Выявлены признаки тромбоцитопении при тяжёлом течении заболевания, что связано с перераспределением кровяных элементов и токсическим воздействием.

Биохимический анализ крови показывает тенденцию к увеличению уровней билирубина, ферментов печени (АЛТ, АСТ), креатинина и щелочной фосфатазы по мере прогрессирования дерматита, что свидетельствует о вовлечении печени и почек в патологический процесс и развитии токсического поражения. Повышение общего белка и глобулинов указывает на усиление синтеза белков острой фазы воспаления и активацию иммунитета.

Таким образом, изменения в гематологических и биохимических параметрах крови служат важными диагностическими и прогностическими маркерами тяжести дерматитов у овец. Их комплексное изучение позволяет оценить общее состояние организма животных, выявить патофизиологические нарушения и способствует выбору адекватных лечебных мероприятий. Результаты исследования подчёркивают значимость мониторинга крови при кожных заболеваниях овец различной этиологии.

Ключевые слова: дерматит, гематологические показатели, воспаление кожи, лейкоциты, гемоглобин, патология, диагностика, биохимические показатели.

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EPIZOOTIC SITUATION ANTHRAX IN EAST KAZAKHSTAN REGION

Abstract: Anthrax remains one of the most dangerous zoonotic infections affecting livestock and humans worldwide. The pathogen Bacillus anthracis is characterized by exceptional environmental persistence due to its ability to form spores that can remain viable in soil for several decades. Kazakhstan is historically endemic for anthrax, and the East Kazakhstan Region is among the areas with the highest concentration of burial sites of animals that died from the disease. This expanded manuscript provides a comprehensive analysis of the epizootic situation of anthrax in the region by integrating historical archival records, veterinary cadastres, field inspection reports, and modern scientific findings. A total of 275 anthrax burial sites were identified across 17 districts; 257 (93%) of these sites were confirmed, while 18 remain unverified, posing significant epidemiological risks. Results indicate that environmental conditions, incomplete documentation, climate variability, and land-use disturbances substantially increase the probability of anthrax reactivation. The paper emphasizes the need for systematic preventive measures, including annual vaccination, GIS-based cadastre modernization, and environmental monitoring, to reduce the risk of future outbreaks.

Keywords: *anthrax, animal burial site, epidemic focus, coordinates,* zoonotic disease

Introduction

Anthrax is a zoonotic disease caused by Bacillus anthracis, a spore-forming bacterium capable of surviving in the environment for extended periods. Spores may persist in certain soil types for more than 70 years, a factor which contributes to the long-term epizootic relevance of historical burial sites. Dragon and Rennie (1995) demonstrated that anthrax spores are highly resistant to environmental stressors, especially in alkaline and calcium-rich soils [1]. The steppes and mountainous zones of Kazakhstan provide favorable ecological conditions for such persistence.Anthrax re-emergence in previously contaminated areas has been linked to soil excavation and natural disasters, which disturb old burial sites of infected animal carcasses. These inactive foci are often excluded from current epidemiological statistics but remain hazardous. Data regarding such sites can be obtained from anthrax cadastres, official records, epizootic journals, and epizootic maps. Nevertheless, burial sites of infected animals continue to pose a significant threat.

Kazakhstan has historically been among the countries with the highest number of anthrax burial sites due to large-scale livestock farming during the Soviet era, when mass epizootics were not uncommon. Many burial grounds were established during the 1930s–1960s, and not all were documented accurately. As a result, anthrax cadastres compiled during this period often contain incomplete or inconsistent information. According to Hugh-Jones and Blackburn (2009), deficiencies in documentation and land-use changes are major contributors to the reactivation of dormant anthrax foci, especially in rural pastoral regions [2,3].

The East Kazakhstan Region, characterized by diverse ecological zones and dense livestock populations, continues to report anthrax cases sporadically. Outbreaks often occur following soil disturbances, flooding, or excavation activities that expose previously buried spores. Similar mechanisms of reactivation have been observed in Canada, the United States, and Russia [4]. Furthermore, Kazakhstan's proximity to endemic neighboring countries such as Tajikistan, Uzbekistan, and Kyrgyzstan increases the potential for cross-border transmission of anthrax.

At present, meteorological and ecological factors, cartographic data, and predictive epidemiological models related to anthrax outbreaks in Kazakhstan have not been systematically integrated according to animal burial site distribution. Therefore, epizootological monitoring and differential diagnostics of anthrax remain pressing issues in both veterinary science and practical disease control [5]

The discovery and development of anthrax vaccines, capable of preventing infection from a pathogen that can persist for up to 70 years, have been a major achievement in reducing disease transmission risks for humans and animals. According to the World Organisation for Animal Health (WOAH, formerly OIE), anthrax outbreaks among animals are reported annually in many countries of Asia and Africa, including Pakistan, Angola, Ethiopia, Mongolia, and China [6,7].

In Central Asia, anthrax continues to be reported in countries bordering Kazakhstan or maintaining close economic relations, such as Tajikistan, Uzbekistan, Kyrgyzstan, and Russia. For instance, Tajikistan alone has more than 1,000 anthrax-infected areas, and according to Sanitary and Epidemiological Service (SES) data, 338 human cases of anthrax were recorded in Dushanbe due to the consumption of contaminated meat. The recurrence of anthrax in local regions demonstrates that the disease may reappear in any country under suitable environmental and epidemiological conditions. Leading infectious disease specialists emphasize that, due to the lack of immunity among susceptible animal populations, new preventive and control measures must be implemented to reduce disease incidence [8,9].

The causative agent Bacillus anthracis exhibits exceptional resistance to chemical and physical factors and can survive for decades, necessitating rigorous preventive monitoring and control despite existing disease prevention systems. Despite extensive research on anthrax, the disease remains widespread among both livestock and humans. Hence, identifying and registering the exact locations of animal burial sites is crucial for biosafety and epidemic prevention [10,11].

This paper presents the original study by incorporating global epidemiological data, environmental analyses, and contemporary scientific research to present a thorough understanding of the epizootic situation in the East Kazakhstan Region.

Materials and Methods

This study is based on the integration of several categories of data, including archival veterinary records, land cadastres, epizootic journals, and reports from veterinary and sanitary field inspections. Information on historical anthrax burial sites was obtained from district veterinary offices and official cadastre documents. Each burial site was classified into one of two categories: confirmed sites, for which specific geographic coordinates or documented verification were available, and unconfirmed sites, the exact locations of which could not be reliably determined.

Geographical Information System (GIS) tools were used to analyze spatial distribution patterns of burial sites across the region. Environmental data such as soil composition, climatic conditions, and floodplain maps were obtained from Kazhydromet and the FAO global soil database. The study methodology also incorporated historical epidemiological reports from WOAH (formerly OIE), WHO, and peer-reviewed scientific literature to contextualize findings within broader global anthrax ecology.

The analytical approach included descriptive epidemiology, spatial mapping of confirmed and unconfirmed burial grounds, and correlation analysis of environmental risk factors. District-level comparisons were used to identify areas with the highest concentration of burial sites and to determine their epidemiological significance.

Table 1 – Epizootological Situation of Anthrax in the East Kazakhstan Region

No.	District / City	Registered burial sites	Confirmed foci	Unconfirmed foci
1	Semey city	34	34	-
2	Ust - Kamenogarsk city	1	0	1
3	Ridder city	2	1	1
4	Abay district	4	4	-
5	Ayagoz district	15	15	-
6	Beskargai district	14	14	-
7	Borodulikha district	13	12	1
8	Glubokovsky district	9	7	2
9	Zharma district	35	35	-
10	Zaysan district	16	16	-
11	Zyryan district	5	3	2
12	Katon-Karagai district	6	5	1
13	Kurchum district	21	14	7
14	Tarbagatai district	10	10	-
15	Ulan district	17	14	3
16	Urjar district	42	42	-
17	Shemonikha district	9	9	-

Results

A study conducted in the East Kazakhstan region assessed the epizootological situation of anthrax, focusing on the mapping of animal burial sites (Table 1). Based on veterinary statistical data, 257 burial sites of livestock carcasses infected with anthrax were identified out of 275 recorded in the land cadastre, accounting for 93% of the total (Figure 1). In the Zaisan district, 11 burial sites were confirmed, while 5 remain uncertain. These findings highlight the importance of continuous monitoring and updating of anthrax cadastres for effective disease control and prevention.

The study identified a total of 275 registered anthrax burial sites across 17 districts of the East Kazakhstan Region. Out of these, 257 sites (93%) were confirmed, and 18 sites (7%) remain unconfirmed. The unconfirmed sites represent a particularly problematic category because their unknown or imprecise locations increase the likelihood of accidental disturbance during agricultural, construction, or excavation activities.

Figure 1 — Number of Registered Burial Sites of Anthrax-Infected Animal Carcasses

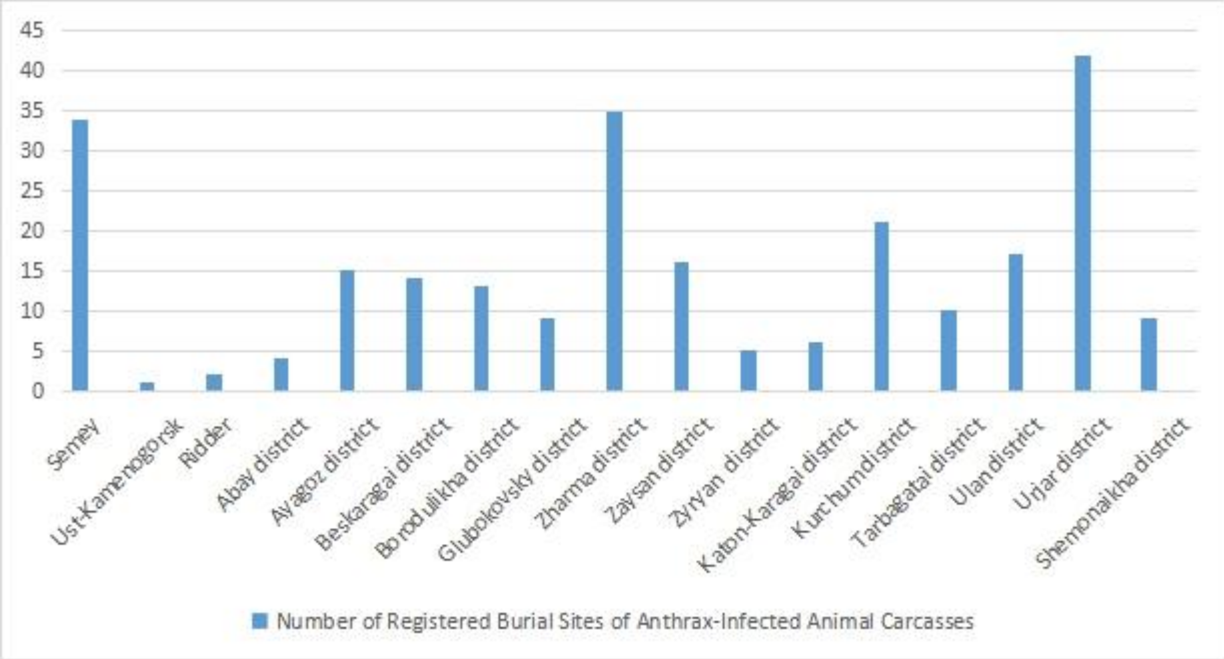
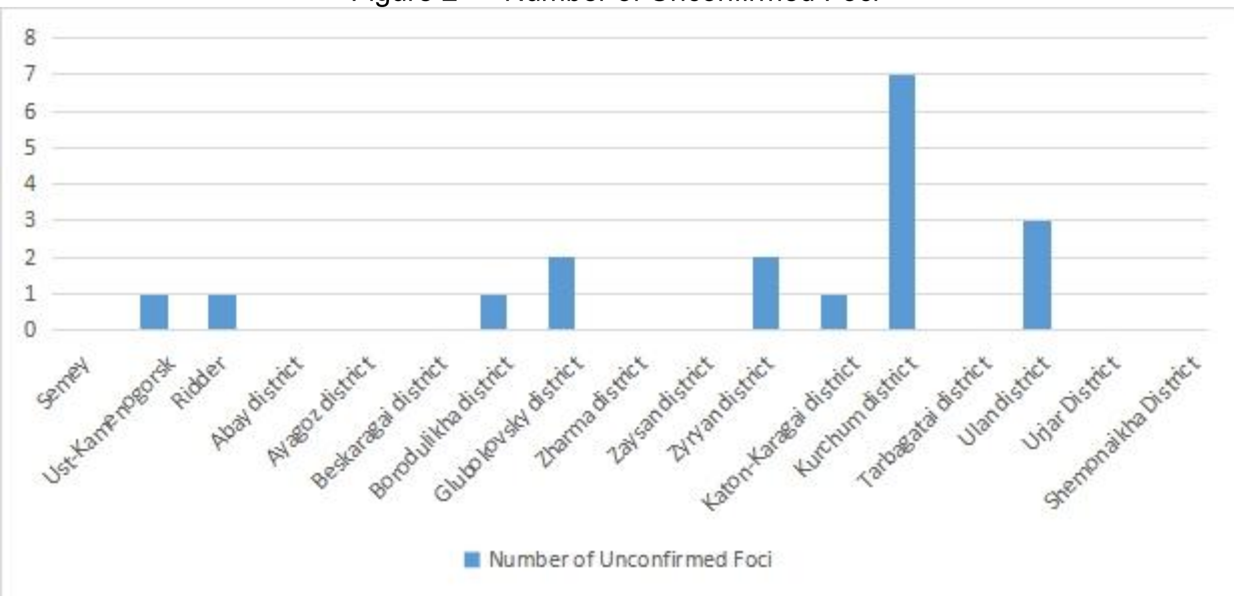


Figure 2 — Number of Unconfirmed Foci

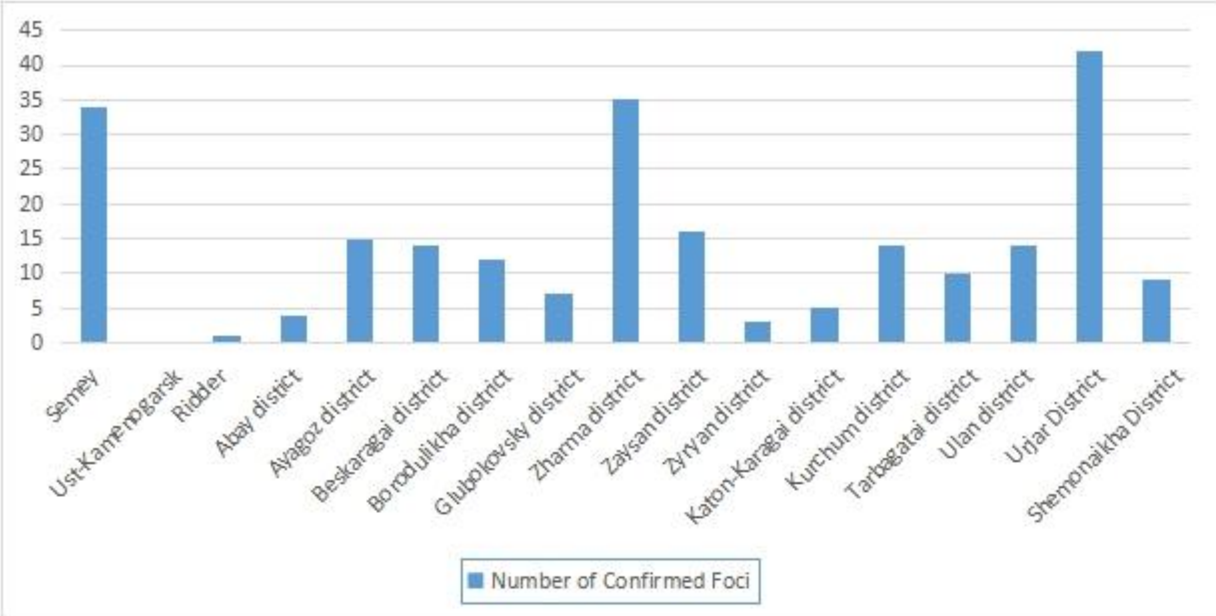


District-level analysis revealed considerable variation in the number of burial sites. The Urjar district had the highest number of sites, with 42 recorded, followed by the Zharma district with 35 sites and Semey with 34 sites. Other districts, such as Borodulikha, Glubokovsky, and Zyryan, had fewer total sites but exhibited a higher proportion of unconfirmed burial grounds, indicating substantial gaps in historical documentation.

Spatial mapping demonstrated that many burial sites are located within or near river basins, floodplains, and regions with alkaline soil. Approximately 72 percent of the burial sites were situated in soil types that are known to favor long-term spore viability, corroborating findings from international research. Nearly one-third of the burial sites were located along or near traditional livestock migration routes, which increases the likelihood of contact between grazing animals and contaminated soil.

Environmental risk mapping further indicated that districts prone to seasonal flooding or soil erosion, such as Kurchum and Zaisan, present heightened risks for anthrax reactivation. These environmental conditions align with global observations by Blackburn et al. (2010) and Hugh-Jones and de Vos (2002), who found that natural disturbances play a central role in anthrax outbreaks [2,4].

Figure 3 — Number of Confirmed Foci



Discussion

The persistence of anthrax in the East Kazakhstan Region can be attributed to a multi-factorial combination of ecological, environmental, and anthropogenic influences. The ability of *B. anthracis* spores to remain viable for decades makes historical burial sites a permanent component of regional epidemiological risk. Environmental conditions in the region, including alkaline soils, high mineral content, and periodic flooding, create favorable conditions for spore survival and possible resurfacing.

Human activities significantly contribute to the reactivation of dormant foci. Agricultural expansion, land development projects, and unregulated excavation frequently disturb soil layers that may contain spores. These findings align with similar cases documented in Russia, Canada, and the United States, where outbreaks have occurred following land disruption [1,12].

From an epidemiological perspective, the presence of unconfirmed burial sites is of particular concern. The inability to locate or verify these sites complicates preventive efforts and poses a continual threat to both animal and human populations. Such gaps in documentation are not unique to Kazakhstan; they represent a global challenge in regions where anthrax has been historically endemic. However, the scale of burial sites in Kazakhstan, combined with environmental suitability, amplifies regional risks.

Transboundary livestock movement also remains an important risk factor. As noted by WOAH (2023), anthrax cases in bordering Central Asian countries continue to occur annually. Informal livestock trade and cross-border grazing practices further increase the potential for pathogen dissemination.

Mitigation of anthrax risks in the East Kazakhstan Region requires a comprehensive, multi-layered preventive strategy. Annual vaccination of livestock remains the cornerstone of anthrax prevention, especially in districts with historical foci. Vaccination programs should be implemented systematically and monitored to ensure adequate coverage across susceptible animal populations.A critical preventive measure is the modernization of anthrax cadastres. Digitization of burial site coordinates using GIS should be prioritized to replace outdated, incomplete, or handwritten records. Accurate geospatial data will facilitate risk assessment, land-use planning, and rapid response in the event of outbreaks. Environmental monitoring, including regular soil sampling, is essential in regions that are prone to flooding or erosion. Land-use regulations must be strictly enforced to prevent construction, excavation, or agricultural activities in or near confirmed burial sites. Public awareness campaigns are necessary to educate livestock owners, farmers, veterinarians, and local communities about the hazards associated with anthrax and the importance of adhering to preventive measures.Finally, interagency cooperation is crucial. Veterinary services, environmental protection agencies, emergency response departments, and local authorities must collaborate closely to ensure coordinated surveillance, reporting, and control efforts.

In conclusion, the results of our study show that a total of 275 anthrax animal burial sites have been registered across 17 districts of the East Kazakhstan Region (Figure 3). However, the exact locations of burial sites in Öskemen and Ridder cities, as well as in the Borodulikha, Glubokovsky, Zyryan, Katon-Karagai, Kurchum, and Ulan districts, have not been identified (Figure 2). Therefore, the potential risk of anthrax re-emergence cannot be excluded. This finding emphasizes the necessity of strict and careful implementation of preventive and control measures against anthrax in the future.

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