Monitoring Epizootic Situation on Anthrax in Ukraine 1920-2019

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The article presents anthrax monitoring studies (Anthrax) for ninety-nine years. The statistics on the regions of the state for outbreaks, unfavorable points and the number of graves of animals killed by anthrax are given. 24955 outbreaks of anthrax have been identified in animals. The epizootic situation on anthrax in Ukraine is complex and tense. Registered about 10 thousand. Diseased items and up to 6 thousand. Mass vaccination of animals significantly reduced the incidence, but still did not completely eliminate the threat of new outbreaks of this infection, the potential possibility of which exists constantly, moreover, in completely new angles of manifestation, in recent years of bioterrorism above all. The results of our research indicate that the occurrence of anthrax is due to the spread of the infectious agent in the soil and the delayed vaccination or its absence. It should be noted that despite the constant presence of the pathogen in the environment, anthrax, as a rule, does not acquire the manifestation of an epizootic, even in areas where there are no preventive vaccinations of animals. Thus, the problem of anthrax and its pathogen as a biological species is still far from being resolved. Both now and in the short term, B. anthracis, actively spreading in the abiotic sphere, represents a potential danger to wild and farm animals, as well as to the population of practically all countries of the world. The presence of foci of the pathogen in the combat zone on the territory of Ukraine in the eastern regions of Ukraine, Donetsk and Lugansk regions actualizes the issue of ensuring people's biosafety. The territory of these areas is uncontrolled, these regions can be considered a risk zone in the occurrence of the disease. To ensure a stable epizootic situation on anthrax, it is necessary to operate with data on the location of permanently unsuccessful locations, as well as the location of the cattle burial grounds. The data on the frequency of occurrence of the disease among different types of farm animals are presented.

Keywords: Anthrax (Anthrax); Epizootology; Monitoring; Analysis; Biosafety

Introduction
For centuries anthrax has been a natural disaster, destroying a huge number of farm animals the economic basis of the state. Human infection results from contact with carcasses of sick animals or animal products (Doganay et al., 2015). The disease has a global distribution, but the incidence of livestock and people varies depending on local ecology, the implementation of control strategies and sociocultural practices that determine the spread of infection from animals to people. (Hugh-Jones, 1999). The disease affects people, often fatal. Despite the fact that in developed countries, the situation with anthrax disease is sufficiently controlled, the disease continues to have devastating global consequences for poor groups of people who depend on small-scale livestock farming in rural areas (Sweeney et al., 2011, Molyneux et al., 2011).

Today in society there is an idea that the anthrax disease has long been eliminated. This contradicts the known data on the biological characteristics of the anthrax pathogen, indicating that the pathogen has survived in the soil for centuries. Once in the soil, under favourable conditions (the ambient temperature is not lower than 12°C), the pathogen forms spores. In the spore form it can be in the soil for an unlimited time, remaining viable and retaining pathogenicity. Spores are resistant to extreme conditions, such as abrupt changes in pH, thermal fluctuations, extreme cold and dry weather conditions, exposure to chemical agents, and so on. In certain environments, with the appearance of favorable conditions for the microorganism, they can remain viable for up to 200 years. Soil contaminated with anthrax spores remains a source of infection for sensitive animals or humans for a time longer than human lifespan (Hugh-Jones, 2002). Prolonged preservation of B. anthracis spores in the environment is a factor in influencing the occurrence of regular outbreaks of the disease. Outbreaks can occur after a long break in time. For example, in Sweden, the disease...
occurred 27 years after the last outbreak (Lewerin et al., 2010). The main source of anthrax is a sick animal, which releases the pathogen into the external environment with urine, feces, milk, and bloody secretions even before the characteristic clinical signs appear.

The scientific literature contains a huge array of information about the subject of our research anthrax. The history of the study, and especially the contribution of domestic scientists to the study of this disease and the fight against it, is still not sufficiently unambiguous, and many of the well-known facts are quite contradictory.

The persistence of anthrax spores and their spread in many regions of the world create prerequisites for the occurrence of epizootics, as well as sporadic and group diseases of people (Bakulov et al., 1971, Bakulov, 2001). There is evidence that the long existence of foci of anthrax infection is provided by the saprophytic reproduction of bacilli in the soil and even in the water of open reservoirs (Bondaryov et al., 2001).

Anthrax is an acute infectious disease, characterized by severe intoxication of the body, fever, septicemia, the occurrence of edema and carbuncles, intestinal lesions, and sometimes lungs. Many species of farm and wild animals, as well as humans, are affected. Anthrax of animals and humans continues to be a serious problem today in many countries of the world, regardless of their level of development.

According to the International Epizootic Bureau (OIE) and the World Health Organization, over the past 15 years, more than 150,000 anthrax outbreaks have been registered in the world. Every year more than 2 million animals die, more than 40,000 people are sick (State Consumer Services Administration of Ukraine, 2019).

On the basis of GU "Ukrainian Research Anti-Plague Institute. I.I. Mechnikov Ministry of Health of Ukraine "annually hosts an event with the support of the US Department of State's Biosecurity Engagement Program (VER-DOS) and the US Civilian Research and Development Foundation (CRDF Global). The program is attended by representatives of the State Food Service, the Ministry of Health of Ukraine, the Ministry of Defence of Ukraine, the National Academy of Agrarian Sciences of Ukraine, research institutions. The subject of discussion at the meeting of specialists in the field of public health and veterinary medicine with international experts is the coverage of problematic issues on the implementation of an integrated approach to the organization of surveillance on priority infectious diseases common to humans and animals (anthrax); interdisciplinary interaction and determining the next steps in the development and implementation of the "One Health" program. The purpose of its implementation is to promote more effective coordination and communication between the health, veterinary medicine, improvement of epidemiological surveillance, response and prevention of outbreaks of zoonotic diseases, including those that may have international significance.

Today, the issue of ensuring biosafety of people, defenders of the border of Ukraine, is particularly relevant because of the fighting in the territory of Donetsk and Lugansk regions. The territory is uncontrolled; this region can be considered a risk zone in the occurrence of the disease. To ensure a stable epizootic situation on anthrax, it is necessary to operate with data on the location of permanently unsuccessful locations, as well as the location of the cattle burial grounds.

The purpose of our study is a retrospective analysis of the epizootic situation of anthrax in Ukraine from 1920-2019.

**Material and methods**

The catalogue of stationary points of concern for anthrax items on the territory of the Ukrainian SSR, 1920-1978. And 1978-2002 (edited by V. Ya. Shabliya), obtained from the State Committee of Veterinary Medicine of Ukraine, as well as data from the State Research Institute for Laboratory Diagnostics and Veterinary-Sanitary Expertise on Anthrax Outbreaks in Ukraine 2000-2019 years.

**Results and discussion**

The constant expansion of the scope of specific immunization of susceptible animals was a decisive reason for the decrease in the incidence of anthrax. In the former USSR over 270 million farm animals were vaccinated against anthrax every year. Mass vaccination of animals significantly reduced the incidence, but still did not fully eliminate the threat of new outbreaks of this infection, the potential possibility of which exists constantly, moreover, in completely new perspectives, such as bioterrorism.

It should be noted that at the beginning of the XXI century the spread of anthrax in Ukraine was not significant. In most cases, sporadic and group diseases of people are caused by a gross violation of the current sanitary and veterinary legislation. The analysis of statistical data on registration of anthrax outbreaks of farm animals and monitoring of disadvantaged items for this disease in Ukraine for the period of 1920-2018. Identified 24,955 anthrax outbreaks in animals (Figure 1). Diseases of anthrax were recorded in all regions of our country. The greatest number of outbreaks was recorded in the period 1920-1970. (Hugh-Jones, 2002). It was then that the veterinary service of Ukraine founded the certification of permanently unsuccessful in terms of anthrax points and burial places for dead farm animals. The study of these data shows that the items are not uniform in the nature of the manifestation of the infection. Of the total number of unfavorable anthrax items, there is one time in 50,2 % of cases, and one-time - in 49,8%. Repeated
outbreaks of the disease appear at different intervals, but the largest number of them (68.0%) were recorded during the first five years after the outbreak of the disease. Within 15 years after the registration of the disease, 98.7% of all repeated cases of anthrax were detected, and after a longer period only 6.3%.

**Figure 1.** The dynamics of anthrax outbreaks from 1920 to 2018.

It should be noted that according to our research for 2013-2015 years no laboratory-confirmed anthrax cases were detected among domestic animals.

**03.23.2016 year**
The Chuguev, Kharkiv region. The allocation of B. anthracis from the pig carcass from the private sector was officially confirmed, the meat from which was used by 17 people, which caused their diseases. In July 2017, in the Sumy region, the pathogen was isolated from two bodies of sheep. The year 2018 also turned out to be unfavorable for anthrax. 02.10.2018 year in the Odessa region, Saransk district, village Menylovka were hospitalized five people diagnosed with anthrax. In this area, anthrax was last recorded in 2000. So, for 99 years, the largest number of the disease was recorded in Vinnitsa (1943 cases) and Odessa (1922 cases) regions, while the smallest anthrax was affected in Volyn (181 outbreaks) and Ivano-Frankivsk regions (241 outbreaks). Over the past 20 years, sporadic cases of the disease have been reported on the territory of our state (Figure 2).

**Figure 2.** The number of unfavorable points for anthrax in the regions of Ukraine for 1999-2019. (According to the State Food Service of Ukraine).
The epizootic situation on anthrax in Ukraine is complex and tense. There are about 10 thousand unfavorable points and up to 6 thousand foci of the causative agent (Figure 3).

Figure 3. The number of disadvantaged items on anthrax for 99 years (image of GIS technology).

For the period 1999-2019
Death from anthrax among animals was recorded mainly in cattle – 71.7%; sheep and goats – 16.4%; pigs – 7.8%; horses – 4.1%. Cases of animal disease have been reported in 24 areas. Human cases of anthrax in 15 regions of Ukraine (Figure 4).

Figure 4. The number of animals with anthrax in Ukraine for 1999-2019 (According to the State Food Service of Ukraine).

Despite the long history of active study of the disease and a huge number of scientific papers on the problem of anthrax, it continues to be in the center of attention of researchers of various professions. This is due both to the socio-economic consequences of the infection and to the insufficient study of various aspects of this biological phenomenon. The results of our research indicate that the occurrence of anthrax is due to the spread of the infectious agent in the soil and the delayed vaccination or its absence. It should be noted that despite the constant presence of the pathogen in the environment, anthrax, as a rule, does not acquire the manifestation of an epizootic, even in areas where there are no preventive vaccinations of animals.
Thus, the problem of anthrax and its pathogen as a biological species is still far from being resolved. And now, *B. anthracis*, actively spreading in the abiotic sphere, representing a potential danger to wild and farm animals, as well as to the population of almost all countries of the world.

Our special interest in the history of anthrax doctrine is also associated with one of the most important issues of modern epidemiology the possibility and potential prospect of using *B. anthracis* as a biological weapon. The study of *B. anthracis* as a possible agent for the construction of biological weapons has a history of almost a century, and in modern conditions the realization of its potential is of great concern. Therefore, to ensure biosafety of the population, it makes sense to develop a strategy for monitoring, forecasting and organizing response measures with the threat of outbreaks (epidemics) of anthrax, and it is also necessary to improve the quality of laboratory diagnostics by introducing modern laboratory technologies for rapid detection (indication) and identification of pathogens.

The remaining issue is the immunization of people in risk areas. In Ukraine, there are no anthrax prophylaxis drugs in military units and veterinary units that introduce quarantine in disadvantaged locations. There are also limitations of vaccination susceptible livestock. Existing vaccine preparations are used in general for cattle, whereas all animals suffer from anthrax. So the question of finding the best option for prevention of anthrax in Ukraine remains open.

### Conclusion

To date, 10,000 disadvantaged locations have been discovered and registered in Ukraine and 6,000 anthrax outbreaks have been installed. Laboratory studies have confirmed that the main source of infection is anthrax-infected animals, among which 71% are cattle. The main tool for the prevention and control of anthrax today is the creation of effective means of immunization and improving the diagnosis of anthrax.

### References


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