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# DIGITAL PLATFORM FOR EARLY WARNING OF THE RISKS OF ZOONOTIC DISEASES IN THE BORDER AREAS OF EASTERN EUROPE

Biosecurity is a complex of scientific knowledge, technologies and management solutions aimed at ensuring the safety of life. It should be seen as a reflection of society to strengthen the will to control the quality of life and sustainable development [1, 2].

In early 2020, the COVID-19 pandemic spread across the world, resulting in the systematic closure of national borders. In Europe, the new reality has led to serious setbacks in the lives of some two million citizens who cross national borders daily to work in neighboring countries. At the first stage, covidfencing process provoked a sharp decline in cross-border cooperation and the abandonment of traditional methods of interaction across friendly integrated borders. The cross-border areas of Europe have been subjected this year to a real test for the vitality of territorial and social cohesion [3]. Covidfencing has highlighted the need to improve cross-border cooperation (CBC) in order to mitigate cross-border barriers and strengthen the European integration processes simultaneously at the social, economic, physical and institutional levels [4].

The issue of Covid-19 should be further considered in the broader biosecurity context as pandemic risks. In this case, the risks of zoonotic diseases in border areas turn out to be closely related to food security issues, as well as to the growing intensity of cross-border flows of goods, services and people.

One of these threats is African swine fever (hereinafter - ASF), the outbreaks of which have led to significant damage in the countries of the former USSR. Countries directly bordering the Russian Federation, especially Ukraine, as well as the Republic of Moldova, Latvia and Poland are most vulnerable to the introduction and endemic establishment of ASF, mainly because the biosecurity of their pig production is predominantly low. Preventing the spread of ASF in Ukraine is especially important for the entire pig sector in Europe. Given the alarming developments in the Russian Federation, European countries must be on the lookout. They must be prepared to prevent and effectively respond to ASF drifts on their territory for many years [5].

The Standing Group of Experts on African swine fever in Europe (hereinafter referred to as "SGE ASF") was established in 2014 under the auspices of the GF-TADs[1]. It aims to forge closer cooperation between countries affected by African swine fever (ASF), and thus a more joint and coordinated fight against this disease across Europe.

A particular danger for European countries is posed by outbreaks of ASF in wild boars, associated, inter alia, with the influence of human economic activity and invasion of their natural habitat.

There is a need to create at the regional and local levels digital systems for calculating the likelihood of especially dangerous zoonotic infections, due not only to large economic losses, but also to the threat of pandemics causing irreparable economic and psychological damage.

Based on the analysis of all the necessary information resources, including the Orthomosaics (Orthophoto Maps) obtained with the help of the unmanned aerial

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[1]The Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs) was launched on May 24, 2004, the signing date of the "FAO-OIE GF-TADs general agreement"

systems (hereinafter, UAS) and a set of created thematic maps, a digital decision support system was developed [6].

To create a database of a digital system for calculating the probability of the occurrence of especially dangerous infections (using the example of ASF), databases of an epizootic situation management system were formed to ensure the visualization of epizootic situations, taking into account possible spatial-temporal transmission links in the epizootic chain from the focus of infection to susceptible individuals located in zone of occurrence and spread of infection. An algorithm for the operation of the system was also developed and implemented, including an algorithm for automated calculation of the probability of transmission of infection and its testing on the model of the emergence of an ASF focus in the region with the creation of an epizootic map for ASF.

An interactive electronic map contains sets of geo objects linked by functional links. These geo-objects are potentially involved as possible transmitters in the spread of ASF infection. The following types of geo objects are selected:

- Pig breeding enterprises, divided into groups, which include enterprises belonging to the same agricultural holding.
- Meat processing enterprises receiving live pigs, pig meat from the pig breeding enterprises.
- Concentric areas around pig breeding enterprises, denoting zones of potential threat of 1 and 2 classes (zone of potential threat of 1 class - ASF occurred in the current or last year; area of potential threat of class 2 - ASF occurred in the year "current year minus 2 years" and "current year minus 3 years").
- Water bodies located in zones of potential threat of both classes (1 and 2).
- Water intake stations providing water delivery for pig farms.
- Fields of arable land located in zones of potential threat of 1 and 2 classes, where agricultural crops (corn, cereals) are grown, which are the main fodder base for wild boars and fields of arable land, where liquid organic fertilizers are exported from pig lagoons enterprises (potential reservoirs of biomaterials including ASF virus).

- Watercourses from the fields of arable land located in the zones of potential threat of classes 1 and 2, from where liquid organic fertilizers can drain into river beds. The watercourse map is generated using data from unmanned aerial systems.
- Settlements located in the zones of potential threat of 1 and 2 classes.
- Places of exit of wild boars and their resting places in the fields identified in the zones of potential threat of classes 1 and 2.
- Posts of veterinary control with disinfection barriers.

On the basis of this Digital system, at the first stage, the most grounded and objective picture of real threats from the natural source of the causative agent of the infection, the mechanisms and factors of its transmission is formed.

At the second stage, using the database of the Digital system for calculating the probability of the occurrence of especially dangerous infections, the probability of transmission of infection from a threatened pig breeding enterprise (zones of potential threat of the first and second classes) to other pig breeding enterprises is calculated based on the account of the mechanisms and factors of the spread of ASF.

The visualization of epizootic situations and the decisions made are formed in the mode of spatial-temporal analysis of the initial data with the subsequent display of the results on an interactive electronic map of potential threats to the spread of African swine fever.

Such a Digital system is most important for cross-border areas in Eastern Europe, linked to existing instruments of cross-border cooperation - EGTC.

The first step in the implementation of this Digital system should be a joint pilot project based on the Kosice platform, created in 2019. At the second stage, it is necessary to expand the expert group and the geography of this cooperation program with the subsequent implementation of the Digital platform in the Pan-European AEBR B-solutions project with the addition of the Territorial Impact Assessment block [7]. This will increase the resilience of cross-border areas for their successful development in the Post-2020 European cohesion programs.

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