



Issues and Epidemiological Aspects of the Rabies Disease in South-Eastern Tajikistan

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Abstract

The Ministry of Economic Development and Trade of Tajikistan notes in a monthly report that the risk of rabies infection and mortality is still high in Tajikistan. The state veterinary authorities on the ground carry out regular vaccination, registration, and certification of dogs, but not full coverage, which increases the risk of infection and mortality from rabies in Tajikistan, according to the monitoring of early warning. This work presents the results of a retrospective analysis of the ecological and epizootic situation of South-Eastern Tajikistan adjacent to nature reserves and state reserves and studies of the role of carnivores and other animals in the circulation of the rabies virus in natural foci. The Khatlon region of South-Eastern Tajikistan has been affected by rabic infection, especially in recent years. In the study area, the role of carnivorous animals in the spread of rabies infection was studied, and a computer model of the spread of rabies in the territory of South-Eastern Tajikistan, in particular in the Khatlon region, was developed. The monitoring of rabies among carnivorous mammals was carried out on the territory of three nature reserves. The relationship between the disease of dogs, cats, and cattle was revealed.

Disciplinary: Agricultural Sciences, Epidemiology, Life Sciences Virology, Zoology.

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1 Introduction

In Tajikistan, a high percentage of stray dog bites have been reported annually over the past 10 years. About 20 people die from this every year. Most fatal cases occur due to the late treatment

of citizens in medical institutions, as well as the shortage and high cost of the rabies vaccine (Gulamadshoeva et al., 2016; Gulahmadov et al., 2016). In 2021, the International Epizootic Bureau plans to develop and approve a plan to combat rabic infection in the national regime. There is a program called the Global Strategic Plan to Prevent Deaths from Dog-Borne Rabies. This program will be implemented by 2030.

The control of stray dogs, the movement of dogs and cats in international terms is relevant (Land Animal Health Code, 2019). Of great importance for the prevention of rabies are diagnosis, prevention. In European countries, rabic infection persists in wild fauna, mainly among foxes, wolves, and raccoon dogs. On the American continent, the reservoir of rabies is preserved by coyotes and bats (Zaykova et al., 2016; Ivanov et al., 2015; Kartavaya et al., 2016; Land Animal Health Code, 2019; Simonova, 2018; Shabeikin et al., 2015; Shabeikin et al., 2016). Epizootological monitoring of unfavorable regions and the main types of wild carnivores for rabies in the Russian Federation was carried out (Figure 1) with the highest number of cases of animal rabies (2015-2019).

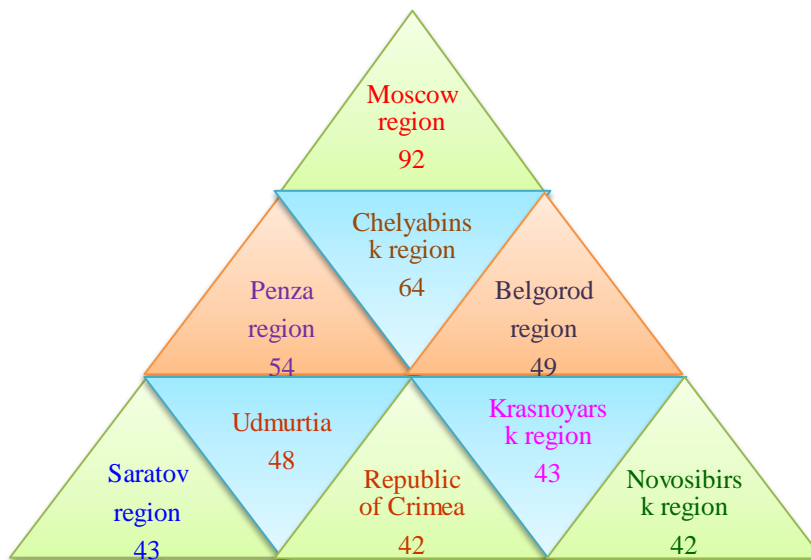


Figure 1: The number of cases of rabies in the regions of the Russian Federation for 2015-2019.

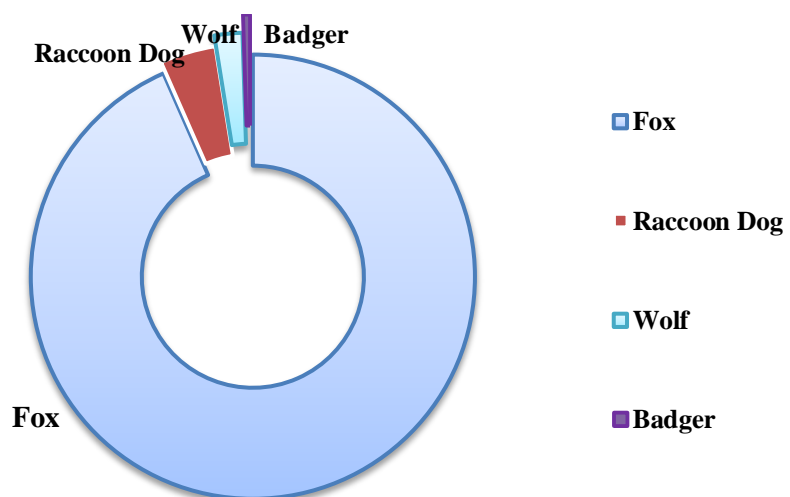


Figure 2: Percentage of the main species of wild carnivores with rabies in the Russian Federation for 2015-2020.

As can be seen in Figure 2, a high percentage of rabies virus infection in the Russian Federation is a fox 92%, a raccoon dog 4%, a wolf 2.2%, a badger 1.8%

On the example of the Sverdlovsk region for three years, epizootological monitoring of the distribution of rabies among wild animals was carried out, the main source of rabies in this territory is a fox (59.8%), the remaining 41.2% are raccoon dogs, dogs, cats, martens, badgers, horses, farm animals (Gorbenko et al., 2018; Novikova & Petrova, 2015a; Novikova & Petrova, 2015b).

The territory of Central Asia and the Caucasus marked anthropologic robicelli foci of infection. As for the European states, the American continent, rabies is observed mainly in the territory of wild fauna, affecting the red fox (Gulamadshoeva et al., 2016; Gulahmadov et al., 2016; Litvinenko, 2016).

In recent years, the percentage of damage to such animals as bats and field mice, beavers, muskrats, martens, domestic carnivores, and farm animals has increased (Novikova & Petrova, 2015a; Novikova & Petrova, 2015b; Simonova et al., 2017). In the Sughd region of Tajikistan, the causative agent of rabies from bats KHUV was isolated (Mamadaminov, 2019; Novikova & Petrova, 2015b; Simonova et al., 2017).

In the maintenance of natural foci of rabies in the Khatlon region of Tajikistan, as well as in many countries of the world, a certain role may belong to foxes, wolves, jackals, and other wild carnivores, some species of rodents, as well as bats. On the territory of Tajikistan, measures are being taken against rabic infection of animals, but it is not possible to eliminate this disease. In veterinary epidemiology, the advantage of comparing data and geographic information systems is obvious. When rabies occurs among animals, the geographic information system is of great importance for preventing the occurrence of infection. In this regard, the research aimed to conduct a retrospective analysis of the epizootic and ecological situation in the regions of South-Eastern Tajikistan adjacent to nature reserves and state reserves and to study the role of wild carnivores and other animals in the circulation of the rabies virus in natural foci.

Purpose of the study: To determine the patterns of development and spread of rabies in the natural foci of South-Eastern Tajikistan and the role of different animal species in its spread.

2 Research Methodology and Methods.

Laboratory tests for rabies were carried out using the conventional method of fluorescent antibodies (MFA)- a method for detecting rabies virus antigen labeled with fluorescein isothiocyanate with anti-rabies antibodies, with the formation of characteristic luminous complexes-inclusions detected in the field of view of a fluorescent microscope. The reverse transcriptase-polymerase chain reaction (RT-PCR) method is a method for detecting the rabies virus genome by converting a specific sequence of the virus RNA into DNA, followed by repeated copying of the resulting DNA and detection of reaction products, carried out in vitro and a bioassay on mice - a method for isolating the rabies virus in white mice by injecting them with a suspension

of pathological material, followed by virus identification by fluorescent antibodies. Geographical records of rabic infection cases were determined using the ArcGIS 10 software.

3 Result and Discussion

The relevance of this study is justified by the unfavorable situation of the Khatlon region with rabies and the preservation of animals registered in the Red Book of Tajikistan in nature reserves and reserves in this territory. Tigrovaya Balka Nature Reserve is 200 km. away from Dushanbe. There are about 250 species of vertebrates in the reserve, some of them are included in the International Red Book and the "Red Book of Tajikistan" -this is the gazelle, Bukhara mountain sheep (urial), and Bukhara deer.



Figure 3: Tigrovaya balka Nature Reserve and Bukhara deer.



Figure 4: Dashtizhum Nature Reserve and Morhur's screw-horned goat.

The second unique nature reserve in the Khatlon region is the nature reserve Dashtijum. The nature reserve is 240 km. away from Dushanbe and 40 km. from Kulyab. The great importance of this reserve is the preservation of the population of the screw-horned goat mother, as well as the Central Asian mouflon, which is included in the Red Book of Tajikistan.

The preservation of animals in the Nurek State Nature Reserve from the occurrence of rabic infection also plays an important role. In the reserve, there are rare animals that are also included in the Red Book of Tajikistan, such as the Bukhara urial, the Tien Shan brown bear, the snow leopard, the Turkestan lynx, the Central Asian otter, and the stone marten.



Figure 5: Nurek Nature Reserve and Bukhara Urial



Figure 6: State Nature Reserve "Childukhtaron" and the Turkestan lynx.

Childukhtaron nature reserve, interesting because it preserves two ecological systems of high-altitude vertical belts with a geological landscape natural monument, is part of the Kulyab province. This reserve is mainly used for scientific purposes for the conservation of wildlife. In the forests of the reserve, there are animals included in the Red Book of Tajikistan Turkestan lynx, stone marten.



Figure 7: Khatlon region with adjacent nature reserves

According to the WHO, one of the main causes of the spread of rabies disease in wild mammals, and therefore, the state of the population of wild animals in the reserves of the Khatlon region was studied for 2016-2019. For this purpose, the monitoring of the state of wild mammals on the territory of 3 nature reserves of the Khatlon region was carried out. When conducting research, the methodology of the UN FAO “Joint Epidemiology (Participatory Epidemiology, Handouts)”, which was published in 1999, was used. The purpose of the research was to collect information about Belize to determine the timing of rabies eradication in the Republic of Tajikistan. During the meeting, the owners of animals and employees of nature reserves of the Khatlon region were told about special clinical signs with the provision of photos. In this regard, we studied the dynamics of the number of wild animals in the reserves of the Khatlon region for the period 2017-2019. The results are presented in Table 1.

Table 1: The number of animals on the territory of nature reserves in the Khatlon region that are not included in the Red List of Tajikistan

Types of animals /years	Tigrovaya Balka			Dashtidgum			Sarikhoso		
	2017	2018	2019	2017	2018	2019	2017	2018	2019
Wolfes	170	180	185	240	240	250	104	104	109
Foxes	350	350	360	461	471	481	90	90	101
Bears	90	70	70	132	137	137	60	63	63
Hogs	537	534	564	1242	1253	1200	562	562	570
Jungle cat	36	26	26	242	256	200	147	145	140
Total	1183	1160	1160	2317	2357	2268	963	964	974

Analysis of the table data shows that the number of foxes and wolves in the Dashtizhum and Tigrovaya Balka nature reserves increases from year to year. The number of foxes and wolves in the Dashtizhum Reserve, respectively, was 461, 471, 481 and 240, 240, 250, and in the Tigrovaya Balka

Reserve, the number of foxes and wolves, respectively, is 350, 350, 360 and 170, 180, 185 and from year to year their numbers are increasing, and in the Sarihosor Reserve, the number of wolves in 2017-2018 was more than 104 and 104 than foxes 90 and 90 a, in 2019, their numbers were almost the same and respectively amounted to 109 and 101 heads.

The results of laboratory and clinical monitoring show that there are no signs of rabies among wild animals and birds. Based on the results obtained, it can be concluded that the infection of farm animals occurs from dogs and cats. Determining the role of wild animals in the etiology of infecting dogs and farm animals with rabies requires additional research.

In this regard, we conducted ecological and epizootological monitoring of the environment of animals living in nature reserves and villages adjacent to nature reserves. Samples from different animal breeds brought from these regions were subjected to a comprehensive study. The results of the studies are shown in Table 2

As can be seen from the results of Table 2, from the studied samples with inadequate animal behavior in 2 cases from 2 wolves, in one sample from jackals and one sample from 44 samples from bats, in 2 samples from 4 part material from field mice and one sample from starling, a positive result for the beschestva virus was detected (Table 2, Figure 8).

Table 2: Results of studies of wild animals for rabies in nature reserves and adjacent villages in the Khatlon region for 2016-2018.

Type of animal	Number of samples		Results of the study		
	Total	Of these, positive	RIF	PCR	Bioprobe
Wolf	2	2	+	+	
Jackal	1	1	+	+	
Bat	44	1	+	+	+
Jungle cat	1	-	-	-	
Rat	3		-	-	-
Field Mouse	4	2	+	+	
Starling	1	1	+	+	
Pheasant	1	-	-	-	
Blackbird	1	-	-	-	
Great Cormorant	1	-	-	-	

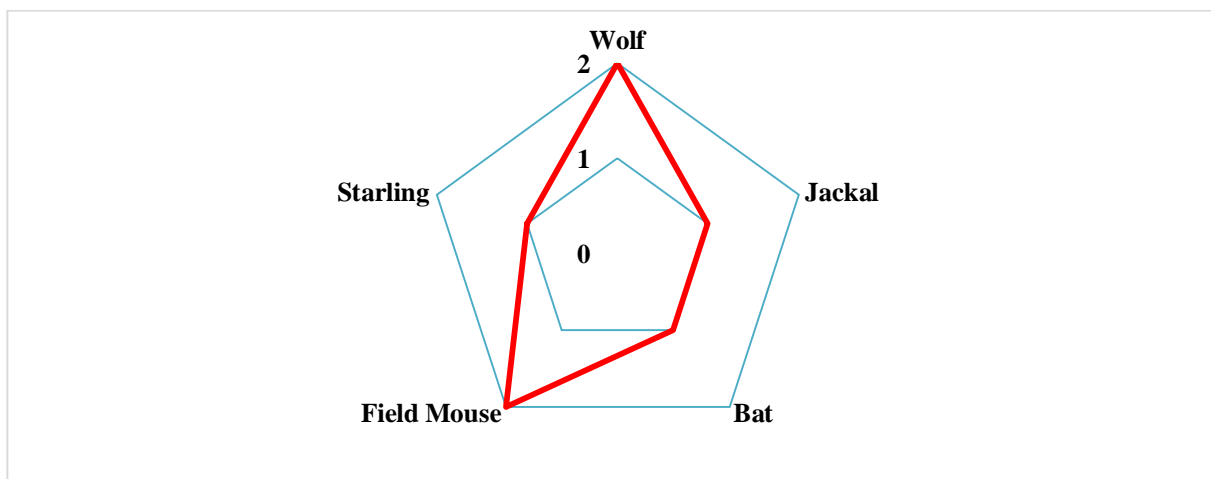


Figure 8: Geographical model of the spread of rabies among carnivores, rodents, and birds

Possible rabic infection of animals of the reserve and nature reserves, farm animals, and their interrelation were analyzed (Figure 9).

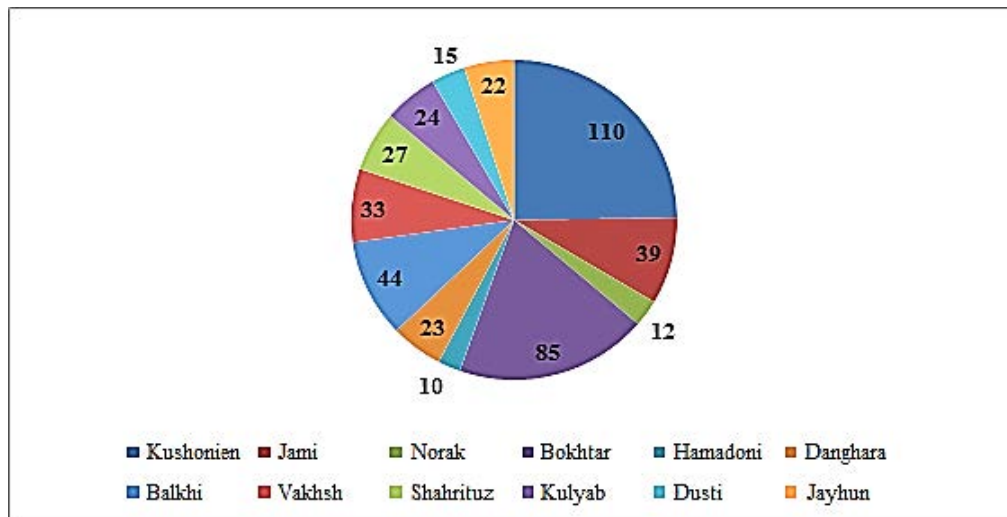


Figure 9: The territory of the Khatlon region and the relationship between the occurrence of rabies in carnivores and farm animals

In general, the incidence of carnivorous and agricultural animals is determined in the areas of Kulyab, Jami, Kushonien, i.e. in the territories located in nature reserves and nature reserves of the Khatlon region. In these geographical zones, the incidence of dogs is noted in the range of 77%, 21% of farm animals, 2% - wolves, jackals, bat, field mouse, starlings).



Figure 10: Geographical model of the spread of animal rabies in the Khatlon region.

The analysis of the data of the conducted studies showed that the spread of rabies in the Khatlon region is associated with the neglect of dogs and cats.

4 Conclusion

The risk of rabies infection and mortality is still high in Tajikistan. This article presents the results of a retrospective analysis of the ecological and epizootic situation of South-Eastern Tajikistan adjacent to nature reserves and state reserves and studies of the role of carnivores and other animals in the circulation of the rabies virus in natural foci. The Khatlon region of South-Eastern Tajikistan has been affected by rabic infection, especially in recent years. In the study area, the role of carnivorous animals in the spread of rabies infection was studied, and a computer model of the spread of rabies in the territory of South-Eastern Tajikistan, in particular in the Khatlon region, was developed. The monitoring of rabies among carnivorous mammals was carried out on

the territory of 3 nature reserves. This study shows that the spread of rabies in the Khatlon region is associated with the neglect of dogs and cats. This study shows a high incidence of domestic carnivores and farm animals in the Khatlon region, and the need for measures against rabies, according to the Sanitary Code of Terrestrial Animals of the IEB (Land Animal Health Code, 2019).

5 Availability of Data and Material

Data can be made available by contacting the corresponding authors.

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