

ANNOTATION
of the dissertation by Ainur Zholtaevna Ragatova
on the topic “Comprehensive Study of the Bovine Nodular Dermatitis
Virus Isolated in the Northern Region of Kazakhstan with the Improvement
of Serological Diagnostic Methods”,
submitted for the degree of Doctor of Philosophy (PhD) in
specialty 6D120200 – Veterinary Medicine

1. General characteristics of the work

The dissertation research is devoted to a comprehensive study of the biological properties of the Kazakh strain of the lumpy skin disease virus of cattle Lumpy skin disease KZ-Kostanay-2018, investigation of its pathogenicity, development of diagnostic methods for detecting the virus and antibodies against it, as well as the creation of an enzyme-linked immunosorbent assay (ELISA) test system for laboratory diagnosis of this disease.

2. Relevance of the research topic

Lumpy skin disease (LSD) of cattle is one of the most dangerous transboundary viral infections causing significant economic damage to livestock production. In recent years, the disease has been actively spreading in countries of Asia, the Middle East and Eastern Europe, which poses a serious threat to the epizootic well-being of neighboring states. The expansion of the pathogen’s geographical range and the high susceptibility of cattle necessitate comprehensive studies of the virus, including investigation of its biological properties, pathogenicity, genetic characteristics, and the development of effective diagnostic methods.

Of particular importance is the study of virus strains circulating in the territory of the Republic of Kazakhstan. Isolation and characterization of local strains make it possible to clarify their pathogenic properties, features of interaction with the host organism, and diagnostic characteristics. This is important for improving the veterinary surveillance system and conducting epizootological monitoring.

In this regard, a comprehensive study of the Kazakh strain of the lumpy skin disease virus of cattle Lumpy skin disease KZ-Kostanay-2018, including investigation of its biological properties and pathogenicity, as well as improvement of diagnostic methods for the disease, is a relevant scientific task.

Keywords: lumpy skin disease, cattle, capripoxvirus, virology, diagnostics, enzyme-linked immunosorbent assay.

3. Purpose and objectives of the study

The purpose of the study is a comprehensive investigation of the biological properties and pathogenicity of the Kazakh strain of the lumpy skin disease virus of cattle Lumpy skin disease KZ-Kostanay-2018, as well as the development of diagnostic methods for detecting the virus and antibodies against it.

To achieve this goal, the following objectives were set:

- to isolate and identify the Kazakh strain of the lumpy skin disease virus of cattle;
- to study the biological properties and pathogenicity of the Lumpy skin disease KZ-Kostanay-2018 strain;
- to determine the optimal conditions for virus cultivation in cell culture;
- to develop a method for obtaining a diagnostic antigen of the lumpy skin disease virus of cattle;
- to optimize the conditions for serological reactions used to detect viral antigen;
- to develop an ELISA test system for detecting antibodies to the lumpy skin disease virus of cattle and evaluate its diagnostic efficiency.

4. Object and subject of the research

The object of the research is the lumpy skin disease virus of cattle isolated in the northern region of Kazakhstan.

The subject of the research includes the biological properties, pathogenicity and diagnostic characteristics of this virus strain, as well as laboratory diagnostic methods for lumpy skin disease of cattle.

5. Relationship with research programs and governmental projects

The dissertation research was carried out within the framework of scientific research projects funded by the Ministry of Education and Science of the Republic of Kazakhstan.

The study was conducted in 2021–2023 under the targeted funding program OR11474297 entitled “Biological Safety of the Republic of Kazakhstan: Scientific and Technological Basis for Risk Assessment, Prevention and Elimination.” In addition, the research was implemented within the grant project of the Ministry of Education and Science of the Republic of Kazakhstan AP23490023 entitled “Lumpy skin disease of cattle: vectors, distribution area, public awareness, and genetic characteristics of a recombinant vaccine-like strain circulating in the territory of Kazakhstan.” The research was also carried out within the framework of the scientific and technical program BR249927852 “Organization and implementation of comprehensive research to ensure sustainable development of the agro-industrial complex of Kostanay region with the establishment of a research and technological center” for the period 2024–2026.

6. Methodology and research methods

The dissertation research was conducted at the Research Institute for Biological Safety Problems during the period 2018–2025.

Modern methods of veterinary virology, molecular biology, and serological diagnostics were used in the course of the research.

The research materials included: pathological material obtained from diseased animals; virus culture isolates; cattle blood sera; laboratory animals; cell cultures.

The following methods were applied in the research:

- virus isolation in cell cultures;
- investigation of the cytopathic effect of the virus;
- determination of the biological activity of the virus;

- serological diagnostic methods (agar gel immunodiffusion and complement fixation test);
- enzyme-linked immunosorbent assay (ELISA);
- preparation of diagnostic antigen;
- production of hyperimmune sera;
- immunoglobulin fractionation;
- preparation of immunoperoxidase conjugate.

The obtained results were processed using statistical analysis methods.

7. Scientific novelty

As a result of the conducted research, new scientific data on the biological properties and diagnostic characteristics of the Kazakh strain of the lumpy skin disease virus of cattle Lumpy skin disease KZ-Kostanay-2018 were obtained.

For the first time:

- the Kazakh strain of the lumpy skin disease virus of cattle Lumpy skin disease KZ-Kostanay-2018 was isolated and identified and subsequently deposited in the microorganism collection of the Research Institute for Biological Safety Problems;
- the biological properties and pathogenicity of this virus strain were established;
- the optimal conditions for virus cultivation in cell culture ensuring effective virus accumulation were scientifically substantiated;
- a method for obtaining a diagnostic antigen of the lumpy skin disease virus of cattle was developed;
- the parameters of serological reactions for the detection of viral antigen were scientifically optimized;
- an ELISA test system for detecting antibodies to the lumpy skin disease virus of cattle was developed;
- the possibility of using the developed test system for detecting specific antibodies in animal sera was experimentally confirmed.

8. Practical significance

The practical significance of the study lies in improving laboratory diagnostic methods for lumpy skin disease of cattle.

The developed ELISA test system allows detection of specific antibodies to the lumpy skin disease virus in cattle sera and can be used in veterinary laboratories for disease diagnosis and epizootological monitoring.

The results of the research have been introduced into the practical activities of veterinary organizations and used in the development of recommendations for the diagnosis and prevention of lumpy skin disease of cattle.

In addition, the studied virus strain was deposited in the microorganism collection of the Research Institute for Biological Safety Problems.

9. Main provisions submitted for defense

- the Kazakh strain of the lumpy skin disease virus of cattle Lumpy skin disease KZ-Kostanay-2018 was isolated, identified and deposited in the microorganism collection of the Research Institute for Biological Safety Problems;

- the biological properties and pathogenicity of the Kazakh strain of the lumpy skin disease virus of cattle were established;
- optimal conditions for virus cultivation in cell culture ensuring efficient accumulation of viral material were determined;
- a method for obtaining diagnostic antigen was developed and the conditions for serological reactions used for viral antigen detection were optimized;
- an enzyme-linked immunosorbent assay (ELISA) test system for detecting antibodies to the lumpy skin disease virus of cattle was developed and tested.

10. Main research results (conclusions)

- the Kazakh strain of the lumpy skin disease virus of cattle Lumpy skin disease KZ-Kostanay-2018 was isolated and its biological properties were studied;
- it was established that the most effective system for virus cultivation is the lamb testicle (LT) cell culture;
- optimal conditions for virus cultivation providing a high level of virus accumulation were determined;
- a method for obtaining diagnostic antigen of the lumpy skin disease virus of cattle was developed;
- an ELISA test system enabling the detection of specific antibodies to the lumpy skin disease virus of cattle was developed;
- it was demonstrated that the developed test system has high diagnostic efficiency and can be used for laboratory diagnosis of the disease.

11. Reliability and validity of the obtained results

The reliability of the obtained results is ensured by the use of modern methods of veterinary virology, serological diagnostics and biotechnology, as well as by conducting experimental studies in accordance with generally accepted scientific methodologies.

All studies were carried out in specialized laboratories of the Research Institute for Biological Safety Problems using standardized virological and immunological research protocols.

Experimental data were obtained using a sufficient amount of biological material. The results were repeatedly reproduced and subjected to statistical analysis. The obtained findings are consistent with data reported in national and international studies in the field of veterinary virology.

12. Publications based on the main results

A total of **13 scientific publications** have been published based on the results of the dissertation research. Among them: 3 articles published in journals recommended by the Committee for Quality Assurance in Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan; 3 publications in the proceedings of international scientific conferences; 2 articles published in journals indexed in the Scopus database with percentile above 30 (<https://doi.org/10.3390/pathogens14060577>); <https://doi.org/10.47278/journal.ijvs/2025.044>); 1 patent for invention; 4 articles published in other scientific journals.

13. Approbation of research results

The main results of the research were presented and discussed at international scientific and practical conferences: Application of Innovations in Veterinary Science Development, Baku, 2019; Science and Education in the Modern World: Challenges of the XXI Century, Nur-Sultan, 2019; Modern Approaches to the Prevention of the Most Common Infectious and Invasive Diseases of Farm Animals, Dushanbe, 2021.

14. Personal contribution of the doctoral student

The personal contribution of the doctoral student includes formulation of the research objectives and tasks, conducting experimental work, analysis and interpretation of the obtained results.

The author personally carried out studies on the isolation and cultivation of the lumpy skin disease virus strain, investigation of its biological properties and pathogenicity, preparation of diagnostic antigen, and development and optimization of parameters of the enzyme-linked immunosorbent assay.

The doctoral student also participated in the processing and analysis of experimental data, preparation of scientific publications and presentation of research results.

15. Volume and structure of the dissertation

The dissertation is presented in printed form and consists of 115 pages.

The work includes the following sections: introduction, literature review, research results, discussion of results, conclusion, practical recommendations, list of references and appendices. The dissertation contains 29 tables, 11 figures, and 177 references.

16. Main results of the study

As a result of the conducted research, the following main scientific results were obtained:

- the Kazakh strain of the lumpy skin disease virus of cattle Lumpy skin disease KZ-Kostanay-2018 was isolated, identified and deposited in the microorganism collection of the Research Institute for Biological Safety Problems;
- the biological properties and pathogenicity of the studied strain were investigated and its ability to cause typical clinical manifestations of the disease was confirmed;
- optimal conditions for virus cultivation in cell culture ensuring efficient virus accumulation were established;
- a method for obtaining diagnostic antigen of the lumpy skin disease virus of cattle was developed and the parameters of serological reactions for antigen detection were optimized;
- an ELISA test system for detecting antibodies to the lumpy skin disease virus of cattle was developed;
- the high diagnostic efficiency of the developed test system was demonstrated, and its applicability for laboratory diagnosis of lumpy skin disease of cattle was confirmed.