky	10,892	130	1.20	486	24	4.90
7	Buinaksky	5,052	–	–	–	–	–
8	Gergebilsky	14,492	79	0.50	–	–	–
9	Gumbetovsky	2,649	4	0.20	185	–	–
10	Gunibsky	33,814	278	0.80	50	–	–
11	Dakhadaevsky	–	–	–	2,754	285	10.30
12	Derbentsky	13,817	31	0.20	–	–	–
13	Dokuzparinsky	2,562	–	–	–	–	–
14	Kazbekovsky	3,500	–	–	–	–	–
15	Kaitagsky	–	–	–	41	–	–
16	Kizilyurtovsky	10,672	9		3,487	1	0.03
17	Kumtorkalinsky	1,545	4	0.30	–	–	–
18	Kayakentsky	5,812	29	0.50	–	–	–
19	Karabudakhkentsky	33,310	–	–	–	–	–
20	Kizlyarsky	22,250	642	2.30	–	–	–
21	Kulinsky	9,305	15	0.20	9,053	120	1.30
22	Kurakhsky	2,855	–	–	–	–	–
23	Laksky	15,545	5	0.03	–	–	–
24	Levashinsky	12,982	96	0.70	3,774	49	1.30
25	Magaramkentsky	10,785	–	–	–	–	–
26	Novolaksky	1,494	–	–	–	–	–
27	Nogaisky	16,243	6	0.04	–	–	–
28	Rutulsky	2,086	31	1.50	690	10	1.45
29	Suleiman-Stalsky	3,425	–	–	–	–	–
30	Sergokalinsky	6,787	20	0.30	110	–	–
31	Tabasaransky	8,577	18	0.20	–	–	–
32	Tarumovsky	–	–	–	7,097	223	3.10
33	Tlyaratinsky	13,490	151	1.10	1,268	24	1.90
34	Untsukulsky	8,253	62	0.80	93	3	3.20
35	Khasavyurtovsky	77,467	1,368	1.80			
36	Khivsky	4,771	–	–	122	–	–
37	Khunzakhsky	8,693	27	0.30	–	–	–
38	Tsumadinsky	19,460	77	0.40	159	6	3.80
39	Tsuntinsky	6,447	15	0.20	152	2	1.30
40	Charodinsky	9,686	51	0.50	9,594	280	3.00
41	Shamilsky	1,784	10	0.60	6,425	641	10.00
42	Kizlyar	421	4	1.00	–	–	–
43	Makhachkala	–	–	–	100	–	–
44	Kaspiysk	–	–	–	98	–	–
45	Izberbash	902	6	0.70	–	–	–
46	Yuzhno-Sukhokumsk	2,663	100	3.80	–	–	–
47	Derbent	354	–	–	–	–	–
48	Dagestankiye Ogni	487	–	–	–	–	–
	Total	**468,404**	**3,489**	**0.70**	**56,496**	**1,872**	**3.30**

The 1–2% morbidity rate due to leukosis was registered in 4 raions of the Republic: Khasavyurtovsky (1.8%), Charodinsky (1.7%), Botlikhsky (1.4%), Tlyaratinsky (1.2%), and in the town of Kizlyar (1.0%). In other raions and municipal districts the percentage of BLV infection was less than 1.0%. In 2020 a total of 524,930 animal sera samples were serologically tested using IDT, 5,362 (1.02%) samples among them were seropositive. In 2020 1,265 sera samples from IDT-positive animals were tested hematologically, and 251 animals (19.8%) were identified as having the hematological disease. Hematological studies of animal sera for leukosis were conducted in 3 raions (Tarumovsky, Khasavyurtovsky, Charodinsky) and in the town of Yuzhno-Sukhokumsk, which does not fully reflect the situation on bovine leukosis morbidity in the Republic.

Thus, based on the official data provided by the GBU RD "Republican Veterinary Laboratory", the number of BLV-infected animals has sharply decreased to 1.02%, being the lowest indicator in the Republic in recent years [13].

Cattle are kept in private (individual) or public (state unitary enterprise, agricultural production cooperative, small-scale farms, etc.) sectors in the Republic of Dagestan. The farm's status is also an important factor in the distribution of BLV. For example, contrary to the private sector, a large number of animals are kept together in public farms, which means that there is close contact of livestock and joint processes of cow milking, feeding, veterinary and zootechnical handling procedures. All this leads to increased level of BLV infection in animals in public farms of the Republic (Table 2).

As it is shown in Table 2, the number of cattle kept in individual farms in the Republic is larger. 468,404 samples from cattle in private farms were serologically tested in 2020, 3,489 (0.7%) samples out of them were seropositive. In total 56,496 sera samples from cattle in public farms were tested for leukosis, and the infection rate was 3.3% (1,872 animals). The number of seropositive animals in the public sector exceeds the number of seropositive animals in individual farms by more than 4 times, and the percentage of infection in livestock in some areas reaches 10% and even higher (Dakhadaevsky – 10.3%, Shamilsky – 10.0%).

Based on the above, it can be concluded that BLV is distributed in all livestock sectors in the Republic, and, in particular, the distribution is more intensive among cattle in public farms. One of the reasons for the spread of infection in the public sectors of the Republic is the entry of infected and leukosis-diseased animals from other regions back in the Soviet times [13].

CONCLUSION

The serological studies for bovine leukosis conducted in the Republic of Dagestan show that in 2020 the general level of BLV infection decreased to 1.02% as compared to previous years. The number of animals with hematological disease detected among BLV-infected animals in the farms of the Republic in 2020 remains at a high level (19.8%). Hematological studies for bovine leukosis are carried out randomly in the Republic, covering small quantities of animals and not all infected livestock population. Nevertheless, the detection rate of animals with the hematological disease is high, which indicates that animals infected with leukosis are not subjected to slaughter. A comparative analysis of the BLV frequency in farms of different categories showed that the percentage of infection in animals is higher in the public sector as compared to the private (individual) sector. Bovine leukosis is distributed in many raions and municipal districts, and that remains one of the main problems of animal husbandry in the Republic of Dagestan.

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