

Review

on a dissertation work for awarding the educational and scientific degree "Doctor", Field of higher education 4. Natural sciences, mathematics and informatics, Professional field 4.4. Earth Sciences, Scientific Specialty "Economic and Social Geography"

Author of the dissertation: Katrin Evgenieva Gotsova, PhD student at the Department of "Regional and Political Geography" at the Faculty of Geology and Geography of the Sofia University "St. Kliment Ohridski".

Topic of the dissertation: "Regional analysis of the spread of infectious diseases among farm animals in the southern border territories of Bulgaria", with scientific supervisor Assoc. Prof. Kosyo Stoychev.

Prepared the review: Assoc. Prof. Roman Pepovich, University of Forestry, Faculty of Veterinary Medicine, scientific specialty "Epizootology, infectious diseases and prevention of infectious diseases in animals", appointed as a member of the Scientific Jury according to Order № RD-38-70 / 07.02.2023 of the Rector of the Sofia University "St. Kliment Ohridski".

BRIEF BIOGRAPHICAL DATA ON THE PHD STUDENT

Katrin Evgenieva Gotsova was born on 14.04.1993 in the city of Sofia. In 2012, she graduated from the National Science and Mathematics High School "Acad. L. Chakalov", Sofia. In the period 2012-2018, she studied at the Faculty of Veterinary Medicine at the University of Forestry and graduated with a Master's degree in "Veterinary Medicine". After that, she worked as a veterinarian in "101 Lyubimtsi" Veterinary Clinic, Sofia. From 01.02.2019 to 01.02.2022 she is a PhD student. She was permitted with the right of defense by order RD 20-446 / 17.02.2022 of the Rector of Sofia University "St. Kliment Ohridski". She participated in various specialized courses and trainings in the field of geographic information system and veterinary medicine, as well as in two scientific conferences in 2021. She speaks English (level B1) and has skills in working with various computer programs.

GENERAL CHARACTERISTICS OF THE DISSERTATION

The dissertation is written on 212 pages and illustrated with 13 tables, 43 figures and 4 appendices. The literature review covers a total of 110 titles, of which 13 are in Cyrillic and 97 are in Latin. Of these, 49.1% are from the last 10 years. Additionally, 16 internet sources are attached.

The dissertation contains the necessary sections according to the generally accepted requirements: introduction, which includes the relevance of the topic, object and subject of the research, objective, five tasks, used methods, information provision, three chapters, conclusion, bibliography and appendices. This description of the included

sections shows that the dissertation is structured correctly and appropriately, with an adequate ratio between the sections.

In 2007, the EU approved a new strategy to improve preventive and control measures in the animal health system, entitled: "Prevention is better than cure". It outlined the framework in which the measures applied by the EU member states extend in terms of health care, protection and animal welfare. Since the eradication of epizootics is an expensive undertaking that raises a number of ethical questions related to the mass killing of animals, the emphasis of this new policy is placed on preventive measures, such as surveillance and biosecurity measures, aimed at reducing the risk of occurrence and further spread of epizootics than the elimination of their consequences. Globalization in the economy, climate change, intensive movement of people, commodities and animals are factors that contribute to the spread of animal diseases and, at the same time, make it difficult to control them. Therefore, the importance of animal healthcare is becoming increasingly important because it is no longer perceived as an independent system, but as part of an integrated system for the protection of human health on one hand, and on the other hand because of the economic damage caused by various infectious diseases. All this gives me reason to conclude that the selected research topic is relevant, contemporary and significant.

The object of the study is the territorial diffusion of three infectious animal diseases of viral etiology (African swine fever, Lumpy skin disease and Bluetongue in ruminants), which exert socio-economic pressure on our country.

The subject of the study are the conditions of spread that affect the characteristics of pathogens, hosts and the environment, as well as their interrelationship with the spread of infectious diseases in animals. It is known that the same disease can progress differently over time if there is a change in any of the above-mentioned determinants.

The purpose of the dissertation is clearly and correctly formulated. It provides for a regional analysis of the spread of infectious diseases among farm animals in the country and to study the factors that influence the diffusion of infectious diseases and their territorial distribution. Five scientific tasks have been formulated that are suitable and sufficient for realizing the purpose of the dissertation work. Different methods and approaches were used in the research. The complex, spatial and systemic approaches, as well as the historical approach, are strongly advocated. General scientific and private methods are applied, such as comparative analysis, causality analysis, descriptive statistical methods, multiplier method, deductive and inductive method of analysis.

The first chapter examines the processes of formation and development of medical geography, as a science that unites the knowledge, methods and approaches of geography and medicine. In order to carry out efficient prevention and fight against epizootics, it is necessary to know very well their nature, the conditions under which they occur, the ways of their spread, as well as the factors having a direct or indirect influence on their progress. Medical geography studies these regularities in all living beings and on the territory of the entire planet. Veterinary geography is directly related to medical

geography, as it uses its concepts, has the same tasks and goals. It seeks to discover causal relationships between animal diseases and environmental factors. The emergence of epidemics in humans and animals lead to biological, economic and social catastrophes, the fight against which is possible through the use of the scientific-theoretical basis of medical geography. The main terms that medical geography considers is disease, health and their location in space. In this regard, nuanced differences of these definitions are presented and an attempt is made for one's own interpretation. Other terms related to medical geography and epizootology are also examined chronologically. It would be good to make a better distinction between forms when describing the clinical manifestation of infectious diseases. There is overt and covert (subclinical) infection. There are two types of overt infection: typical and atypical infection, the latter of which can develop into an abortive or malignant form. Covert infection, on the other hand, can occur as a latent and inapparent infection. I am left with the impression that the PhD student does not differentiate between the applied restrictive measures - quarantine and isolation. The qualitative and quantitative characteristics of the epizootic process are presented, but there is a lack of proper understanding of the endemicity of the disease. Of particular importance for the success in the prevention and fight against infectious diseases in animals is the categorization of territories in terms of their well-being and degree of risk of penetration and spread of a given disease through regionalization. I believe that the thesis would have a higher scientific value if it also describes the concept of compartmentalization, which introduces new "risk boundaries" instead of the geographic or administrative boundaries used so far.

The second chapter is dedicated to factors and conditions for the spread of diseases among farm animals. The chapter is well structured and written in an academic and at the same time comprehensible language, which allows it to be used by both researchers and practicing veterinarians. PhD student Gotsova's excellent knowledge of mathematical models, which serve to study how the real system functions, how its individual components interact with each other and how a given situation can develop with different types of interventions, makes a good impression. The three units of the epidemic process (host, pathogen and environment) that interact are characterized in detail. Disruption of transmission mechanisms and connections between the three units results in termination of the disease. One of the main tasks of epizootology is to support the prevention and fight against animal diseases, by revealing the causes of their occurrence and the ways in which they can be prevented. Therefore, a correct understanding of the causes of a disease is important in the field of animal health, not only in terms of prevention, but also in terms of diagnosis and the application of correct approaches of treatment. A cause can be defined as sufficient when it inevitably induces a disease and as necessary if a disease cannot develop in its absence. The stages in the course of the epizootic process, as well as the influence of climate-meteorological conditions on its main driving forces, responsible for the seasonal manifestation of infectious diseases, are examined. The phenomenon of periodicity of epizootics becomes clear that it is related to the created immune response in the recovered animals, its gradual weakening and the appearance of new animals. The chapter ends with formulated conclusions.

The third chapter in the dissertation is "Analysis and trends of the geographical distribution of selected infectious diseases in farm animals" and begins with section 3.1. "African swine fever". It provides a general overview of the disease, describing the clinical and epidemiological features of the infection in detail. Regarding the characterization of the viral pathogen, I believe that it is insufficient. The virus has 24 genotypes, and the strains also differ in their virulence, which is related to the course and territorial diffusion of the disease. It is fair to note that the first entry of ASFV into Europe in 1957 in Portugal was associated with genotype I, while the second outbreak in 2007 in Georgia was identified genotype II. In the current section, the territorial distribution of ASF on a global and national scale within two populations - domestic and wild pigs - is examined in detail. The first case of ASF in Bulgaria was registered in August 2018 in the village of Tutrakantsi, Varna region in a backyard type farm, and the typed virus belongs to genotype II (GII, CVR1 IGR2, MGF1). A characteristic manifestation of the spread of the disease are the large "geographic jumps" of the virus. In 2019, the disease also affected 5 industrial farms in the regions of Ruse, Silistra and Veliko Tarnovo, thus making the North Central region the region with the most cases in domestic pigs to date. When examining the situation with wild pigs, the epizootological role of one of our autochthonous pig breeds - the Eastern Balkan pig, which is bred only in the regions of Burgas, Varna and Shumen - was not taken into account. In my opinion, it was possible to analyze the measures taken in the Czech Republic, which managed to limit the disease only in wild boars and thanks to these measures managed to eradicate the disease in a short period of time, as a result of which the European Commission on 12.03.2019. recognized it as a country free from ASF. All this shows that ASF has different faces, but it seems that the cause is the same - the Anthropogenic factor! The next section of this chapter is dedicated to Lumpy Skin Disease (LSD). The disease mainly affects cattle and causes serious economic consequences related to the imposed restrictions on the trade in animals and animal products, as well as the killing of the animals. Transmission of the virus occurs through various mechanical and biological vectors, but can also occur through direct and indirect contact. In the late 1980s, the disease spread outside the African continent, primarily in the Middle East. The PhD student makes a detailed analysis of the rapid spread of the disease affecting new territories. The infection was detected in our country at the beginning of April 2016. I accept as correct the reasoning of the PhD student regarding the rapid spread of infection in the country affecting more than half of the districts, despite the undertaken large-scale emergency vaccination with a live homologous attenuated vaccine, as the main anti-epidemic measure against the disease. In the end, this made it possible to interrupt the epidemic process, and after July 2016, a sharp decrease in the newly appeared outbreaks was observed in the affected regions, leading to the complete cessation of the epidemic. In our country, general vaccination against LSD has been carried out for 7 years, and given the current epidemiological situation, its termination is being discussed, with the implementation of an appropriate program for active and passive surveillance of the disease. We must be very careful with this disease, because in early 2023 a scientific publication noted the zoonotic potential of the virus in Cairo, Egypt. In the last section of this chapter Bluetongue in ruminants is viewed. Information on the etiological agent is presented and the characteristics of the

disease are described in detail. The epidemiological situation in the world and in Bulgaria regarding the disease is very well examined and an answer is given for the prevalence of the individual serotypes of the virus. Whether Bluetongue virus (BTV) will become established in a new area depends on the number and prevalence of susceptible hosts, the duration of viremia and virus titer in the hosts, the vectorial capacity of the local vector population, and environmental temperature. More attention should have been paid to whether BTV is able to survive between epidemic seasons. Data on the circulation of BTV show that epizootic strains of BTV-4, after the 2014-2016 epizootic break, remained circulating in certain regions of Europe and, through the vectors, were able to "hibernate", to persist in the inter-epidemic periods and continue to circulate by spreading to new territories. A key point is the increase in transplacental transmission of the newly emerged strain of BTV-8 in cattle, which is of interest as a possible mechanism for "hibernation" of the virus in the absence of culicoid vector activity during the winter months in northern Europe.

The **CONCLUSION** is structured, contains an in-depth interpretation of the data from the conducted studies, which shows the high awareness of the PhD student on the topic of the dissertation work.

The **ABSTRACT** for the dissertation is 38 pages long, prepared according to the requirements and reflects the main results achieved in the dissertation.

I accept the formulated **scientific contributions** of the dissertation.

DISSERTATION-RELATED PUBLICATIONS: Two independent publications on the subject of the dissertation are presented, which is evidence of the PhD student's personal involvement in the conducted research, which are part of the developed dissertation work.

CONCLUSION

The dissertation work contains scientific and scientific-applied results, which represent an original contribution to science and meet all the requirements of the Law on the development of the academic staff in the Republic of Bulgaria and other normative acts. The candidate has in-depth theoretical knowledge and professional skills, demonstrating qualities and skills for independent conduct of scientific research. All this gives me the reason to give my positive vote and to propose to the honorable scientific jury to award the educational and scientific degree "DOCTOR" to Katrin Evgenieva Gotsova in Professional field 4.4. Earth Sciences, Scientific specialty "Economic and Social Geography".

Sofia, 24.04.2023

Reviewer:

/ Assoc. Prof. Roman Pepovich /