



## Analysis of the epizootic situation and improvement of the scheme for the specific prevention of anthrax

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Article History:	ABSTRACT
Received on: 02.08.2019 Revised on: 09.11.2019 Accepted on: 15.11.2019	The article shows the epizootic situation for three periods (decades): from 1990 to 1999, from 2000 to 2009 and from 2010 to 2019. As a result of the studies, it has been established that since 1990, the 26 sporadic outbreaks of anthrax have occurred in the territory of the republic, 13 of them in territories where the disease was not previously recorded, which indicates the spread of the pathogen in the environment. Due to the special situation of anthrax, which consists of a large number of unidentified anthrax cattle burial grounds, as well as high density and activity of dysfunctional sites, the republican veterinary service recommended vaccinating an adult cattle population twice a year with an interval of 6 months: in spring and autumn, to create the maximum percentage of immune animals. In addition, a method has been introduced in the republic for assessing specific prophylaxis of anthrax, based on the detection of specific antibodies in the blood serum of an immunized livestock by an indirect hemagglutination test. This method allows the detection of animals that were skipped during vaccination and tolerant animals. Thanks to the joint work of veterinarians and scientists who improved the specific scheme for the prevention of anthrax, the republic managed to reduce the number of outbreaks of infection by 15 times, which allows us to predict further improvement in the epizootic situation for this infection.
Keywords:  anthrax, Republic of Tatarstan, disease prevention, morbidity structure, monitoring, dysfunctional point	



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## INTRODUCTION

The first half of the 20th century was characterized by numerous outbreaks of anthrax in the Republic of Tatarstan (Russian Federation) among farm animals. Today, the entire territory of the republic is endemic for this disease (Yakobson *et al.*, 1998). The presence of a large number of anthrax cattle burial grounds, including those not established (Schetters *et al.*, 1990), as well as permanently dysfunctional sites, their high density and specific gravity, create constantly persisting high risks in the republic of a possible aggravation of the situation (Jaworski *et al.*, 2016). The existing system for the preven-

tion of anthrax is not capable of completely eliminating it, since there are currently no effective and harmless methods of sanitizing the soil foci of infection, and the question of the appropriateness of their use remains open. Therefore, the annual vaccination of the entire susceptible livestock of farm animals remains the main method of controlling morbidity (Mammerickx *et al.*, 2010). However, the shortcomings of the existing programs of specific prevention (Ungar-Waron *et al.*, 1992, 1999; Konishi *et al.*, 2018), which do not take into account the high risks of a possible infection in the subjects of the Russian Federation, remain an urgent problem.

The purpose of the work is to conduct a comparative retrospective analysis of the dynamics of anthrax outbreaks in farm animals and evaluate the specific infection prevention scheme used in the Republic of Tatarstan.

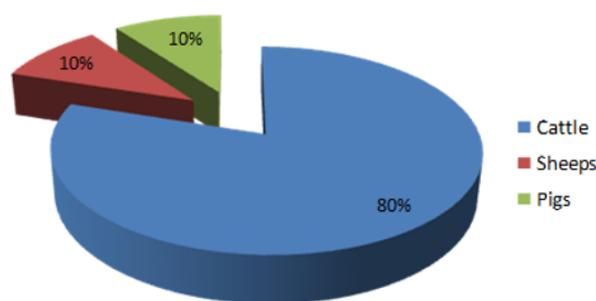
## MATERIALS AND METHODS

A retrospective epizootological analysis of the incidence of anthrax in farm animals in the Republic of Tatarstan was carried out for three periods (decades) from 1990 to 1999, from 2000 to 2009 and from 2010 to 2019 on the basis of archival documents of the Main Veterinary Directorate of the Cabinet of Ministers of the Republic of Tatarstan and of the cadastre of points of the Russian Federation permanently disadvantaged on anthrax (Ruggiero and Bartlett, 2019).

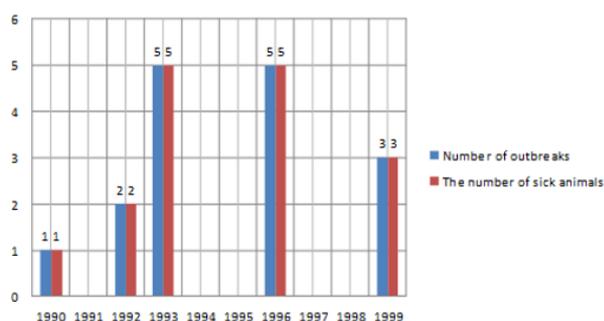
## RESULTS AND DISCUSSION

Since 1990, there have been 26 outbreaks of anthrax in farm animals in 16 (37.2%) municipal districts out of 43 (100%) in the Republic of Tatarstan. In total, during the indicated period, 26 anthrax-disadvantaged permanently inhabited localities (ADPIL) showed an activity of anthrax, which is 2.1% of all ADPILs (1208) registered in the republic. Thirteen (50%) of 26 active ADPILs were registered for the first time, which may be an indicator of incomplete accounting of soil foci of infection, or indicate the spread of the pathogen by wild animals, birds, insects, etc. (Table 1). In addition, 2 new ADPILs were active in subsequent years.

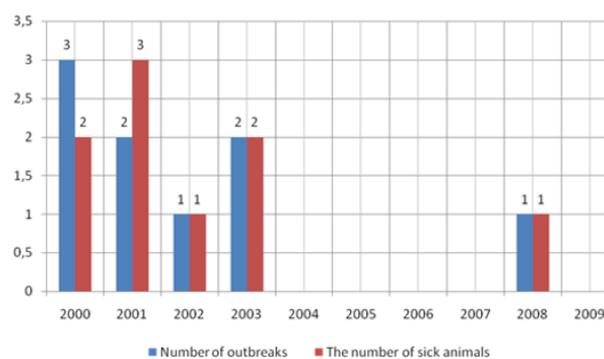
In total, 26 animals fell ill during the study period, including 21 big cattle, 2 small cattle animals, and 3 pigs. Big cattle account for 80.8% of all diseased animals (Figure 1), which makes this type of animal the main factor determining the risk of human infection. In order to analyze the epizootic situation of anthrax in farm animals in the Republic of Tatarstan, we compared 3 periods: from 1990 to 1999, from



**Figure 1: The structure of the incidence rate by animal species in the Republic of Tatarstan from 1990 to 2019**



**Figure 2: The manifestation of the activity of the ADPILs and the incidence of anthrax in the Republic of Tatarstan for the period from 1990 to 1999**



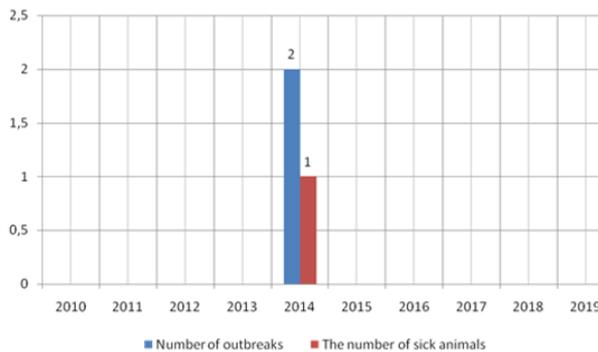
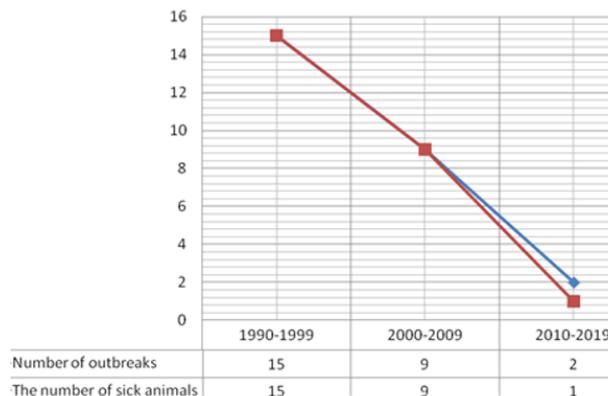
**Figure 3: The manifestation of the activity of the ADPILs and the incidence of anthrax in the Republic of Tatarstan for the period from 2000 to 2009**

2000 to 2009 and from 2010 to 2019.

The first period (1990-1999) is characterized by the largest number of active ADPILs and diseased animals in comparison with subsequent decades (Figure 2). This fact may be associated with the collapse of the Soviet Union and, as a result, a change in the economic situation in the republic due to the liquidation of collective livestock farms, which entailed some difficulties in the work of the state veterinary service.

**Table 1: The structure of active ADPILs in the Republic of Tatarstan from 1990 to 2019**

Character SUS	Quantity SUS	
	absolute number	%
Non-manifest	12	46.2
Recurrent	1	3.8
New	13	50

**Figure 4: The manifestation of the activity of the ADPILs and the incidence of anthrax in the Republic of Tatarstan for the period from 2010 to 2019****Figure 5: Dynamics of a decrease in the number of active ADPILs and the incidence of anthrax animals in the Republic of Tatarstan by decades during 1990-2019**

During the first period in the Republic of Tatarstan, 16 ADPILs showed activity, of which 9 (56.2%) are newly formed, 1 ADPIL (6.2%) is relapsing, and 6 ADPILs are non-manifest, showing activity more than 30 years ago for the last time. The manifestation of ADPIL activity in the study period was in the nature of sporadic outbreaks, in which 16 farm animals fell ill, 13 of them were bit cattle, 1 was small cattle animal, and 2 were pigs (Khudhair *et al.*, 2016).

The second period (2000-2009) was characterized by the already existing stable economic situation

both in general in the Russian Federation and in the Republic of Tatarstan in particular. In the second decade under study, the activity of ADPILs, in comparison with the first period, decreased by 43.7% and amounted to 9 ADPILs (Figure 3). Of these, 4 (44.4%) are newly formed, 4 (44.4%) are non-manifest, showing activity 36 or more years ago, and 1 (11.1%) ADPIL, formed in 1999, but re-showing its activity in 2000.

The number of sick animals from 2000 to 2009 decreased to 9: 7 big cattle, 1 small cattle, and 1 pig, which indicates a positive trend in reducing the incidence.

The third period (2010-2019) was characterized by the smallest number of cases of anthrax (Figure 4). In total, for the indicated period, 2 ADPILs showed activity as follows: Knya-Bash village, in which 1 person fell ill and the village of Luga, Kukmorsky district, in which 1 big cattle fell ill. The sick animal was brought into the village without veterinary accompanying documents, in addition, the owners did not inform the administration of rural settlements and the district veterinary service about the fact of acquiring the animal, thereby creating conditions for the possibility of the occurrence and spread of especially dangerous diseases common to humans and animals.

Thus, the only case of anthrax animal disease since 2010 occurred due to the fault of the owners themselves, and without taking into account this incident, it can be stated that the epizootological situation of anthrax in the Republic of Tatarstan has stabilized.

It should be noted that in the third period, the scheme for the specific prevention of anthrax in the republic underwent changes. Due to the special situation of anthrax, which consists of a large number of unidentified anthrax cattle burial grounds, as well as high density and activity of ADPILS, the republican veterinary service recommended vaccinating farm animals twice a year: in spring and autumn, to create the maximum percentage of immune animals. This experience was also demonstrated in the 1980s when, in many republics of the former USSR, animals were vaccinated twice during the year with the STI vaccine, which entailed a sharp decrease in

the incidence of humans and farm animals. In addition, a method has been tested in the republic for assessing specific prophylaxis of anthrax, based on the detection of antitoxin antibodies in the blood serum of immunized livestock. During the testing of this method on livestock widely, it was possible to identify mistakenly unvaccinated and tolerant animals and to apply appropriate measures in a timely manner, which also helps to maintain the welfare of the republic in this disease.

The general dynamics of the epizootic situation in the Republic of Tatarstan over the past three decades can be seen in Figure 5.

The data presented indicate a generally positive trend in reducing the incidence of anthrax in farm animals and the manifestation of the activity of the ADPIs in the Republic of Tatarstan. Since 1990, the number of outbreaks of the incidence has decreased by 15 times, which allows us to predict further stabilization of the epizootic situation in the country for this disease.

## CONCLUSIONS

In the course of the work, it was found that the epizootic situation for anthrax in the Republic of Tatarstan is characterized by a positive trend towards a decrease in the incidence of farm animals. Owing to the focused joint work of veterinary specialists and scientists, the specific prevention of infection, taking into account the high risks of anthrax in the republic, the third period (2010-2019) can be described as the most stable in the epizootic situation, both over the past 30 years and for the entire period of registration of outbreaks of the disease in the republic since 1914.

## REFERENCES

Jaworski, J. P., Porta, N. G., Gutierrez, G., Politzki, R. P., Álvarez, I., Galarza, R., Trono, K. G. 2016. Short communication: Relationship between the level of bovine leukemia virus antibody and provirus in blood and milk of cows from a naturally infected herd. *Journal of Dairy Science*, 99(7):5629–5634.

Khudhair, Y. I., Hasso, S. A., Yaseen, N. Y., Shammari, A. M. 2016. Serological and molecular detection of bovine leukemia virus in cattle in Iraq. *Emerging Microbes & Infections*, 5(1):1–6.

Konishi, M., Ishizaki, H., Kameyama, K., Murakami, K., Yamamoto, T. 2018. The effectiveness of colostral antibodies for preventing bovine leukemia virus (BLV) infection in vitro. *BMC Veterinary Research*, 14(1):419–419.

Mammerickx, M., Portetelle, D., Burny, A. 2010. Experimental Cross-Transmissions of Bovine Leukemia Virus (BLV) between Several Animal Species. *Zentralblatt Für Veterinärmedizin Reihe B*, 28(1):69–81.

Ruggiero, V. J., Bartlett, P. C. 2019. Control of Bovine Leukemia Virus in Three US Dairy Herds by Culling ELISA-Positive Cows. *Veterinary Medicine International*, pages 1–6.

Schettters, H., Rohmer, H., Hehlmann, R., Erfle, V. 1990. Quantitative determination of retrovirus-specific immune complexes. *Journal of Immunological Methods*, 134(1):113–119.

Ungar-Waron, H., Brenner, J., Paz, R., Trainin, Z. 1992. Circulating immune complexes in bovine leukemia virus (BLV)-infected cattle. 34:90160–90160.

Ungar-Waron, H., Paz, R., Brenner, J., Yakobson, B., Partosh, N., Trainin, Z. 1999. Experimental infection of calves with bovine leukemia virus (BLV): an applicable model of retroviral infection. *Veterinary Immunology and Immunopathology*, 67(2):221–230.

Yakobson, B., Brenner, J., Ungar-Waron, H., Trainin, Z. 1998. Short-termed expression of interleukin-12 during experimental BLV infection may direct disease progression to persistent lymphocytosis. *Veterinary Immunology and Immunopathology*, 64(3):136–142.