МІКРОБІОЛОГІЯ, ЕПІЗООТОЛОГІЯ ТА ІНФЕКЦІЙНІ ХВОРОБИ

UDC 636.4:637:578

Comparative epidemiological study of the spread of African swine fever in Ukraine and some Eastern European countries

Savcheniuk M.[1], Shubara O.[1], Shevchenko M.[1], Panteleienko O.[1], Ukhovskyi V.[2], Kornienko L.[2], Bilyk S.[1], Dovgal O.[1], Tsarenko T.[1]

[1] *Bila Tserkva National Agrarian University*
[2] *State Research Institute for Laboratory Diagnostics and Veterinary and Sanitary Expertise*

E-mail: Mykhailo Savcheniuk dep.epizootology@btsau.edu.ua

Савченюк М.О., Шубара О.О., Шевченко М.В., Пантелеєнко О.В., Уховський В.В., Корнієнко Л.Є., Білик С.А., Довгаль О.В., Царенко Т.М. Порівняльне епізоотологічне дослідження поширення Африканської чуми свиней в Україні і деяких країнах Східної Європи. Науковий вісник ветеринарної медицини, 2024. № 1. С. 49–59.

Savcheniuk M., Shubara O., Shevchenko M., Panteleienko O., Ukhovskyi V., Kornienko L., Bilyk S., Dovgal O., Tsarenko T. Comparative epidemiological study of the spread of African swine fever in Ukraine and some Eastern European countries. Nauk. visn. vet. med., 2024. № 1. PP. 49–59.

Рукопис отримано: 26.04.2024 р.
Прийнято: 09.05.2024 р.
Затверджено до друку: 24.05.2024 р.

Doi: 10.33245/2310-4902-2024-188-1-49-59

African swine fever is one of the most serious threats to the world pig industry due to high infectivity and mortality rates among pigs. To date, no effective means of active prevention of the infection have been developed. The only effective method of control is passive monitoring of the spread of the pathogen among the population of domestic and wild pigs, detection of infected animals and their depopulation.

The study analyzes the spread of African swine fever in Ukraine from 2012 to 2024 and compares it with the countries that share a common border – Poland, Romania, Hungary, Slovakia and Moldova. In Ukraine, the first outbreaks were recorded in 2012 in Zaporizhzhia region among domestic pigs. In total, 619 outbreaks were detected during the study period: 482 among domestic pigs and 137 among wild pigs. The largest number of outbreaks was recorded in Odesa (64), Poltava (54), Mykolaiv (52) and Kyiv (46) regions.

In Eastern European countries, African swine fever was detected later: in Poland – since 2014 (1304 among domestic and 17871 among wild pigs), Romania – since 2017 (6729 and 3649, respectively), Hungary and Slovakia – since 2018 (0 and 7875; 72 and 3645). In Moldova, the first outbreak was in 2020 (39 among domestic and 45 among wild pigs). The highest total number of outbreaks was recorded in Poland (19175), mainly among wild boars (93.2%). In Hungary, all detected cases involved wild animals. The analysis revealed a statistically significant difference in the number of African swine fever outbreaks between the analyzed countries. There is also a difference in the number of outbreaks within the analyzed time period. If we analyze the number of cases since 2018, there is no statistically significant difference.

Prevention and control of African swine fever are complicated by the circulation of the pathogen among wild boars, non-compliance with biosecurity measures by owners of small pig farms and the movement of infected animals. Comprehensive monitoring with early detection of outbreaks and timely destruction of infected animals plays a key role.

Key words: pigs, African swine fever, spread, viruses, epizootic analysis, epizootic situation.

Problem statement and analysis of recent research. African swine fever (ASF) is a serious threat to the global pig industry due to the high level of infectivity and mortality among pigs. The causative agent of the disease is African swine fever virus (ASFV), which belongs to the Asfarviridae family. The ASFV virus has a complex genomic structure that includes many genetic elements and regulators that ensure its adaptation, spread and resistance to the immune response of the pig's body [1, 2].

Domestic pigs, wild boars and other members of the pig family are susceptible to ASF. However, ASF is not a zoonotic disease and the virus does not infect humans.

To date, 24 genotyping methods have been used to identify the sequences of the p72 capsid protein gene. The infection caused by this virus can cause a wide range of clinical syndromes, from acute with 100% mortality to long-term persistent infection. It is important to note that the virulence of the pathogen does not depend on its genus. The virus itself has a stable structure, and even new generation sequencing methods do not have sufficient resolution to determine the molecular epizootology of ASF [3, 4].

The epidemiology of ASF is complex. The dynamics of ASF spread varies depending on the characteristics of the local or regional pig production and food systems, combined with the ability of national animal health authorities and other stakeholders to prevent and control the disease [5]. Healthy pigs can be infected directly through contact with blood, secretions, feces, and excrement of infected animals. The virus can also be transmitted indirectly through contaminated feed, vehicles, equipment, and people [6].

The first outbreak of ASF was registered in Georgia in 2007, after which the disease spread to the territory of the current aggressor country, the Russian Federation. From there, through the territory of Belarus, the ASF pathogen quickly spread to European countries by wild boars [7].

The spread of ASF does not depend on the geographical location of the country. The highest risks of spread are associated with the environment, transportation of animals and the management system on farms. The greatest threat is the failure to comply with appropriate biosafety and biosecurity measures on pig farms of various forms of ownership, as well as uncontrolled movement of pigs and the presence of reservoir animals – wild boarsthat can support the circulation of the pathogen [7]. The EU countries are characterized by an integrated pig food system that covers most member states and facilitates the movement of pigs at different stages of the production process to optimize costs. A significant risk factor is small farms, which often violate biosecurity conditions due to lack of resources and insufficient awareness of owners and staff [8]. Wild boars-reservoirs complicate the fight against the spread of the pathogen due to the difficulty of controlling their numbers [9]. The location of pig farms near wild boar habitats and low biosecurity contribute to the spread of the pathogen [10, 11].

The difficult epizootic situation with African swine fever limits the export opportunities of pig producers, which requires a significant transformation of approaches to industry management and significant financial investments [12]. Prevention and control of the spread of the ASF virus is based on the timely detection of infected pigs and preventive measures to limit the spread of the disease [13]. Currently, the only method to stop the spread of the virus from the ASF outbreak area is forced slaughter and safe disposal of all susceptible pigs in the threatened area, which leads to economic losses [14, 15].

The main challenges associated with the development of a vaccine against ASF include the diversity of circulating virus strains, which makes it difficult to develop a vaccine that can provide cross-protection due to antigenic differences between vaccine and field strains. Vaccines based on live attenuated viruses may pose a risk of vaccine virus shedding in the field if some pigs have not been successfully immunized and are susceptible to infection with large amounts of vaccine virus. Another obstacle is the lack of a stable cell line suitable for culturing ASF virus at the level required for large-scale vaccine production, as experimental vaccines are produced using primary cells that do not meet technological requirements [16, 17].

Currently, three live vaccines from different manufacturers have been developed, commercially named NAVET-ASFVAC, AVAC ASF Live and DACOVAC ASF2, and are approved for sale in the Vietnamese domestic market and are being considered for approval by other Asian governments. The World Organization for Animal Health (WOAH) monitors progress in the development of vaccine candidates and has provided additional guidance on the development of quality and safe vaccines. However, in its report, the WOAH emphasizes that vaccination programs should be implemented as part of a comprehensive prevention strategy to ensure the effectiveness of vaccines. Thus, passive surveillance, timely detection of outbreaks and risk analysis remain the main effective strategy to combat the spread of ASF in the world and in Ukraine [18–20].

The aim of the study was to conduct a comparative spatial and temporal analysis of the epizootic process of ASF in domestic and wild boars populations in Ukraine, as well as in neighboring countries on the southwestern border, namely Poland, Hungary, Romania, Moldova and the Slovak Republic.

Material and methods of the study. Data from open information resources were used to study the dynamics of the ASF epizootic process in Ukraine and neighboring countries on the southwestern border, namely Poland, Hungary, Romania, Moldova, and the Slovak Republic. The main sources of information were the EU Animal Disease Information System (ADIS) [21] and public data from the African Swine Fever website [22].

Statistical data on registered ASF outbreaks among domestic and wild boarswere analyzed using descriptive veterinary epidemiology methods with time series analysis and comparative spatial analysis. Regression models (Spearman correlation) were used to identify trends. The method of polynomial time series regression was used to determine trends in the dynamics of ASF spread. In order to approximate the nonlinear nature of the trend and assess the quality of the approximation, a polynomial trend line was built for the number of registered outbreaks of ASF in Ukraine for the period 2012-2023. The determination coefficient R2 of the polynomial regression model was used to quantify the degree of approximation of the original data by the polynomial curve. The dynamics of the epizootic process of ASF in Ukraine was compared between regions, years, and between populations of domestic and wild boars [23].

The Jamovi computer program (Australia, 2023, version 2.4) was used for statistical analysis. The normality of the data distribution was checked using the Shapiro-Wilk test. For statistical analysis, a non-parametric test with one-way analysis of variance of ranks was used – the Kruskal-Wallis test, followed by pairwise comparison by the Duane method.

Maps of ASF spread were created using Microsoft Excel based on Bing data, © GeoNames, Microsoft, Navinfo, TomTom, Wikipedia.

Research results. The first case of African swine fever was officially registered in 2012 in the south of Ukraine in Zaporizhzhia region (domestic pigs). Since then, continuous epizootic surveillance and collection of statistical data on the spread of the disease has been conducted. As of today, 619 outbreaks of ASF have been registered in Ukraine, of which 482 were among domestic pigs (private sector and infected farms) and 137 among wild boars.

The number of registered ASF outbreaks has been increasing since 2014. The disease peaked in 2017, when the maximum number of outbreaks was recorded. Subsequently, there was a downward trend in the spread of ASF, which lasted until 2022. However, in 2023, there was a new increase in the number of reported outbreaks. The results of the polynomial regression of the time series of the number of ASF outbreaks in Ukraine in 2012-2023 showed a high degree of approximation of the polynomial curve ($R^2 = 0.8511$) (Fig. 1).

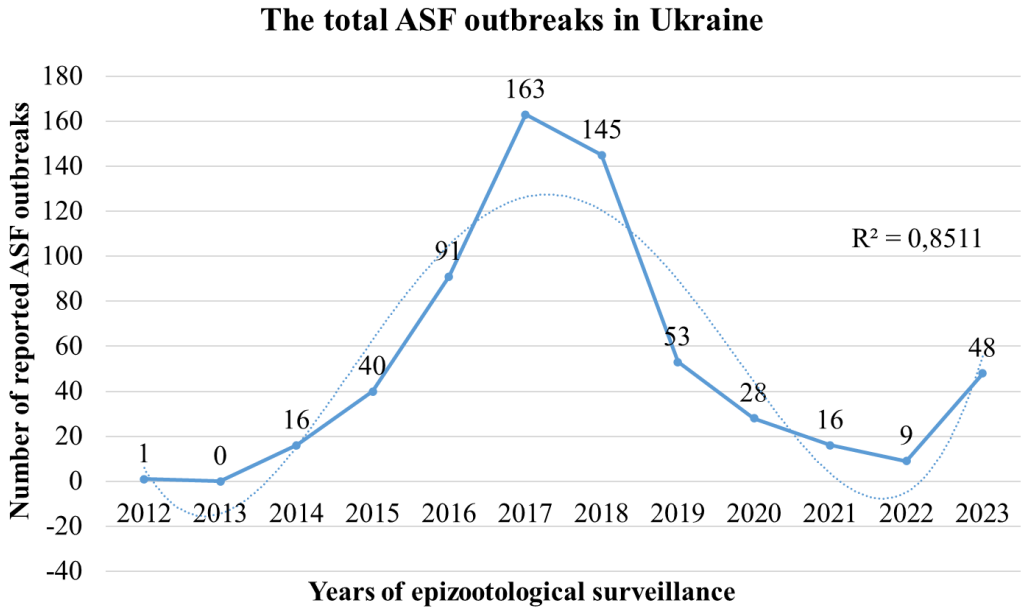

Fig. 1. **ASF outbreaks in Ukraine since 2012.**

An interregional comparative analysis of registered ASF outbreaks over the entire period of epizootic surveillance showed that the largest number of outbreaks occurred in Odesa region (64 outbreaks). Somewhat fewer cases were registered in Poltava (54), Mykolaiv (52) and Kyiv (46) regions. The lowest incidence rates were observed in Ivano-Frankivsk (5 outbreaks) and Khmelnytsky (8 outbreaks) regions (Fig. 2).

The highest number of ASF outbreaks was recorded among domestic pigs (482 outbreaks) compared to wild boars (137 outbreaks). The highest rates of ASF outbreaks among domestic pigs were recorded in Odesa (54 outbreaks), Mykolaiv (49), Poltava (45) and Kyiv (40) regions. The smallest number of ASF outbreaks in domestic pigs was recorded in the western regions of Ukraine – from 2 to 5 outbreaks – in Lviv (2), Ivano-Frankivsk (3), Zakarpattia (4) and Volyn (5) regions (Fig. 3).

Over the entire period of epizootic surveillance, the largest number of ASF outbreaks among wild boars was recorded in the Zakarpattia region – 23 cases. Almost half as many cases were observed in Chernihiv region – 13 outbreaks. In Rivne and Odesa regions, 10 outbreaks were registered, in Poltava and Kharkiv regions – 9 outbreaks of ASF in wild pigs.

In other regions of Ukraine, outbreaks of ASF among wild boars were much less frequent. The number of reported cases ranged from 1 outbreak in Zaporizhzhia region to 7 outbreaks in Luhansk region. It should be noted that in Lviv and Khmelnytsky regions, no cases of the disease among wild boars were recorded during the entire period of epizootic surveillance (Fig. 4).

Further, the difference in the number of ASF outbreaks in Ukraine and countries with which it shares a common border was analyzed. The first outbreak of ASF among domestic pigs in Ukraine was detected in 2012. In Poland, the first cases were recorded in 2014 among both domestic and wild pigs. In Romania, the first outbreak among domestic pigs occurred in 2017. In Hungary, the first cases of ASF among wild boarswere detected in 2018. In the Slovak Republic, the first outbreaks among both domestic and wild boarswere also recorded in 2018. In Moldova, the first outbreak of ASF was detected in 2020 (Table 1).

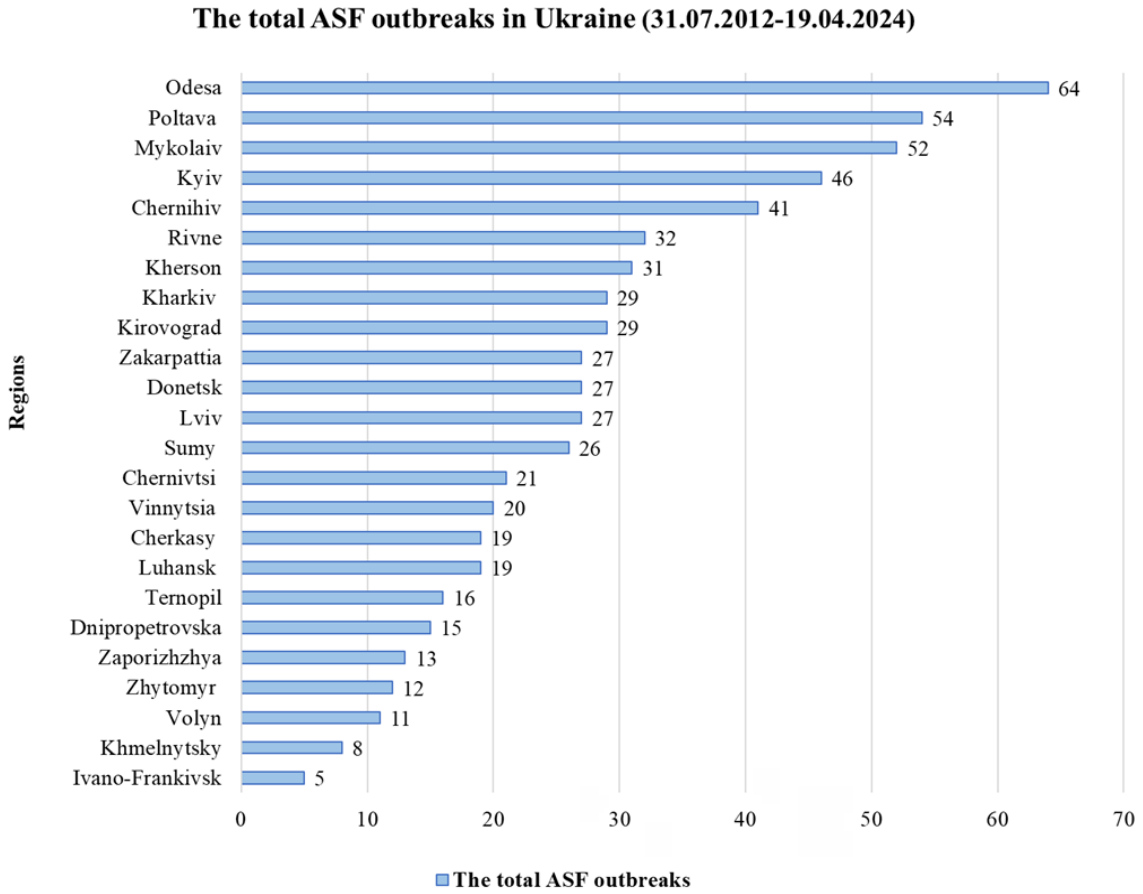

Fig. 2. **Interregional dynamics of ASF outbreaks in Ukraine** (31.07.2012-19.04.2024).

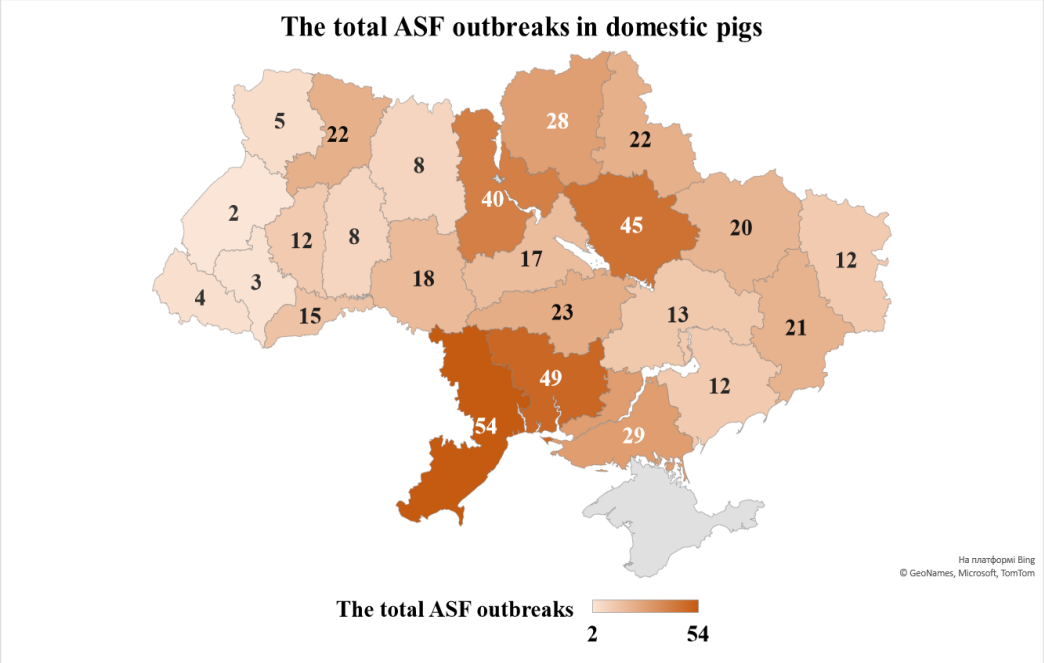

Fig. 3. **Total number of ASF outbreaks in domestic pigs by regions of Ukraine** (31.07.2012-19.04.2024).

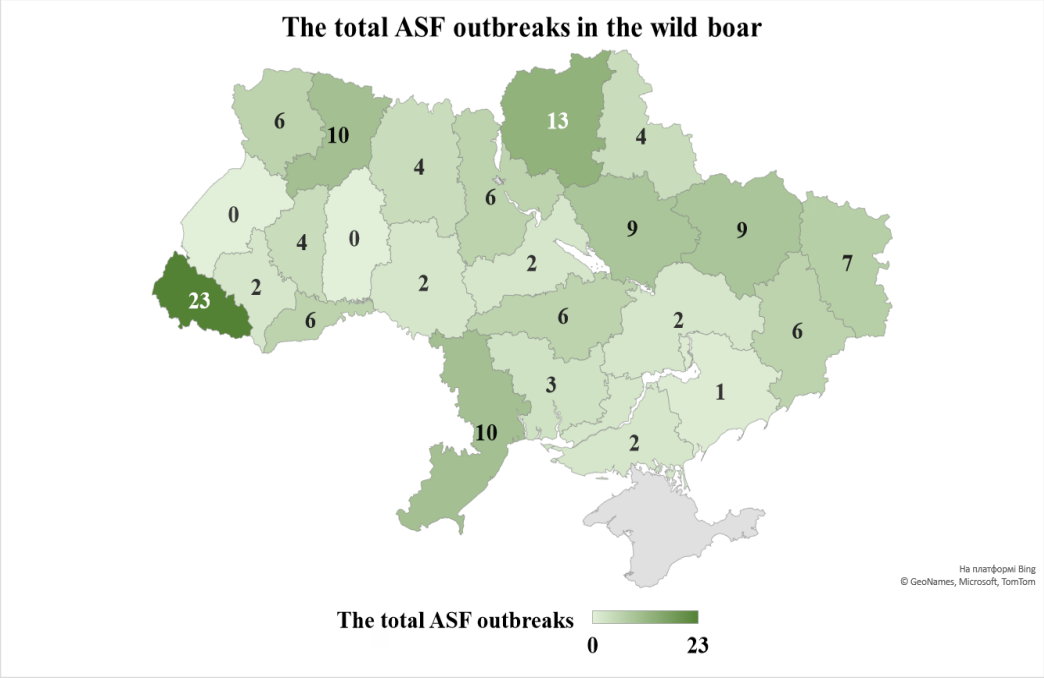

Fig. 4. **Total number of ASF outbreaks in wild boars by regions of Ukraine** (31.07.2012-19.04.2024).

Table 1 – **Number of ASF cases among the analyzed countries**

Years	Ukraine		Poland		Romania		Hungary		Slovak Republic		Moldova	
	Domestic pigs	Wild boars	Domestic pigs	Wild boars	Domestic pigs	Wild boars	Domestic pigs	Wild boars	Domestic pigs	Wild boars	Domestic pigs	Wild pigs
2012	1	0	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0	0	0
2014	4	12	2	30	0	0	0	0	0	0	0	0
2015	35	5	53	1	0	0	0	0	0	0	0	0
2016	84	7	80	20	0	0	0	0	0	0	0	0
2017	125	38	741	81	2	0	0	0	0	0	0	0
2018	106	39	109	2438	1163	170	0	138	28	415	0	0
2019	42	11	48	2468	1734	683	0	27	11	27	0	0
2020	23	5	103	4070	1053	885	0	4001	17	375	2	30
2021	13	3	124	3221	1676	1059	0	2584	11	1671	2	0
2022	7	2	14	2152	329	465	0	550	5	550	14	3
2023	38	10	30	2744	740	292	0	407	0	546	19	6
19.04.2024	4	5	0	646	32	95	0	168	0	61	2	6
Total	**482**	**137**	**1304**	**17871**	**6729**	**3649**	**0**	**7875**	**72**	**3645**	**39**	**45**

In general, during the study period, 77.9% of ASF cases among domestic pigs and 22.1% of cases among wild boarswere recorded in Ukraine, without a statistically significant difference between them (p=0.123).

As for the countries with a common western border, the lowest number of outbreaks was detected in Moldova. In this country, 46.4% of outbreaks were recorded among domestic pigs and 53.6% among wild boars (p=0.8) (Fig. 5).

In Hungary and the Slovak Republic, 7875 and 3717 outbreaks were detected, respectively. At the same time, 100% of ASF detections in Hungary were associated with wild boars, in Slovakia ASF was detected in 1.9% of domestic pigs and 98.1% of wild boars (p=0.003). In Romania, out of 10378 outbreaks of ASF, 64.8% were detected in domestic pigs and 35.2% in wild boars (p=0.279). The largest number of outbreaks was recorded in Poland – 19175, of which 93.2% were among wild and 6.8% among domestic pigs (p=0.053).

The results of the analysis revealed a statistically significant difference in the number of ASF outbreaks since their detection between the studied countries (p<0.001). Pairwise comparison shows a statistically significant difference between Ukraine and Poland (p=0.016). It is also worth noting the insignificance between Ukraine and Slovakia (p=0.056) and Moldova and Poland (p=0.074). No statistically significant difference was found between the other countries (p-value ranged from 0.108 to 1).

When comparing the total number of ASF outbreaks between different time periods, a statistically significant difference was found (p<0.001). However, after applying mathematical corrections for the number of groups (time periods) compared, no specific statistically significant differences in the number of cases between individual years were observed. When the analysis was limited to the period starting in 2018, when ASF cases were recorded in all the countries studied except Moldova, there was also no statistically

significant difference in the number of outbreaks between these countries.

When analyzing the data from the period of the first detection of ASF in wild animals, a statistically significant difference in the number of outbreaks between countries was observed (p=0.001) (Fig. 6). Pairwise comparisons indicated differences in the number of cases between Ukraine and Poland (p=0.033), Romania (p=0.0006), Hungary (p=0.012) and Slovakia (p=0.012). There was also a difference between Moldova and Romania (p=0.05), but no significant difference between Moldova and Hungary or Slovakia (p=0.078).

In addition, a statistically significant difference in the number of outbreaks among domestic pigs (p<0.001) was found (Fig. 7). According to the results of pairwise comparisons, a difference was found between Romania and Moldova (p=0.043), as well as a slight difference between Ukraine and Romania (p=0.055).

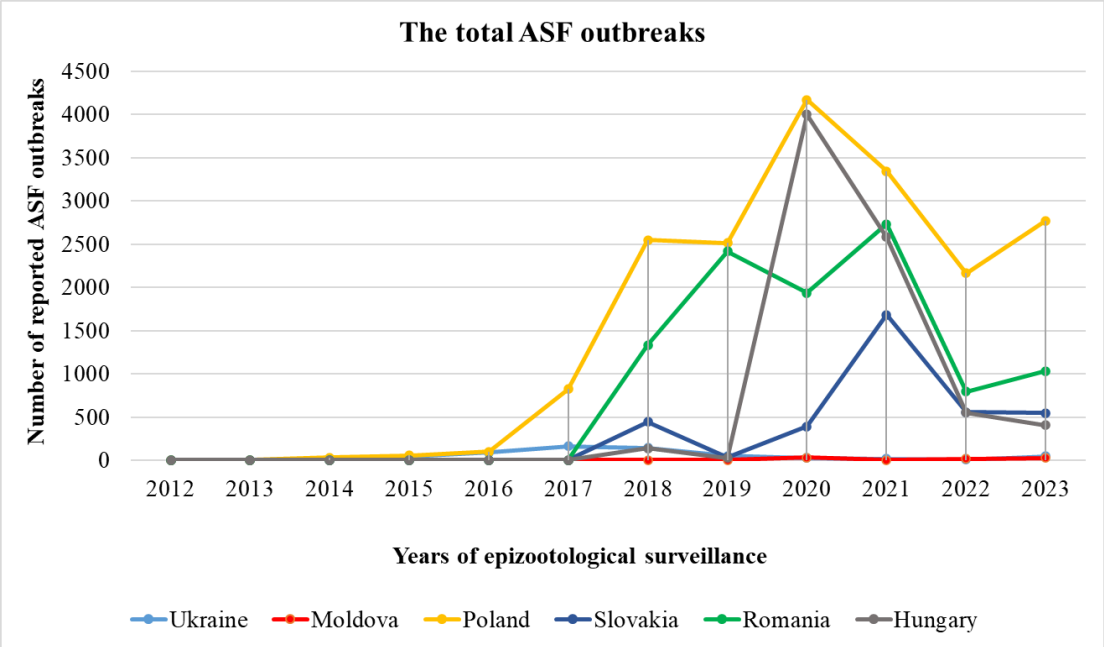

Fig. 5. **Total number of ASF outbreaks among the analyzed European countries.**

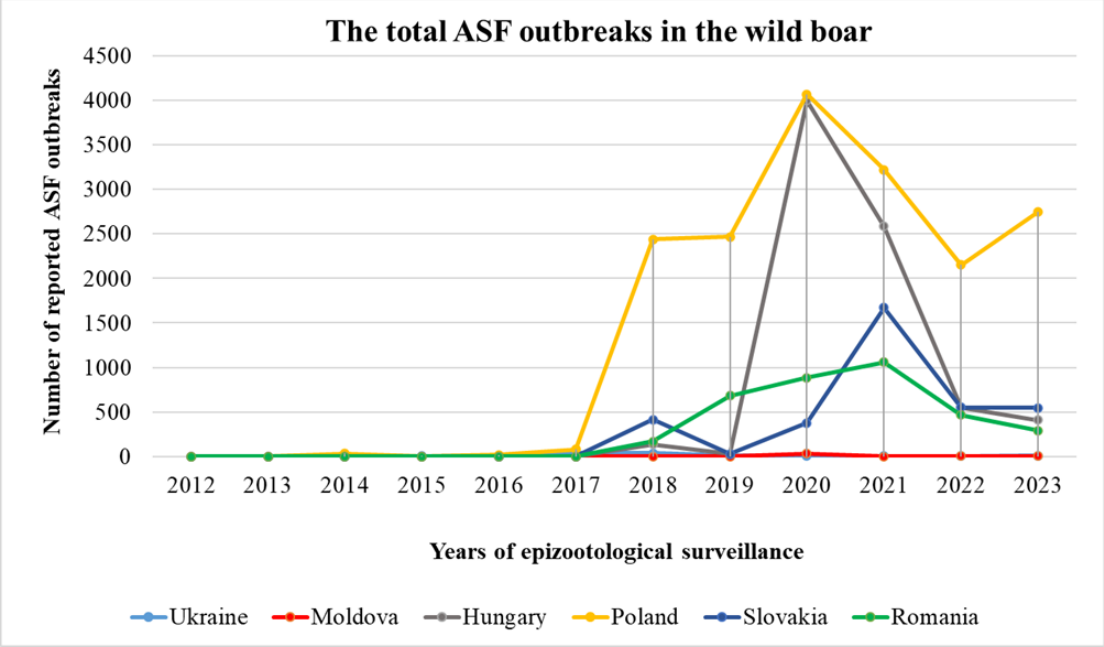

Fig. 6. **Number of ASF outbreaks among wild boarsin the analyzed countries.**

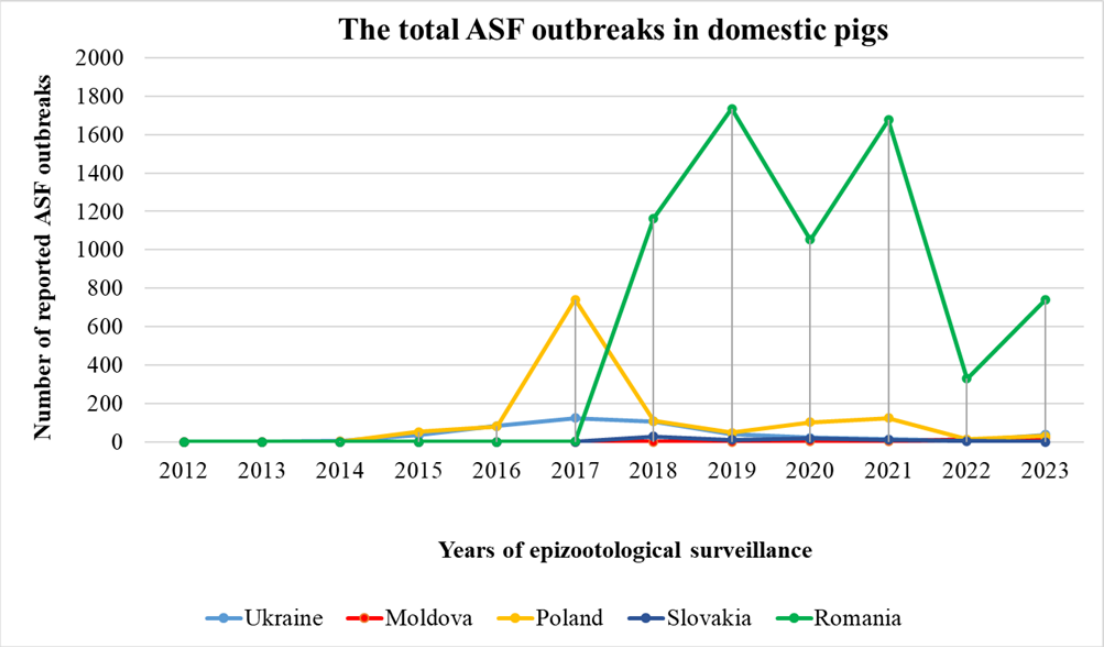

Fig. 7. **Number of ASF outbreaks among domestic pigs in the analyzed countries.**

A moderate positive correlation was found between the number of ASF outbreaks among domestic and wild boars(Spearman's rho 0.556, $p<0.001$).

Discussion. In Ukraine, the first outbreaks of ASF were recorded much earlier than in European countries with which it shares a common border. As noted by other researchers, ASF outbreaks in Ukraine have repeatedly occurred as a result of the introduction of the pathogen from neighboring countries [24].

There is a downward trend in the number of pigs in Ukraine, while the ratio of the number of pigs in industrial complexes and households has remained stable in recent years. It is also worth noting the significant impact of the war on the pig industry, with imports and exports of pork decreasing in 2023. However, producers continue to increase the number of pigs, and 10-12% of market operators are modernizing or expanding production facilities [25]. Owners of private households in Ukraine have low awareness of the peculiarities of ASF spread and methods of preventing the disease [26].

The number of ASF outbreaks detected in Ukraine is lower than in Eastern European countries. In recent years, there has also been a downward trend in the number of outbreaks among both wild and domestic pigs. However, this may be due to the transformation into an endemic disease or a decrease in the effectiveness of monitoring measures [27].

The largest number of cases was detected in 2017-2018. During this time period, the first outbreaks of ASF appeared in Romania, Hungary and the Slovak Republic. The peak of outbreaks in these countries occurred in 2020-2021 and was recorded among wild pigs. An interesting situation is in Hungary, where no outbreaks were detected among domestic animals.

As in Ukraine, cases of ASF in Eastern Europe are associated with the introduction of the pathogen across the border. The first outbreaks in Poland are likely related to the migration of wild boars from the Russian Federation and Belarus. In Hungary, the first cases of ASF were detected not far from the border with Ukraine. In Slovakia, outbreaks of ASF are also detected mainly among wild boars on the border with Hungary. In contrast, in Romania, the first outbreaks were detected among domestic pigs, and then among wild boars [28].

Although Hungary and Slovakia inform about the detection of ASF outbreaks through the ADIS system, the lack of scientific publications with detailed data analysis makes it difficult to understand the epizootic processes in these countries.

In Poland, most of the detected outbreaks of ASF among wild boarswere detected by examining materials from pig carcasses, while cases of infection in hunted wild boars were less common [29]. Also, the implementation of measures related to the fencing of the territory where ASF outbreaks were detected in Poland did not yield

results, the disease continued to spread, although such measures proved to be effective in the Baltic countries [30].

Romania accounts for about 90% of ASF infections among domestic pigs in Europe [31].

In Eastern Europe, small pig farms predominate. Compliance with biosecurity requirements on such farms depends on the farm owners and may vary [32]. The advantage of small farms is that sick and dead animals are detected more quickly, while the pathogen can circulate for a long time on large complexes [33]. Despite the large share of industrial complexes in Ukraine, the greatest threats associated with ASF are the circulation of the virus between the infected wild boar population and the private and non-commercial pig sector [27].

Conclusions. The conducted studies revealed a statistically significant difference in the number of ASF outbreaks between Ukraine and other countries with which it shares a common border. In Ukraine, 77.9% of ASF cases were registered among domestic pigs and 22.1% among wild pigs. Compared to the countries with a common western border, the largest number of outbreaks was recorded in Poland (93.2% among wild boarsand 6.8% among domestic pigs). In general, a statistically significant difference in the spread of ASF between the studied countries was found.

The statistical analysis showed significant differences in the number of ASF outbreaks between the studied countries, which indicates the importance of further research on this issue for effective disease control.

A moderate positive correlation was also found between the number of ASF outbreaks in domestic and wild pigs. Outbreaks of ASF in countries with a common western border, in particular in Hungary and the Slovak Republic, were mainly detected among wild pigs, while in Ukraine and Romania, outbreaks of ASF among domestic pigs predominated.

REFERENCES

1. Juszkiewicz, M., Walczak, M., Woźniakowski, G., Podgórska, K. (2023). African Swine Fever: Transmission, Spread, and Control through Biosecurity and Disinfection, Including Polish Trends. Viruses, 15 (11), 2275 p. DOI:10.3390/v15112275.

2. Galindo, I., Alonso, C. (2017). African Swine Fever Virus: A Review. Viruses, 9 (5), 103 p. DOI:10.3390/v9050103.

3. Blome, S., Franzke, K., Beer, M. (2020). African swine fever - A review of current knowledge. Virus research, 287, 198099 p. DOI:10.1016/j.virusres.2020.198099.

4. Manual of diagnostic tests and vaccines for terrestrial animals 2021 - 6ème èdition. Home - WOAH - World Organisation for Animal Health. Available at:https://www.woah.org/fileadmin/ Home/eng/ Health_standards/tahm/A_summry.htm

5. Dixon, L. K., Stahl, K., Jori, F., Vial, L., Pfeiffer, D. U. (2020). African Swine Fever Epidemiology and Control. Annual review of animal biosciences, 8, pp. 221–246. DOI:10.1146/ annurev-animal-021419-083741.

6. Bergmann, H., Dups-Bergmann, J., Schulz, K., Probst, C., Zani, L., Fischer, M., Gethmann, J., Denzin, N., Blome, S., Conraths, F. J., Sauter-Louis, C. (2022). Identification of Risk Factors for African Swine Fever: A Systematic Review. Viruses, 1 (10), 2107 p. DOI:10.3390/ v14102107.

7. Cwynar, P., Stojkov, J., Wlazlak, K. (2019). African Swine Fever Status in Europe. Viruses, 11 (4), 310 p. DOI:10.3390/v11040310

8. Bellini, S., Casadei, G., De Lorenzi, G., Tamba, M. (2021). A Review of Risk Factors of African Swine Fever Incursion in Pig Farming within the European Union Scenario. Pathogens (Basel, Switzerland), 10 (1), 84 p. DOI:10.3390/pathogens10010084.

9. Rogoll, L., Güttner, A. K., Schulz, K., Bergmann, H., Staubach, C., Conraths, F. J., Sauter-Louis, C. (2023). Seasonal Occurrence of African Swine Fever in Wild Boar and Domestic Pigs in EU Member States. Viruses, 15 (9), 1955 p. DOI:10.3390/v15091955.

10. Arias, M., Jurado, C., Gallardo, C., Fernández-Pinero, J., Sánchez-Vizcaíno, J. M. (2018). Gaps in African swine fever: Analysis and priorities. Transboundary and emerging diseases, 65, pp. 235–247. DOI:10.1111/tbed.12695.

11. Bosch, J., Rodríguez, A., Iglesias, I., Muñoz, M. J., Jurado, C., Sánchez-Vizcaíno, J. M., de la Torre, A. (2017). Update on the Risk of Introduction of African Swine Fever by Wild Boar into Disease-Free European Union Countries. Transboundary and emerging diseases, 64 (5), pp. 1424–1432. DOI:10.1111/ tbed.12527.

12. Adamyk, V., Chernobai, L., Adamyk, O. (2019). Problems and prospects for swine breeding development in Ukraine in the context of its influence on public welfare. Herald of Ternopil National Economic University, 3 (93), pp. 22–34. DOI:10.35774/ visnyk2019.03.022.

13. Wales, A. D., Davies, R. H. (2021). Disinfection to control African swine fever virus: a UK perspective. Journal of medical microbiology, 70 (9):001410. DOI:10.1099/jmm.0.001410.

14. Council Directive of the European Commission 2002/60/EC Laying Down Specific Provisions for the Control of African Swine Fever and Amending Directive 92/119/EEC as Regards Teschen Disease and African Swine Fever. EUR-Lex — Access to European Union law — choose your language. Available at: https://eur-lex.europa.eu/legalcontent/EN/TXT/PDF/?uri=CELEX: 32002L0060& amp;from=EN.

15. On Approval of the Instruction on the Prevention and Control of African Swine Fever, Order of the Ministry of Agrarian Policy and Food of Ukraine. no. 111, 2017. Available at: https://zakon.rada.gov.ua/ laws/show/z0432-17#Text. (Ukrainian).

16. Revilla, Y., Pérez-Núñez, D., Richt, J. A. (2018). African Swine Fever Virus Biology and Vaccine Approaches. Advances in virus research, 100, pp. 41–74. DOI:10.1016/bs.aivir.2017. 10.002.

17. Urbano, A. C., Ferreira, F. (2022). African swine fever control and prevention: an update on vaccine development. Emerging microbes & infections, 11 (1), pp.2021–2033.DOI:10.1080/22221751.2022.2108342.

18. African swine fever prevention, detection and control in resource-limited settings. (2023). FAO. DOI:10.4060/cc7491en.

19. Report of the Meeting of the Biological Standards Commission/February 2023 WOAH - World Organisation for Animal Health. WOAH - World Organisation for Animal Health. Available at:https://www.woah.org/app/uploads/2023/03/a-bsc-report-feb-2023.pdf

20. African swine fever: WOAH warns Veterinary Authorities and pig industry of risk from use of sub-standard vaccines - WOAH - World Organisation for Animal Health. WOAH - World Organisation for Animal Health. Available at:https://www.woah.org/en/document/african-swine-fever-woah-warns-veterinary-authorities-and-pig-industry-of-risk-from-use-of-sub-standard-vaccines/

21. Animal Disease Information System (ADIS). (n.d.). Food Safety. Available at:https://food.ec.europa.eu/animals/animal-diseases/animal-disease-information-system-adis_en.

22. African swine fever. (n.d.). Available at:https://www.asf.vet.ua/index.php/publications/ asf-cases-in-ukraine-since-2012.

23. Dohoo, I. (2003). Veterinary epidemiologic research. Univ. of Prince Edward Island.

24. Bezymennyi, M., Tarasov, O., Kyivska, G. V., Mezhenska, N. A., Mandyhra, S., Kovalenko, G., Sushko, M., Hudz, N., Skorokhod, S. V., Datsenko, R., Muzykina, L., Milton, E., Sapachova, M. A., Nychyk, S., Halka, I., Frant, M., Huettmann, F., Drown, D. M., Gerilovych, A., Mezhenskyi, A. A., Lange, C. E. (2023). Epidemiological Characterization of African Swine Fever Dynamics in Ukraine, 2012-2023. Vaccines, 11 (7), 1145 p. DOI:10.3390/vaccines11071145.

25. Yurchenko, O. S., Bondarska, O. M., Lykhach, V. Y., Kalitaev, K. K., Kovalenko, O. A. (2024). The state of domestic pig production. Problems and prospects. Podilian Bulletin Agriculture Engineering Economics, 42, pp. 55–63. DOI:10.37406/2706-9052-2024-1.8.

26. Muñoz-Gómez, V., Solodiankin, O., Rudova, N., Gerilovych, A., Nychyk, S., Hudz, N., Ukhovska, T., Sytiuk, M., Polischuk, V., Mustra, D., De Nardi, M., Lechner, I., Schuppers, M. (2021). Supporting control programs on African swine fever in Ukraine through a knowledge, attitudes, and practices survey targeting backyard farmers. Veterinary medicine and science, 7 (5), pp. 1786–1799. DOI:10.1002/vms3.578.

27. Omelchenko, H., Avramenko, N. O., Petrenko, M. O., Wojciechowski, J., Pejsak, Z., Woźniakowski, G. (2022). Ten Years of African Swine Fever in Ukraine: An Endemic Form of the Disease in the Wild Boar Population as a Threat to Domestic Pig Production. Pathogens (Basel, Switzerland), 11 (12), 1459 p. DOI:10.3390/pathogens11121459.

28. Sauter-Louis, C., Conraths, F. J., Probst, C., Blohm, U., Schulz, K., Sehl, J., Fischer, M., Forth, J. H., Zani, L., Depner, K., Mettenleiter, T. C., Beer, M., Blome, S. (2021). African Swine Fever in Wild Boar in Europe-A Review. Viruses, 13 (9), 1717 p. DOI:10.3390/v13091717.

29. Kruszyński, M., Śróda, K., Juszkiewicz, M., Siuda, D., Olszewska, M., Woźniakowski, G. (2023). Nine Years of African Swine Fever in Poland. Viruses, 15 (12), 2325 p. DOI:10.3390/v15122325.

30. Bocian, Ł., Frant, M., Ziętek-Barszcz, A., Niemczuk, K., Szczotka-Bochniarz, A. (2022). Dynamics of the African Swine Fever Spread in Poland. Journal of veterinary research, 66 (4), pp. 459–471. DOI:10.2478/jvetres-2022-0067

31. Ladoşi, I., Păpuc, T. A., Ladoşi, D. (2023). The Impact of African Swine Fever (ASF) on Romanian Pig Meat Production: A Review. Acta Veterinaria, 73 (1), pp. 1–12. DOI:10.2478/acve-2023-0001.

32. de la Torre, A., Bosch, J., Sánchez-Vizcaíno, J. M., Ito, S., Muñoz, C., Iglesias, I., Martínez-Avilés, M. (2022). African Swine Fever Survey in a European Context. Pathogens (Basel, Switzerland), 11 (2), 137 p. DOI:10.3390/pathogens 11020137

33. Ardelean, F., Globig, A., Gârdan Năvălici, A. I., Blome, S., Dietze, K., Depner, K., Zani, L. (2021). The course of African swine fever in Romanian backyard holdings - A case report. Veterinary medicine and science, 7 (6), pp. 2273–2279. DOI:10.1002/vms3.592.

Порівняльне епізоотологічне дослідження поширення Африканської чуми свиней в Україні і деяких країнах Східної Європи

Савченюк М.О., Шубара О.О., Шевченко М.В., Пантелеєнко О.В., Уховський В.В., Корнієнко Л.Є., Білик С.А., Довгаль О.В., Царенко Т.М.

Африканська чума свиней є однією з найбільших загроз для світового свинарства через високі показники контагіозності та летальності серед свиней. На сьогодні не розроблено ефективних засобів активної профілактики поширення інфекції. Єдиним дієвим методом контролювання залишається пасивне спостереження за поширенням збудника серед популяції свійських і диких свиней, виявлення інфікованих тварин та їх депопуляція.

У дослідженні проаналізовано поширення АЧС в Україні з 2012 до 2024 рр. та порівняно з країнами, що мають спільний кордон – Польщею, Румунією, Угорщиною, Словаччиною та Молдовою. В Україні перші спалахи були зареєстровані у 2012 р. в Запорізькій області серед свійських свиней. Загалом за досліджуваний період виявлено 619 спалахів: 482 серед свійських та 137 серед диких свиней. Найбільшу кількість спалахів зафіксовано в Одеській (64), Полтавській (54), Миколаївській (52) та Київській (46) областях.

У країнах Східної Європи АЧС було виявлено пізніше: у Польщі – з 2014 р. (1304 серед свійських і 17871 серед диких свиней), Румунії – з 2017 р.

(6729 і 3649 відповідно), Угорщині та Словаччині – з 2018 р. (0 і 7875; 72 і 3645). У Молдові перший спалах був у 2020 р. (39 серед свійських і 45 серед диких). Найбільшу загальну кількість спалахів зареєстровано в Польщі (19175), переважно серед диких свиней (93,2 %). В Угорщині всі виявлені випадки стосувалися диких тварин. В результаті аналізу було виявлено статистично значиму різницю в кількості спалахів АЧС між проаналізованими країнами. Також спостерігається різниця в кількості спалахів у межах проаналізованого часового проміжку. Якщо аналізувати кількість випадків починаючи з 2018 року, то статистично значуща різниця відсутня.

Профілактика та контроль АЧС ускладнюються через циркуляцію збудника серед диких кабанів, недотримання заходів біобезпеки власниками дрібних свиногосподарств та переміщення інфікованих тварин. Ключове значення має комплексний моніторинг з виявленням спалахів на ранніх етапах та своєчасним знищенням заражених тварин.

Ключові слова: свині, африканська чума свиней, поширення, віруси, епізоотологічний аналіз, епізоотична ситуація.

ORCID iD:
Savcheniuk M. https://orcid.org/0000-0003-2306-4114
Shubara O. https://orcid.org/0009-0008-5985-0882
Shevchenko M. https://orcid.org/0000-0002-7002-1494
Panteleienko O. https://orcid.org/0000-0002-4311-9680
Ukhovskyi V. https://orcid.org/0000-0002-7532-3942
Kornienko L. https://orcid.org/0000-0001-6832-0789
Bilyk S. https://orcid.org/0000-0003-4590-0881
Dovgal O. https://orcid.org/0000-0001-8620-8117
Tsarenko T. https://orcid.org/0000-0003-4373-5958