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## HYGIENE, SANITATION, EPIDEMIOLOGY AND MEDICAL ECOLOGY

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## EPIZOOTOLOGICAL EPIDEMIC MONITORING OF THE ANTHRAX IN THE CENTRAL AND SOUTH AREAS OF YAKUTIA

### ABSTRACT

739 epizootics of anthrax were registered in 244 stationary disadvantaged settlements on the territory of the republic.

In the present work there are modern data on epizootological epidemic monitoring of anthrax in the central and southern economic zones of the Republic of Sakha (Yakutia), which significantly clarify the quantitative and qualitative aspects of the indicated problem. Thus, the maximum number of epizootics of anthrax (numerator) and disadvantaged settlements (denominator) is registered in the areas of the central economic zone (323/109), and their respective minimum values are in the areas of the south economic zone (2/2). It has been determined the intensity of death of domestic animals by species, the number of registrations at disadvantaged settlements, the prevalence and periodicity of epizootics by area of the zone.

Attention is focused on an episode associated with the possible, specific, infectious and epidemiological danger of group burials of people.

**Keywords:** epizootic-epidemiological monitoring, anthrax, anthrax burial sites, agricultural animals, stationary disadvantaged settlements, economic zones, incidence level.

### Introduction

Anthrax, an especially dangerous saprozootic infection, is now manifested in the form of sporadic cases, and sometimes in the form of outbreaks. The causative agent of anthrax, actively spreading in the abiotic environment, poses a potential danger to wild and farm animals, as well as humans. Despite the significant decline in economic damage from this infectious disease in recent decades as a result of preventive measures, the disease continues to be registered in many countries around the world, in various regions of Russia [1]. In Siberia and the Far East to the territories with marked epizootic-epidemiological disadvantage in the Siberian anthrax include the Altai Territory, the Omsk Region, the Republics of Buryatia and Tyva, the Novosibirsk Region and the Trans-Baikal Territory, as well as Central Yakutia [8], on the territory of which, by the example and results of modern microbiological research, archaeological remains (Churapchinsky district) of the group burial of dead people, evidence of their specific epidemiological danger has been obtained [10].

On the territory of the Russian

Federation there are over 35,000 registered stationary disadvantaged settlements, which account for about 8 thousand anthrax cattle cemeteries. More than 70,300 group and single cases of diseases of humans and animals with anthrax have been identified.

Didactic interest is represented by epizootic and epidemiological events of 2016 taking place in the tundra regions of the Yamalo-Nenetsky Autonomous District, where a large epidemic outbreak of anthrax with a number of stricken - 36 people and a case of 2,650 heads of domestic deer was recorded. The source of infection were reindeer and unaccounted anthrax burials in which *B.anthraxis* spores persisted for a long time in the Yamal soils [2]. In the before- revolutionary Yakutia, anthrax was one of the most common and dangerous infectious diseases. The first information about the occurrence of anthrax in Yakutia dates back to 1811. In subsequent years, up to 1993-1994, i.e. for more than 100 years, almost annually diseases and death of animals from anthrax were recorded [3-5, 8]. Our monitoring studies and generalizations do not exclude the relevance of anthrax

on the territory of the Republic of Sakha (Yakutia). Due to the impossibility of defining clear boundaries of stationary disadvantaged settlements (SDS), the only indicators of potential disadvantage are information on the mortality of animals from anthrax and burial related to the objects of the first class of danger. According to the study results of the characteristics of anthrax burial sites (CABS), it was established that most of the burial sites on the territory of the republic date back to 1960 [4]. For the planned organization of anti-anthrax measures, it is necessary to keep a record and constant monitoring of the status of all known stationary disadvantaged settlements, since the potential danger of occurrence of new outbreaks remains in any of these disadvantaged settlements, including «dormant» or «forgotten» [8].

The aim of the study is to conduct, evaluate and forecast epizootic-epidemiological monitoring of anthrax for various disadvantaged (primarily stationary) settlements in the Central and Southern economic zones of the Republic of Sakha (Yakutia), indicating their veterinary medical and

sanitary significance in administrative and geographical areas under implementation of megaprojects and formation of special development territories (SDT).

**Materials and methods of research.** In studying of the epizootic situation on the anthrax, there were used the official records of the Veterinary Department of the Yakutsk region, the annual reports, the official information of the Yakut Autonomous SSR, the Ministry of Agriculture of the Republic of Sakha (Yakutia), the Department of Veterinary Medicine of the Republic of Sakha (Yakutia) on the timing of registration of disadvantaged settlements and cases of manifestations of the disease in them, as well as materials of their own research, epizootic foci of anthrax in the Yakutsk region and the Republic of Sakha (Yakutia).

To assess the nature of epizootic and epidemiological processes of anthrax in the Central and Southern zones of the Republic of Sakha (Yakutia), there were determined the level of epizootic ill-being and the nature of prevalence, territorial confinement, duration of the process, and the frequency of recurrence of outbreaks at the level of attachment to human settlements.

**Results and discussion.** Based on the study of geographical, natural climatic, soil features of agroclimatic zones, the configuration of the population and the transport network, agricultural and industrial specialization of the regions, the territory of the Republic of Sakha (Yakutia) is divided into five economic zones: Arctic, North-Eastern, Western, Central and Southern [6]. In this case, we conduct an epizootic-epidemiological monitoring of anthrax in the Central and Southern economic zones of the republic.

The Central economic zone occupies the Central Yakut plain, covered with medium light-coniferous taiga. In the Leno-Amginsky interfluvium there are mostly forest-steppe areas and a large number of lakes. These are the main agricultural regions of the republic [6]. It includes Amginsky, Gorny, Megino-Kangalassky, Tattinsky, Ust-Aldansky, Churapchinsky, Namsky, Khangalassky, Kobyaysky, Yakutsky districts.

The Southern economic zone includes two districts: Aldansky and Neryungrinsky. They are occupied by medium light-coniferous taiga of Dahurian larch, mountain light-coniferous, sometimes pine forests [6]. The mining industry is developed here. Agriculture and livestock farming are focal.

The territory of the Republic of Sakha (Yakutia) is divided into 4 epizootic zones according to the indices of activity of the epizootic process and the level of incidence and degree of disadvantage on the Siberian anthrax: a zone of high incidence and disadvantage (11 to 90 outbreaks), a zone with an average level of incidence and disadvantage (4-10 disease outbreaks), a zone with a low level of incidence and disadvantage (1-3 outbreaks) and an anthrax-free zone [7] (Fig. 1). Based on the results of the analysis of the epizootic situation, the frequency and degree of disadvantage, the areas of the Central economic zone; Amginsky, Gorny, Megino-Kangalassky, Tattinsky, Ust-Aldansky, Churapchinsky, Namsky, Khangalassky, Yakutsky, Kobyaisky belong to the zone with a high incidence rate and disadvantage, in which the epizootics of anthrax were recorded from 11 to 90 times during the studied period [4]. Areas of the Southern economic zone (Aldansky and Neryungrinsky) belong to the zone with a low incidence and disadvantage, since for the studied period epizootics of anthrax in the territories of these regions were recorded 2 times [4].

Fig. 1 Incidence rate and degree of disadvantage on the Siberian anthrax of the territory of the Republic of Sakha (Yakutia) for 1811-1993.

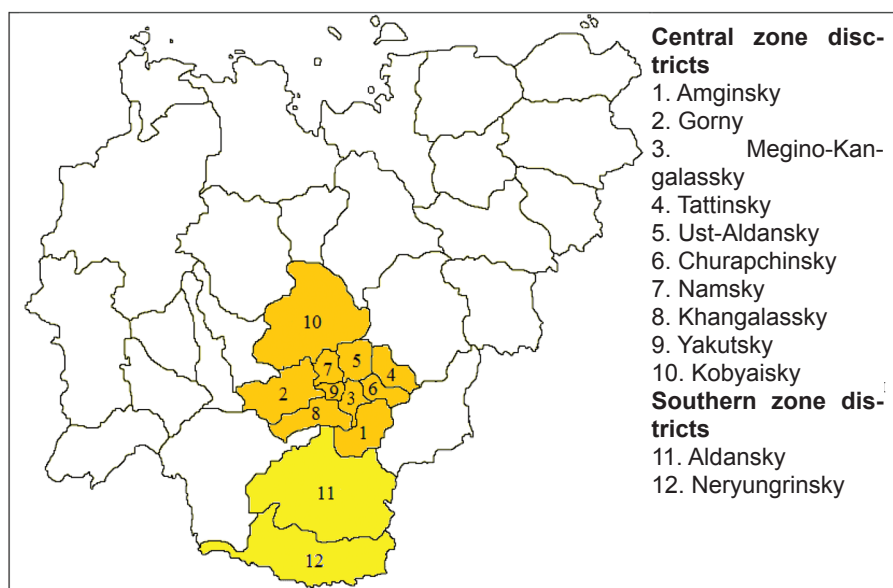
1 – a high level of incidence and disadvantage (11-90 outbreaks);

2 – an average level of incidence and disadvantage (4-10 outbreaks);

3 – a low level of incidence and disadvantage (1-3 outbreaks);

4 – an area free of anthrax.

Historically, during the 206-year observation period (1811-2017) in the Republic of Sakha (Yakutia) 739 epizootics of anthrax were registered in 244 stationary disadvantaged settlements. At the same time, the maximum number of epizootics of anthrax and stationary disadvantaged settlements was identified in the areas belonging to the Central economic zone (the number of epizootics is 323, stationary disadvantaged settlements - 109), and the minimum number of epizootics of anthrax and stationary disadvantaged settlements was noted in the areas related to the South economic zone (the number of epizootics 2, stationary disadvantaged settlements 2) (Table 1). [4]. The analysis of epizootic-epidemiological monitoring showed that 43.7% of epizootics of anthrax, as well as 38.8% of stationary disadvantaged settlements registered on the territory of the republic, were noted in the Central economic zone. During the study period, two epizootic outbreaks of anthrax (0.27%) and two stationary disadvantaged settlements (0.31%) were identified in the Southern economic zone, the cartographic situation (GIS) is still present. On the territory of the Republic of Sakha (Yakutia), 78,017 heads of domestic and wild animals fell from epizootics of anthrax (cattle – 29,480, horses – 35,995, deer – 12,517, wild animals – 25) [4].



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In the areas of the Central economic zone of the total number of dead animals in the republic there are 26,336 heads (33.7%), including cattle 13,464 heads (51.1%), horses 12,534 heads (47.5%), deer 338 (1.28%). In the areas of the Southern economic zone, 6 heads of domestic animals fell, of which cattle 2 heads, horses 4 heads [3, 4]. During the study period, anthrax was detected in animals of nine species (cattle, domesticated and wild deer, horses, roe deer, elk, bears, wolves and dogs), the main part of which were cattle (37.7%), horses (46.1%), deer (16.1%) of the total number of cases (78,024 animals) [8, 9].

Anthrax epizootics in the areas of the Central economic zone 323 disadvantaged settlements were registered, while the frequency of epizootics of anthrax in them was expressed by the following indicators:

1 time in 100 settlements (43% of the total number);

2 times in 43 (18.5%);

3 times in 27 (11.6%);

from 4 to 6 times in 38 settlements (16.4%);

from 7 to 9 times in 15 settlements (6.5%);

from 10 to 18 times in 9 settlements (3.9%).

18.5% of cases were recorded for 2 consecutive years in the same village, 3 consecutive years - 11.6%, 4 to 6 consecutive years - 16.4%, from 7 to 9 years in a row - 6.5%, from 10 to 18 years in a row - 3.9% of the 182 total years of activity in the Republic of Sakha (Yakutia). This is evidence that the level of repeated (in a row) diseases in the territory of the Republic was high up to the 1930s.

The analysis of epizootic and epidemiological monitoring of anthrax in the Central and Southern economic zones of the republic made it possible to identify areas and stationary disadvantaged settlements, where epizootics of anthrax and mass mortality among domestic and wild animals were active (Table).

However, the calmness of the observed pattern should be considered relative, because from soils in the zones of realized megaprojects (pipelines of the ESPO and the «Power of Siberia», Taranakh, Kankunskaya HPS and «AYAM-YaZhD» objects: locomotives, stations, bridges), we repeatedly distinguished strains of bacteria (*B. cereus*), closely related to the classical type - *Bacillus anthracis*.

### Conclusion

To date, 739 outbreaks of anthrax among animals in 29 administrative districts, in 244 settlements out of 628 have been identified in the territory of

**Indicators of the epizootic process of anthrax and the mortality of animals in the Republic of Sakha (Yakutia) from 1811 to 1993**

Name of economic zones and districts	Number of settlements	Number of disadvantaged settlements	% Disadvantaged settlements	Number of anthrax	Number of dead animals				
					cattle	horses	deer	Wild animals	Total
<b>Central zone districts</b>									
Amginsky	21	9	42,8	24	182	358	0	0	540
Gorny	16	7	43,7	21	300	671	32	0	1003
Megino-Kangalassky	36	8	22,2	11	74	47	0	0	121
Tattinsky	15	11	73,3	37	923	626	146	0	1695
Ust-Aldansky	35	24	68,5	90	6705	5244	0	0	11949
Churapchinsky	30	9	30,0	21	1355	1124	0	0	2479
Namsky	14	10	71,4	29	1454	1790	146	0	3390
Khangalassky	29	11	37,9	27	2082	2303	0	0	4385
Yakutsk (Zhatai village)	11	8	72,7	30	362	279	0	0	641
Kobyaisky	23	12	52,1	33	27	92	14	0	133
<b>Total</b>	230	109	47,39	323	13464	12534	338	0	26336
<b>Western zone districts</b>									
Mirinsky	14	6	42,8	6	3	0	97	15	115
Lensky	19	2	10,5	3	5	3	0	0	8
Olekminsky	54	21	40,5	56	763	911	160	0	1834
Suntarsky	39	12	30,7	26	964	1116	0	0	2080
Nyurbinsky	24	16	66,6	44	2085	2269	0	0	4354
Verkhnevilyuysky	29	13	44,8	47	2547	3016	299	0	5862
Vilyuysky	27	16	59,2	74	6241	5420	0	0	11661
<b>Total</b>	206	86	41,7	256	12608	12735	556	15	25914
<b>Arctic zone districts</b>									
Anabarsky	3	0	0	0	0	0	0	0	0
Allaikhovskiy	7	0	0	0	0	0	0	0	0
Abyiskiy	7	0	0	0	0	0	0	0	0
Bulunsky	10	0	0	0	0	0	0	0	0
Zhigansky	4	3	75	5	38	18	1871	0	1927
Oleneksky	4	4	100	10	0	0	1096	10	1106
Ust-Yansky	10	0	0	0	0	0	0	0	0
Nizhnekolymsky	13	2	15,2	2	4	21	0	0	25
Verkhnekolymsky	6	2	33,3	4	34	55	0	0	89
Verkhoyansk	29	3	10,3	6	140	227	850	0	1217
Momsky	7	2	28,5	4	0	6	351	0	357
Srednekolymsky	15	11	73,3	85	2625	9617	5459	0	17701
Eveno-Bytantaisky	4	1	25,0	1	0	0	12	0	12
<b>Total</b>	119	28	23,5	117	2841	9944	9639	10	22434
<b>Eastern zone districts</b>									
Oimyakonsky	16	12	75,0	26	508	755	1109	0	2372
Tomponsky	14	4	28,5	8	1	3	882	0	886
Ust-Maisky	15	3	13,3	7	56	20	0	0	76
<b>Total</b>	45	19	42,2	41	565	778	1991	0	3334
<b>Southern zone districts</b>									
Aldansky	19	2	10,5	2	2	4	0	0	6
Neryungrinsky	9	0	0	0	0	0	0	0	0
<b>Total</b>	28	2	7,1	2	2	4	0	0	6
<b>Total in the Republic of Sakha (Yakutia)</b>	628	244	38,8	739	29480	35995	12524	25	78024

the Republic of Sakha (Yakutia). 38.8% of the settlements of the republic are disadvantageded in the Siberian anthrax, with an average for the Russian Federation - 24.4%, the epizootic-epidemiological significance of which persists.

The majority of stationary disadvantaged settlements marked in the Republic of Sakha (Yakutia) are

registered (47.3%) on the territory of the Central economic zone. During the study period, the number of disadvantaged settlements for the Siberian anthrax was determined, in which mass cases of diseases and mortality of agricultural animals were recorded; Amginsky (24), Gorny (21), Megino-Kangalassky (11), Tattinsky (37), Ust-Aldansky (90), Churapchinsky (21), Namsky (29),



Khantalassky (27), Kobyaisky (33), Yakutsky (30) districts where it was registered 323 cases of anthrax diseases of agricultural animals in 109 stationary disadvantaged settlements. The last dates of registered epizootics of anthrax in the areas of the Central economic zone of the Republic: Amginsky - 1963, Gorny - 1976, Megino-Khantalassky - 1957, Tattinsky - 1935, Ust-Aldansky - 1394, Churapchinsky - 1929, Namsky - 1930, Khantalassky - 1932, Yakutsky - 1949, Kobyaisky - 1938.

Of the well-known - 739 (dormant, forgotten, dumb) burials associated with anthrax, only 284 were taken into account, as stationary disadvantaged settlements. It is in relation to the designated places that there are rules (code) of special measures restricting and regulating any of their use.

In addition, with large-scale excavation work, there is a high probability of a significant number of unrecorded anthrax burials, including the so-called «crippled fields», which according to archival documents, the reports of the Yakutian Autonomous Soviet Socialist Republic early in the 20th century practically cover the northern and groups of Vilyuisky territories in the Republic of Sakha (Yakutia). The presence of such sites in the designated zones is not fixed. Taking into account the epizootic situation of the Siberian anthrax in the Russian Federation in recent years, we can conclude that it is inadmissible to stop preventive measures in the regions of the republic, regardless of the period of limitation of the last manifestations of infection. One-time group burials of deceased people, as well as the circulation of closely related anthrax bacteria in the soils of Central and Southern Yakutia, are subject to special assessment. Timely sounding of risk potentials is correct and adequately to the volume and quality of preventive, medico-veterinary and preventive measures in modern conditions of anthropogenic load.

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