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MODERN SUDDEN APPEARANCE OF AFRICAN SWINE FEVER (ASF) AS A POSSIBLE MEANS FOR BIOLOGICAL DIVERSITY AGAINST UKRAINE DURING THE PERIOD OF MILITARY AGGRESSION IN THE EAST

M. Romanov[1], O. Kovaliuk[2], M. Velychko[3], Y. Goncharuk[4]
[1]National Univtrsity Ostroq Akademie, Ostroq, Ukraine
[2]Security Service of Ukraine, Kyiv, Ukraine
[3]National Academy of the Security Service of Ukraine, Kyiv, Ukraine
[4]Higer State Education Establishment of Ukraine "Bukovinian State Medical University", Chernivtsi, Ukraine

ABSTRACT. *The purpose of the research carried out by the authors is to establish the causes for the appearance of the African swine fever (ASF) virus on the territory of Ukraine and the mechanisms of its most widespread distribution. In this case, special significance was granted to studying the role of an anthropogenic factor in the context of a confirmation or denial of a possible diversion by the country-aggressor under the existing conditions of aggression against Ukraine. Attention was also paid to a prediction of the long-term spreading of the pathogen along with the development of recommendations for the implementation of preventive measures based on international experience of those struggling against ASF for the purpose of counteracting the threat posed by its biological character and how this would then affect national security and the extent of economic losses to the state.*

Key Words: *biological diversion; African Swine Fever (AFS); source of AFS infections; ASF agents.*

Introduction. Biological diversion is a deliberate criminal activity of human, corporate, political and religious groups of people, and aggressor states designed to inflict economic damage on a person, a group of people or another state. Both dangerous naturally existing and artificially created biological objects or the products or their vital functions and the products received from them and plants, as well as the application of biologically harmful hazardous agents to human health, are used for deprivation of life [1]. It might lead to economic damage of a country, create an atmosphere of social tension, undermine faith in the leadership of the state and its actions and create thereby favorable preconditions for its capture or the bringing to power of a puppet-useful regime. On the other hand, this might lead to the obtaining of financial supremacy by the leading biotechnology companies of a country-aggressor.

Biological diversion unlike biological terrorism is not only carried out secretly at the stage of its conduction, but most worrisome, it can be concealed into the future. The magnitude of such criminal activities sharply increases during the prewar and war periods. The facts of biological diversion themselves are a violation of both international and national laws of the state against which the hostile activities are being carried out. Biological saboteurs, against whom such accusations are made internationally, deny the charges and carefully mask and hide the traces of their involvement.

Methods. The methods of the research were chosen after considering the topic, purpose and tasks of the research. The positions of axiology, ontology, general theory of cognition, theory of social relations, statistics, information etc. are the basis of the research.

The results of the investigation into the origin and spreading of the diseases on the territory of our state, especially the dangerous infectious animal disease of ASF prepared by the State Service of Ukraine for Food Safety and

Consumer Protection during four years of study have been summarized and analyzed. An analytical review of scientific publications from the abstract database of scientific libraries and text database of veterinary publications from domestic and foreign internet resources has been conducted.

Discussion. Ken Foster, a Professor of Economics and Agriculture at Purdue University believes that the damage from the actions of biological saboteurs in this sphere can be much more harmful then regular epidemias, since the terrorists are able to choose the most vulnerable places in the system of state control of biosecurity and strike in several places simultaneously at a moment they find most favorable for themselves. The damage caused by biological diversion, in his opinion, depends directly on the time needed for detecting the problem: the longer the epidemia develops, the more difficult it will be to stop it from spreading and the greater will be the damage caused by it [2].

ASF is included in the list of the most probable biological objects that can be used in biological diversions.

African swine fever (AFS, African fever, East-African plaque, Montgomery disease) is a highly contagious, anthropozoonous transmissible virus disease of domestic and wild pigs that manifests itself as a fever, cyanosis of the skin and extensive hemorrhages of the internal organs. The danger of ASF primarily consists in lack of effective medicines for its prophylaxis, as the only means to control the disease is the execution of quarantine and burning and stamping out of the infected pigs in the endemic zone.

Etiology. Pathogen of the disease and its characteristics. The ASF virus is a big and complex DNA-containing pathogen, the genome of which is represented by a linear double-stranded DNA. Virions have a spherical form, and their diameter is 175-215 nm. They have an external lipoprotein shell. The ASF virus is taxonomically referred to the individual Asfarviridae group and is the only one of its kind in the Asfivirus group. This pathogen is the only DNA-containing virus of this type among more than 700 known human and animal DNA-viruses that belong s to arboviruses. There exists only one serotype of ASF, while twenty-two its genotypes are known.

The ASF virus of the second genotype, the highly virulent genotype from Mozambique and Madagascar, has spread to the countries of the Caucasus and Russia. The various strains of ASF virus differ in virulence and have different capabilities to bring about disease in pigs. The population of this pathogen is heterogeneous and consists of clones that differ in hemadsorption, virulence, infectiousness, plaque formation and antigenic properties. The antibodies precipitating and binding the complement and delaying hemadsorption appear in the blood serum of the pigs-reconvalescents, so that the neutralizing anti-bodies are not formed. This is connected to the inability of the ASF virus to induce their creation. The absence of virus-neutralizing bodies within the infected organism brings about the inability to bind, neutralize and remove the ASF virus [3, 4].

This pathogen is very stable and remains infectious for a long time at a wide range of pH and temperatures, easily survives in drying, freezing-defrosting processes and even in the rotting of the host. It remains viable in the feces and blood of the diseased animals in the soil for a long time; in corpses of the pigs, and is only inactivated after two months. In faeces, it remains viable for 16 days, and in the soil for up to 190 days [5].

In the environment not containing serum, the virus inactivates at pH below 3.9 or above 11.5, and in the objects rich in protein the virus is stable in a wider range of pH (1.9-13.4) [4].

The pathogen can remain viable in corpses up to ten weeks and in the meat of dead animals and smoked foods – 5 months and more. The virus can maintain its vitality for seven weeks in rotten blood; for five weeks in meat with bones kept at a temperature of 4 °C; for up to 140 days in salt dried meat, and from three to six months in ham and sausages produced without high temperature processing.

All species of the swine family are susceptible to the ASF virus (Suide). The most vulnerable are domesticated pigs of all species and age groups, and the European wild boar. They can all become infected, and with the advent of clinical signs die shortly. The natural progenitors of the virus are African wild pigs: Warthogs, Bushpig and Giant forest hogs. The diseases of these African wild pigs are usually asymptomatic, but these species can be the carriers and reservoirs of the aramivirus. The other species are invulnerable to the pathogen of the ASF [6].

The ASF virus can also infect the mild mites of the species Ornithodoros. This pathogen is replicated in the mites' of the Ornithodorosmoubata

organism in Africa and in the Ornithodoroserraticus on the Iberian Peninsula in Europe, and can be transmitted from them to pigs during biting. The mites of these species live in the burrows of the wild pigs forming natural sources of infection and providing thereby the means for the long-term preservation of the ASF virus. Thereby making them biological vectors of the virus. It is believed that this pathogen originates in the virus of mites, which are its primary holders whereas the wild and domestic pigs are the random recipients of it [3, 4, 7].

The clinical signs of the disease and the resultant mortality among the animals have been reported only with participation of the domestic pigs in this cycle. The source of the ASF infection is mites and sick and sickly pigs.

Virulence in some animals lasts up to two years and more. The pathogen is excreted from the organism of the infected animals with blood during nose bleeding, feces, urine, and saliva and by the secretions from the mucous membranes of the nasal cavity. Animals are predominantly infected oronasically when eating infected contaminated feeds. Infection can also be induced by the respiratory system or through the bites of the infected argas mites of the species Ornithodoros, the carriers and holders of the ASF pathogen for many years. The infection occurs asymptomatically among wild pigs (Warthogs, Bush pigs). These animals are the main reservoirs of the virus in the zones of permanent distress [5,6].

The pathogen is spread by the infected animals, including those at the stage of the incubation period, and by the various infected objects. Especially dangerous are the products of infected slaughtered pigs (meat, meat products, fat, blood, bones, skin etc.). Pork products infected with the virus that were prepared without careful and proper boiling are mostly the cause of ASF infections in developing countries. Healthy animals are infected during their joint maintenance with sick animals and virus holders, and during their stay in contaminated facilities and transport. Mechanically, the virus can be spread by people, various species of domestic animals, insects, and rodents that were in the epizootic cell or in the territory infected by the virus (slaughterhouses, warehouses etc.). The usual way of bringing the ASF virus from or into the disadvantaged territories is feeding the pigs with the food wastes coming by air of sea transport from the infected with the ASF virus territories.

The disease is mainly being spread by means of direct contact between the infected and healthy animals. After the infection, during the incubation period, the pigs become virus carriers thereby playing an important role in the infection process.

ASF is a hemorrhagic disease that manifests itself in various clinical features depending on the form of the course (extra cranial, acute, subacute, chronic forms, and asymptomatic infection). The severity of the symptoms is determined by the virulence of the virus strain and the type of the species pigs. The acute disease is characterized with high fever, hemorrhages and high lethality. The soft mites of the Ornithodoros species (O. moubata & O. erraticus) can be reservoirs and carriers of the ASF virus [3, 5, 8].

ASF is one of the most devastating virus diseases endangering the pig population in the whole world. The virus brings about high rates if morbidity and mortality of the animals. This is due to the large amount of the virus being released by the secretions and excreta of the infected pigs; extremely high resistance of the pathogen to the factors of the external environment; lack of a vaccine for ensuring protection of the vulnerable pig population. This results in huge economic losses and significant social and economic consequences in the infected countries for industrial pig breeding and people connected to the industry and also puts at risk the food security of the nation.

The emergence of the ASF outside of the epidemic zone is a catastrophe for the pig breeding industry, since even in the primary centers of infection we can observe a high lethality of pigs; a total ban on the export of pigs and pork products; this is accompanied by enormous costs for the containment and elimination of the infection along with losses in the field of agricultural communications and tourism. That is why the ASF belongs to transboundary animal diseases and is a subject to notification in the OIE [3, 5].

The highly virulent strains of the ASF virus cause acute disease among domestic pigs. The over acute form manifests itself in the sudden death of the animals in the absence of any clinical signs and lesions. The acute form can be characterized by a high fever, refusal of food consumption, weakness, appearance of hyperemia and cyanosis of skin, especially at the tips of the ears, neck, lower parts of extremities and abdomen. The sick animals are reported with vomiting,

appearance of constipation replaced with diarrhea – mucous and bloody, and in the form of generalized hemorrhages on the skin and the internal organs. The animals of all age groups can be infected, and the abortions are possible for the sows. The disease spreads rapidly, and in several days the incidence can reach 100% of the infected farm population. The infected animals die in one-two weeks after the onset of the disease. The mortality rate can reach 97-100%. In the endemic regions of the ASF it varies from 10 to 90%. In our opinion, this can be explained by a higher immune resistance of the local pig populations that has evolved in the process of evolution in relation to the local strains of the virus [5].

The lower-acute form of the disease is caused by the virus strains with moderate virulence. It can be characterized with the same clinical symptoms as the acute one, being less manifested. Animals of all age groups can be infected, and the infected animals die within 3-4 weeks. The mortality rate can fluctuate from 3-5% to 30-70%, and it is higher among younger animals. The chronic form can be caused by the weaker virulent strains of the virus and is characterized by weight loss, growth retardation, remitting fever, appearance of necrosis cells and ulcers on the skin, birth of lifeless piglets, and frequent abortions among sows. The disease develops within 1-3 months; mortality ranges from 1-3 to 30% and is much lower among the adult animals.

The law-banded strains of the ASF usually cause subclinical infection and seroconversion. Some animals may have certain lesions in their lungs or on their skin over certain bony protrusions, or on other injured parts of the body. The animals that have recovered from the acute or chronical infection become persistent infecting virus carriers that can create serious problems for the control of ASF [5, 8].

Pathoanatomical changes in the dead animal in all forms of the disease is characterized by hemorrhages on the mucous and serous membranes; increase of the lymph nodes and internal organs, especially the spleen and kidneys, with multiple hemorrhages on them; and sero-hemorrhages exudate in the chest and abdominal cavities. Clinical and pathoanatomical signs in acute and lower-acute forms of the ASF are very similar to the signs and changes caused by classical swine fever, another viral disease, which also requires notification to the OIE.

Until the middle of the 20th century, the presence of the ASF was limited to the African continent. The disease remained endemic in many other countries south of the Sahara manifesting in the form of an enzootic disease or sporadic epizootics among domestic pigs. In 1957 and 1960 the ASF went beyond Africa for the first time and was brought to Portugal, from where it was spread to Spain and became an enzootic disease on the Iberian Peninsula. It took more than 30 years to eliminate it. From the Iberian Peninsula, the disease spread to neighboring countries – France, Belgium, Netherlands and Italy, while in Sardinia ASF became a secondary source of infection that exists until the present day. In the 1970s ASF cases were being reported in the countries of South America and the Caribbean (Cuba, Brazil, Haiti, and Dominican Republic) [5].

The ASF virus was brought to the territory of the USSR in 1977 through the seaport in Odesa. Disease outbreaks appeared in the Odesa Region (primary cell), the territory of Moldova, in Kyiv and the Sverdlovsk Regions (secondary cells) [8].

In 1995, ASF was limited again by the boundaries of the countries in Africa to the south of Sahara, and the island of Sardinia. Therefore, it was considered as to be an exotic disease with a comparatively low risk rate of infection for the pig breeding industry in America and Europe. However, the period from 1997 until 2003 was characterized by a new outbreak of this disease in Africa, with the expansion of its range to new countries, and the islands of Madagascar and Mauritius.

In 2007 there were new outbreaks of a pig's disease identified s later as the ASF – first noted in Georgia near the Poti seaport, which was probably brought about by a delivery of the infected pork to the port by sea transport. The disease rapidly spread across the country, after which it appeared in Armenia and Azerbaijan.

Expansion of the ASF to the territory of the Russian Federation was reported in 2007. The first case of the disease was registered in Chechnya among the wild boars, after which it spread to pigs in the Southern Federal District, including the region of the Northern Caucasus, and the Stavropol Krai as well as the Rostov Region, territories bordering with Ukraine. The disease showed a tendency of spreading in northerly and northwestern directions.

From November 2007 till October 2011 more

than 200 cases of the ASF outbreak were reported in Russia, including above 20 cases of the spreading of the ASF virus far beyond the borders of the infected territories of the country. Outbreaks of the disease were reported mainly among the domestic pigs in small households, and among the wild boars. The reappearance of outbreaks of the ASF virus was reported in some affected areas. The territory of the Caucasus (North Caucasus and Southern regions of Russia) and Transcaucasia (Georgia, Armenia, Azerbaijan) became essentially an endemic zone in relation to the ASF virus, with the disease showing a tendency to keep on spreading. This is why, before the military aggression in the East of Ukraine, there existed only the potential threat of the expansion of the ASF to the territory of Ukraine, which is actually located in the intermediate risk zone near the endemic regions of Russia [4, 7, 9, 10].

People cannot be infected with the ASF virus. The greatest risk when working with this pathogen is associated with the possibility of passive transmission of the virus to domestic pigs through contaminated inventory or clothing. Therefore, it is necessary to use the methods of biological safety when working with the pathogen to prevent its spread disease cells.

The ASF virus requires the quarantine of diseased animals in Ukraine. Due to the highly contagious nature of the pathogen and resultant severe economic consequences, it is necessary to work with this microorganism as with an in vitro culture and only in a laboratory facility according to the norms of biological security of BSL-3 level. Facilities for storing and working with the infected animals should also comply with this security level. Particular attention should be paid to the earliest possible detection and quarantining of the infected carriers as the ASF virus is a very dangerous pathogen for both domestic and wild pigs.

As for Ukraine, according to the report of the Analytical department of the Ukrainian Agrarian Confederation, up to 6,12 mln. heads of pigs dying in Ukraine while the number of them in 2017 decreased by 8.2% [11].

According to the experts in the field of livestock breeding, despite the overall negative dynamics in livestock production, it is the pig breeding which was affected the most during the last year. The number of these animals at the beginning of February of this year is lower than at a similar time in February 2017. So, as of February 1, 2018, there were 5.99 mln. pigs in Ukraine. Compared to the same date in the previous year, the decrease of stock reached 8.2%, and the main reason for decrease is the rapid spread of the ASF [12].

During the research it was found out that the number of the ASF outbreaks at the present time has presently reached an unprecedented mark for Ukraine. During the period from 2012 till May 2018, 371 cases of the ASF have been reported in Ukraine (271 among the domestic animals, 87 cases among the wild one, and 13 infected objects).

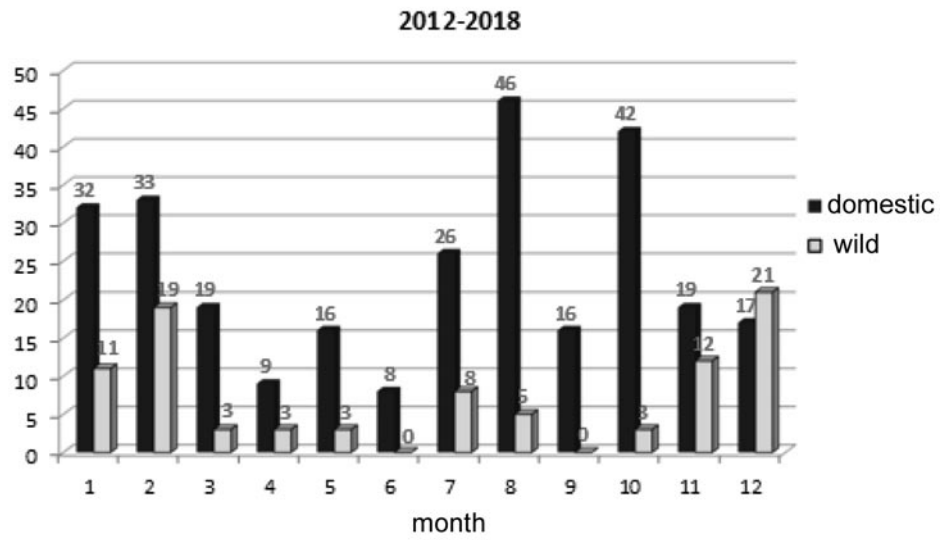

Fig. 1.
Seasonality of the ASF

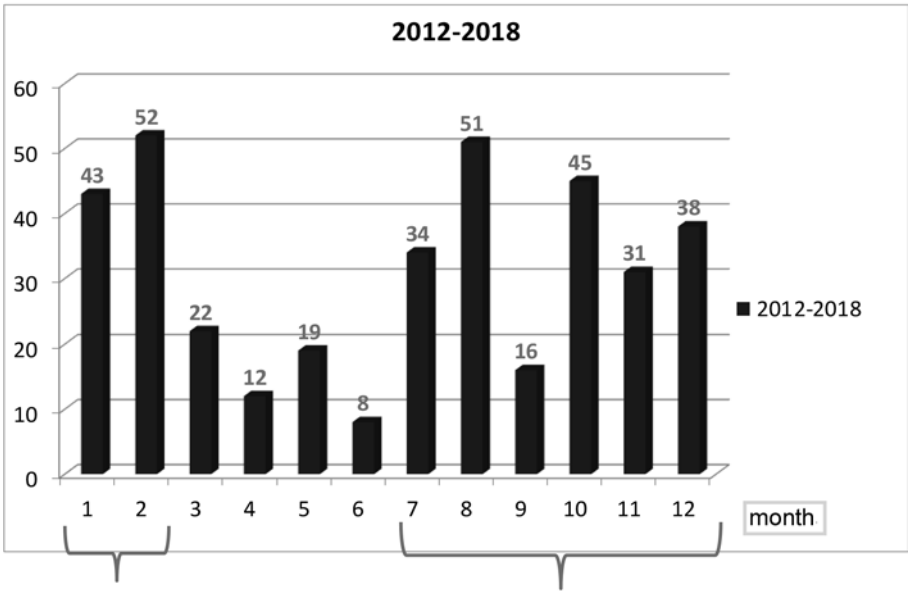

Fig. 2. Cases of the ASF in Ukraine (371) by months

Including (by years and by regions, as of June 18, 2018): 2012 – 1 case (domestic); 2013 – no cases ASF reported; 2014 – 16 cases (4 – domestic, 12 – wild).

As of June 18, 2018, the dynamics of decrease of the number of diseases was reported in comparison with the similar period of 2017 – 60 cases (35 domestic, 25 wild).

At the same time in 2018, there is an increase of the amount of the disease among wild boars compared to 2017 [13].

There have been reported 371 cases of the disease, of which 271 of them are domestic animals whereas 100 were wild ones, a ratio of 73% to 27%.

At the present time, quarantine measures for the ASF are active in 13 infected locations in 8 regions of Ukraine. The largest numbers of the quarantine zones are located at the territory of Donetsk (3), Odesa (3) and Kyiv (2) regions.

However, the anti-record for the decrease of domestic pig numbers during the period from February 2017 till February 2018 belongs to Donetsk Region (-51.9%). Only 4 regions of Ukraine that are the most distant from the ATO zone have managed to maintain the positive dynamics of the pig numbers. These regions are Volyn (+4.4%), Lviv (+2.3%), Ivano-Frankivsk (+1.0%) and Zakarpattia (+0.3%). Losses from

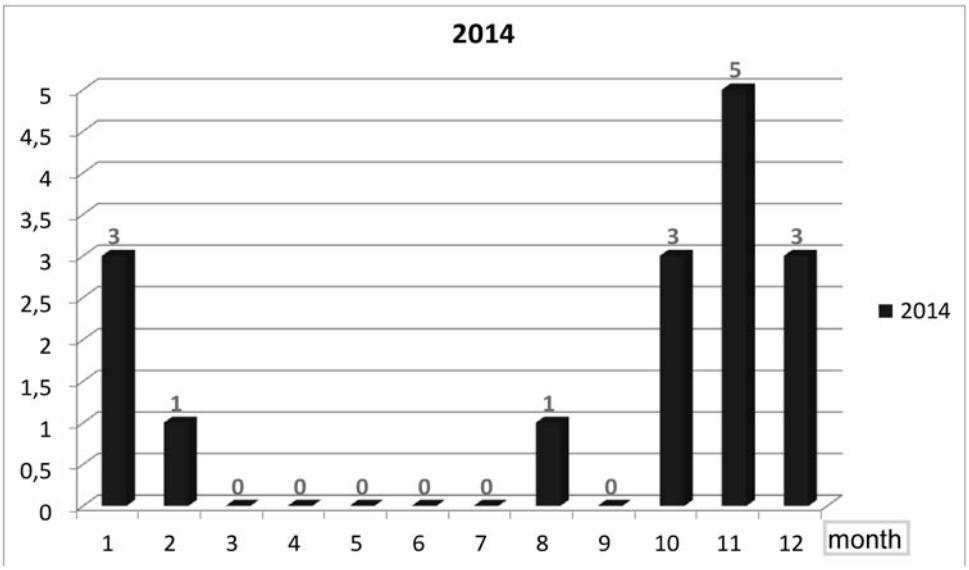

Fig. 3 . Monthly reports of the ASF cases in 2014

2015 - 40 cases (34 - domestic, 5 - wild, 1 – infected object);

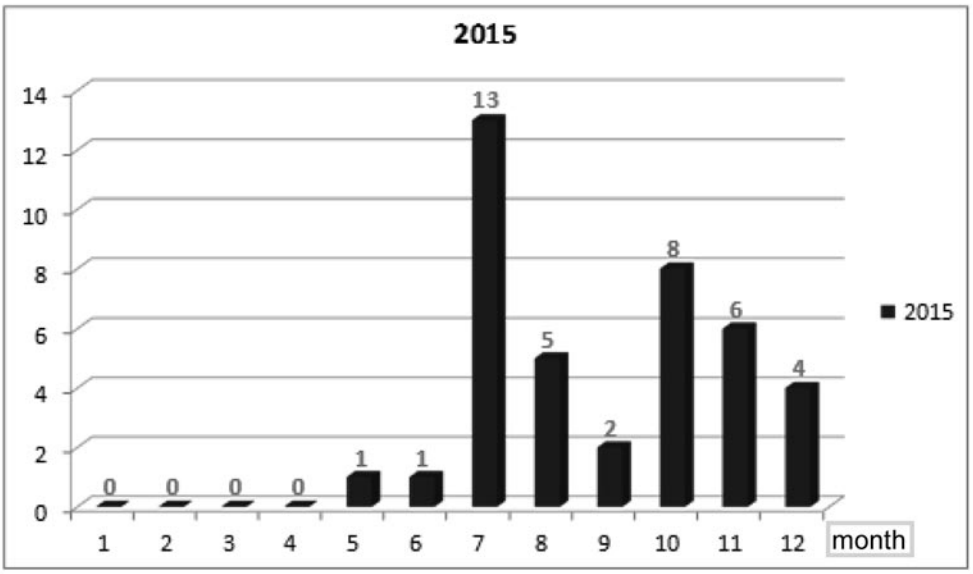

Fig. 4. Monthly report of the ASF cases in 2015

2016 - 91 cases (84 - domestic, 7 - wild);

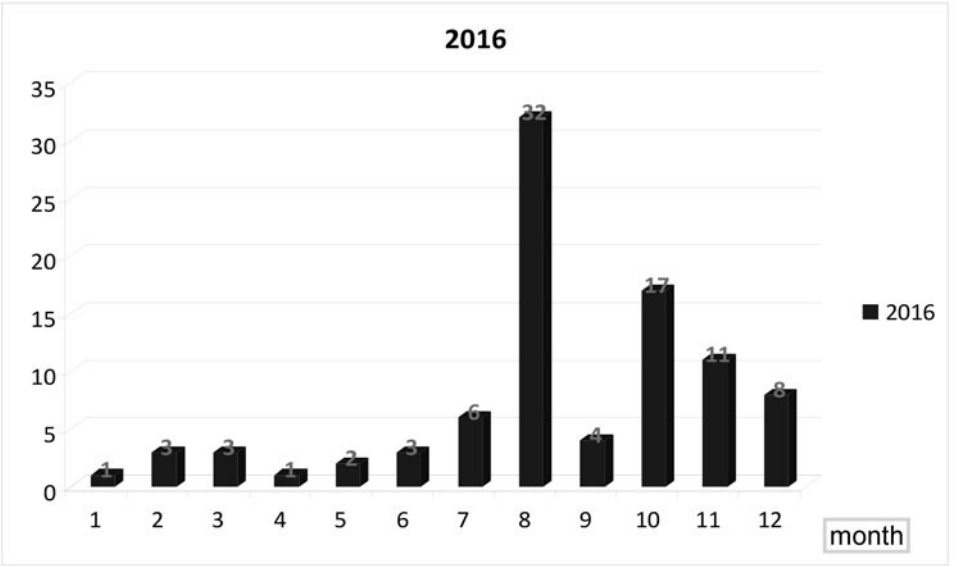

Fig. 5. Monthly report of the ASF cases in 2016

2017 – 163 cases (119 – domestic, 38 wild, 6 – infected objects);

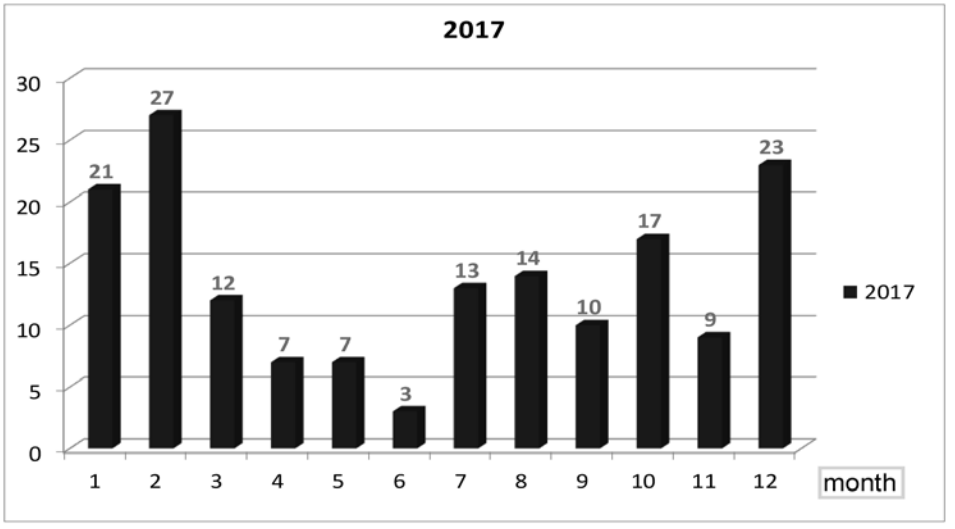

Fig. 6. Monthly report of the ASF cases in 2017

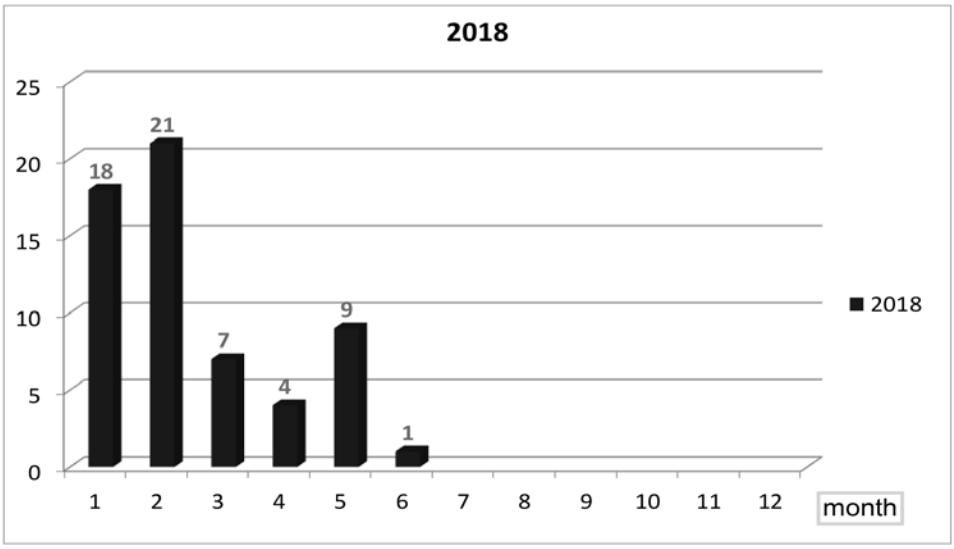

Fig. 7. Monthly report of the ASF cases as of June 18, 2018

the ASF in Ukraine estimated for the last year are about $ 5 million.

Besides the mentioned above, the rapid positive dynamics of spreading the disease from the eastern territories bordering with Russia (Chernihiv, Sumy and Luhansk) to the western ones, has been characteristic in Ukraine since 2014.

The situation in Ukraine's neighboring countries is rather not better. The ASF virus continues to "conquer" all the new territories in Hungary, Moldova, Czech Republic and Romania. "But the highest rate of spread of the ASF continues to be shown in Poland where 1 263 cases have been reported during this year only", – is emphasized in the report. The countries infected by the ASF, have reinforced their border controls the movement of the goods that could possibly become the source of new outbreaks of the virus [13].

Conclusions and Results. The given above data indicates the appearance of a new problem of the ASF in Ukraine that manifested itself simultaneously with the military actions in the east of the country. Diseases began in the areas bordering with the RF regions of Ukraine and actively spread to the western regions of the country. The great contract between the ASF diseases among the domestic and wild pigs provides grounds for asserting the primarily anthropogenic character of the spreading of the disease, and its foremost advantage over the natural one. Additionally there is the frequency of the pig diseases in the private sector that is significantly greater than in the industrial sector of pork production.

The situation may be particularly worsened with the transferring of the ASF pathogen by rodents and insects to the places of retention of domestic animals after their stay in the place of the death of the infected wild animals. It is worth further investigating whether the local mites have not become yet a source of circulation for the ASF pathogen.

Consideration of the fact that people cannot be infected with the ASF virus, but at the same time can be the source for both passive and intentional transmission of the virus to the domestic pigs and wild boars through the contaminated inventories, clothing and feed etc., enables an assumption that the beginning and active dynamics of the current outbreak of the ASF in Ukraine during the period of the military aggression may have signs of the character of a biological diversion and requires reaction in all aspects at both national and international levels.

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СУЧАСНИЙ СПАЛАХ АФРИКАНСЬКОЇ ЧУМИ СВИНЕЙ (АЧС) ЯК МОЖЛИВИЙ ЗАСІБ БІОЛОГІЧНОЇ ДИВЕРСІЇ ПРОТИ УКРАЇНИ В УМОВАХ ВІЙСЬКОВОЇ АГРЕСІЇ НА СХОДІ

М. Романов[1], О. Ковалюк[2], М. Величко[3], Я. Гончарук[4]
[1]Національний університет «Острозька академія», м. Київ, Україна
[2]Служба безпеки України, м. Київ, Україна
[3]Національна академія Служби безпеки України, м. Київ, Україна
[4]Буковинська академія, м. Чернівці, Україна,

РЕЗЮМЕ. Мета. *Встановлення причин появи на території України африканської чуми свиней та механізми її поширення. Детальне вивчення ролі антропогенного фактора, а також зосередження уваги на можливості (підтвердження або спростування) диверсійної діяльності країни агресора – Російської Федерації. Прогнозування подальшого розвитку поширення збудника та вироблення на базі даних по Україні, враховуючи міжнародний досвід, рекомендації щодо превентивних заходів задля створення системи протидії загрозі біологічного характеру, а також мінімізації збитків для держави.*
Ключові слова: *африканська чума свиней, антропогенний фактор, міжнародний досвід.*

СОВРЕМЕННАЯ ВСПЫШКА АФРИКАНСКОЙ ЧУМЫ СВИНЕЙ (АЧС) КАК ВОЗМОЖНОЕ СРЕДСТВО БИОЛОГИЧЕСКОЙ ДИВЕРСИИ ПРОТИВ УКРАИНЫ В УСЛОВИЯХ ВОЕННОЙ АГРЕССИИ НА ВОСТОКЕ

Н. Романов[1], А. Ковалюк[2], Н. Величко[3], Я. Гончарук[4]
[1]Национальний университет «Острожская академия», Украина, г. Киев
[2]Служба безопасности Украины, Украина, г. Киев
[3]Национальная академия Службы безопасности Украины, Украина, г. Киев.
[4]Буковинская академия, Украина, г. Черновцы

РЕЗЮМЕ. Цель. *Установление причин появления на территории Украины африканской чумы свиней и механизмы ее распространения. Детальное изучение роли антропогенного фактора, а также сосредоточение внимания на возможности (подтверждение или опровержение) диверсионной деятельности страны агрессора – Российской Федерации. Прогнозирование дальнейшего развития распространения возбудителя и выработки на базе данных по Украине, учитывая международный опыт, рекомендации по превентивным мерам для создания системы противодействия угрозе биологического характера, а также минимизации убытков для государства.*
Ключевые слова: *африканская чума свиней, антропогенный фактор, международный опыт.*

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