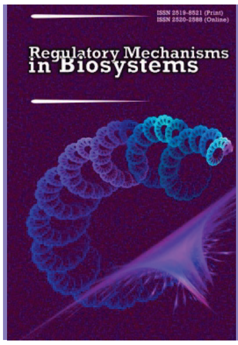

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Serological prevalence of *Leptospira* spp. in horses in Ukraine

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Leptospirosis, a zoonotic disease with constantly evolving pathogens, poses risks to both human and animal health. We investigated the prevalence of *Leptospira* spp. among horses in Ukraine from 2007 to 2021, encompassing clinical and subclinical cases. The study utilized data from the State Research Institute for Laboratory Diagnostics and Veterinary and Sanitary Expertise (2007–2021) to analyze leptospirosis prevalence in Ukrainian horses. Seroprevalence was calculated for each region. Equine leptospirosis outbreaks were retrospectively analyzed based on serological data from microagglutination reaction (MRA) studies using eight major serogroups. A geospatial analysis, utilizing quantile classification with five data classes, was conducted. Spanning 2007–2021, our analysis evaluated the prevalence and dynamics of equine leptospirosis in Ukraine. Serum samples tested for *Leptospira* antibodies exhibited varying dynamics over this period, with the highest and lowest rates observed in different years. Among the 125,101 horse serum samples analyzed, 10.8% tested positive for leptospirosis. The incidence rate fluctuated, peaking in certain years. The dominant serovars were Copenhageni (32.8%), Bratislava (16.1%), Grippotyphosa (15.4%), and Canicola (13.2%), while mixed reactions constituted 55.1% of positive cases. The analysis also revealed shifts in the prevalence of specific serovars over time. Geospatial analysis showcased the distribution of positive cases for each serovar across Ukraine's regions. The highest infection rates were observed in the eastern and northern regions, each characterized by distinct serovar prevalence. The etiologic composition map depicted varying serovar proportions among different regions. Furthermore, the density map delineated regions with different risk levels, with several regions falling into the "very high risk" category, while others like Odesa and Lviv were classified as low risk due to fewer positive leptospirosis cases. Detection of specific serovars like Tarassovi, Pomona, and Canicola in horses points to potential pathogen sources such as cattle, pigs, and dogs. The dominance of serovar Copenhageni (serogroup Icterohaemorrhagiae), accounting for 32.8% of seropositivity, reflects close contact with rodents, recognized reservoirs of this serogroup. These findings illuminate the evolving prevalence and distribution of leptospirosis in Ukrainian horses, offering vital insights for targeted interventions and disease management strategies. The insights garnered from this study can hold significant value for equine veterinarians, aiding the development of tailored preventive and control measures adapted to specific regions with varying risk levels. Our research offers a comprehensive examination of equine leptospirosis from both ecological and geographical perspectives, unveiling pivotal observations.

Keywords: zoonotic disease risks; equine leptospirosis dynamics; serovar prevalence shifts; geospatial analysis; pathogen sources.

Introduction

Leptospirosis is one of the most pressing zoonotic diseases. It is a global problem, as sick animals and pathogen-carrying animals pose a significant danger to humans as possible sources of leptospirosis infection. The disease has not only survived to this day, but its pathogens are evolving. Their evolution affects industrialized and developing countries (Ghazaei, 2018; Aymée et al., 2021). Animal infection is mainly carried out through direct contact with leptospore-contaminated urine or indirectly through interaction with contaminated water and/or soil (Ramos et al., 2006). Currently, based on phylogenetic analysis, *Leptospira* spp. are divided into three lineages that reflect their degree of pathogenicity: saprophytic (26), transitional (21) and pathogenic (17) (Hamond et al., 2015).

Cases of leptospirosis are often associated with poor hygiene and sanitation, so the disease is mainly reported in agricultural enterprises related to livestock farming. People working in processing plants and mining may also be at risk (Torres et al., 2016).

There is a growing number of studies that show the role of water and soil in the transmission of the pathogen to animals, and then to humans (Vincent et al., 2019). Rains, floods, and disasters associated with water sources contribute to the spread of the pathogen (Mwachui et al., 2015). The ability of leptospores to form biofilms and cellular aggregates has been proven (Wollanke et al., 2022). Due to this, the pathogen avoids the dispersive effect of urine in large natural water sources and accumulates in quite significant quantities (Yamaguchi et al., 2018; Sato et al., 2019; Rodríguez Torrens et al., 2021).

Horses can become infected by drinking water contaminated with Leptospirae, by contact with urine or any fluids from infected animals. Leptospirae can enter the body of a susceptible animal through mucous membranes, damaged skin and transplacental routes, and subsequently colonize mainly the renal tubules (Khalili et al., 2019). Later, Leptospirae are excreted in the urine, contaminate various water sources used in agricultural production, livestock, and human consumption, and thus create conditions for human and animal infection (Pulido-Villamarin et al., 2014). The presence of Leptospira spp. DNA in horse semen in 50% of the studied samples confirms the possibility of sexual transmission (Hamond et al., 2015). There are studies that confirm the role of horses as sources of the pathogen for other animals and horses (Hashimoto et al., 2007; Houwers et al., 2011). The clinical manifestations of leptospirosis vary from ultra-acute to chronic in different animal species (Båverud et al., 2009; de Vasconcelos et al., 2023). Animals also show subclinical forms of the disease, and in some individuals and species, lifelong carriage of the pathogen is observed. Horses can manifest a clinical form of the disease, including abortion, neonatal death, kidney and liver dysfunction (Hartskeerl et al., 2004; Vemulapalli et al., 2005; Dewes et al., 2020). Di Azevedo & Lilenbaum (2022) pointed out that in horses, it is necessary to speak of genital leptospirosis syndrome (EGL) (similar to the reproductive syndrome of bovine leptospirosis – BGL) (Libonati et al., 2018). The main agent causing EGL is mainly Bratislava serovar (serogroup Australis). In horses, in addition to systemic infections, eye damage and significant performance impairment have been described, especially for racehorses (Hamond et al., 2012, 2014). In 84% of cases of equine uveitis, it was found to be of leptospirosis origin (Dorrego-Keiter et al., 2016). Recurrent uveitis is an important consequence of leptospirosis infection and the main cause of blindness in horses (Verma & Stevenson, 2012).

In a study by Kulbrock et al. (2013), antibodies to *Leptospira* in horses were detected in 49% of vitreous samples from 45 vitrectomized eyes. The authors were able to isolate Leptospira DNA from 20 vitreous samples, and they evaluated 25 of the 45 vitrectomized eyes as positive for leptospirosis because the vitreous samples contained either *Leptospira* DNA or antibodies to the pathogen. In general, it is now generally accepted that equine leptospirosis can be associated with four syndromes: (1) ocular, characterized by equine recurrent uveitis (ERU), also called moon blindness or recurrent ophthalmia (Hartskeerl et al., 2004); (2) hepatorenal, characterized by classic jaundice symptoms (Malalana et al., 2017; Di Azevedo & Lilenbaum, 2022); (3) pulmonary, with acute respiratory failure (Pinna et al., 2013); (4) reproductive, causing reproductive disorders in mares (Velineni et al., 2016; Olmo et al., 2018). Reproductive disorders are associated with abortion and intrauterine fetal death, while the birth of infected foals is a common consequence of *Leptospira* infection (Timoney et al., 2011; Hamond et al., 2014). In addition, abortions are associated not only with local inflammation, but also with the presence of leptospires in the uterine environment (Di Azevedo & Lilenbaum, 2022). In the specialized literature, there are reports of changes in lipid metabolism due to immune activation caused by *Leptospira* (consequences of prolonged *Leptospira* carriage) (Gazi et al., 2011).

We have analyzed the serological prevalence of leptospirosis in horses in Ukraine for the period 2007–2021, identified the most epizootologically significant serovars of *Leptospira*, and provided appropriate recommendations for the control of this disease.

Materials and methods

The distribution and etiological composition of leptospirosis in horses were analyzed based on reports from the State Scientific Research Institute of Laboratory Diagnostics and Veterinary Sanitary Expertise for the years 2007 to 2021. The seroprevalence for each oblast was calculated by dividing the number of positive leptospirosis samples by the total number of samples in that specific oblast.

Taking into account the requirements of the current Instruction (Meites et al., 2004), we conducted a retrospective analysis of outbreaks of equine leptospirosis caused by each of the main eight serogroups of *Leptospira* circulating in livestock farms of Ukraine among farm animals, in particular: Grippotyphosa, Canicola, Icterohaemorrhagiae, Australis, Pomona, Tarassovi, Hebdomadis, Sejroe. One strain of *Leptospira* with the broadest antigenic spectrum was used in the microagglutination reaction (MRA) from each serogroup (Table 1).

The analysis excluded data from the occupied region of the Autonomous Republic of Crimea, the city of Sevastopol, and segments of the temporarily occupied zones within the Donetsk and Luhansk regions due to unavailability. Information regarding the overall count of susceptible animals was extracted from statistical records provided by the State Statistics Service of Ukraine (http://ukrstat.gov.ua).

Geoinformation mapping analysis was conducted utilizing Quantum GIS 3.16.0 software, accessible for free at www.qgis.org/ru/site/ forusers/download.html. Vector layers delineating the boundaries of Ukrainian regions were sourced from www.diva-gis.org/Data. Data distribution employed quantile classification, employing 5 data classes, with each class encompassing an equal number of regions.

Table 1
List of diagnostic strains of *Leptospira*

Serogroup	Serovar	Strain
Sejroe	Polonica	493 Poland
Hebdomadis	Kabura	Kabura
Tarassovi	Tarassovi	Perepelicyni
Pomona	Pomona	Pomona
Grippotyphosa	Grippotyphosa	Moskva V
Canicola	Canicola	Hond Utrecht IV
Icterohaemorrhagiae	Copenhageni	M 20
Australis	Bratislava	Yež bratislava

Results

The amount of serological diagnostics of horses for the detection of specific antibodies to pathogenic leptospires in Ukraine for the period 2007–2021 is shown in Figure 1.

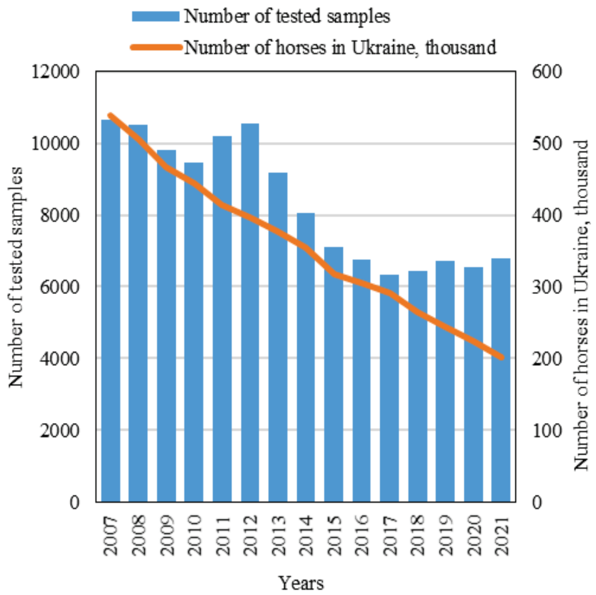

Fig. 1. Dynamics of the number of studied blood sera samples from horses on leptospirosis and total population of this species in Ukraine (2007–2021 years)

As can be seen from Figure 1, for the period 2007–2021, the largest number of blood serum samples from horses was tested in 2007, 2008 and 2012 – 10,643, 10,515 and 10,534 samples, respectively, and the smallest in 2017 and 2018 – 6,330 and 6,453 samples, respectively. It should be noted that during the period from 2012 to 2017, the volume of serological diagnostics of equine leptospirosis decreased significantly, from 10,534 samples in 2012 to 6,330 samples in 2017 (the number of samples tested during this period decreased by 39.9%). Since 2017, the number of equine serum samples tested has been approximately the same.

In order to compare the amount of research conducted and the number of horses, Figure 1 shows the dynamics of the number of livestock on the territory of Ukraine, according to the State Statistics Service of Ukraine (https://ukrstat.org/uk/druk/publicat/Arhiv_u/07/Arch_tvar_zb.htm) as of January 1 of each year. As evident from the graph, the count of horses in Ukraine has also been declining over the analyzed period. Thus, during the period of 2007–2021, the number of horses in Ukraine decreased from 538.3 to 202.0 thousand, i.e., there was a decrease in the number of horses by 62.5% during the specified period. In general, since Ukraine's independence, the number of horses has decreased by 3.5 times (from 700 thousand in 1991 to 202 thousand in 2021). At the same time, statistics show that about 95% of horses are currently used in the private sector.

During the period 2007–2021, veterinary laboratories of Ukraine examined 125,101 samples of equine blood sera, of which 13,543 were positive, which is 10.8% of the total number of samples tested. The dynamics of the incidence of leptospirosis in horses in Ukraine for the period 2007–2021 is shown in Figure 2.

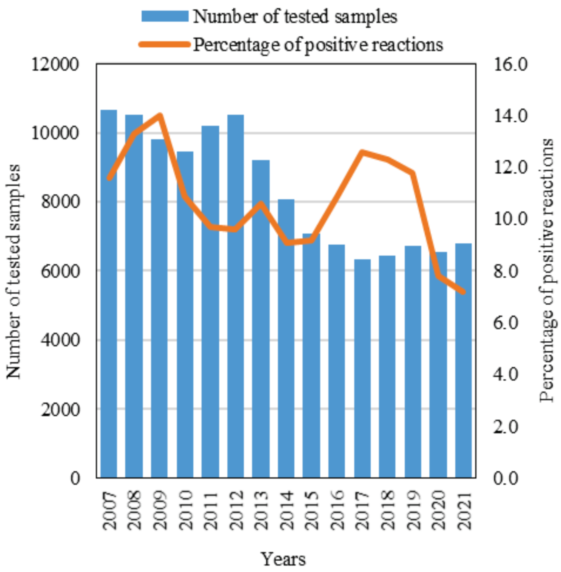

Fig. 2. Dynamics of leptospirosis infection in horses in Ukraine (2007–2021 years)

As shown in Figure 2, the leptospirosis infection rate in horses during the analyzed period was highest in 2008, 2009 and 2017 – 13.3%, 14.0% and 12.6%, respectively. The lowest infection rate was observed in recent years 2020 and 2021 – 7.8% and 7.2%, respectively. In 2014–2017, the infection rate increased slightly, and in the next four years (2018–2021), this figure began to decline again – 7.27–12.3%. In general, during the analyzed period, from 2007 to 2021, there was a steady downward trend in the number of horses seropositive for leptospirosis.

The etiological structure of equine leptospirosis in Ukraine for the period 2007–2021 is shown in Figure 3.

In the etiological structure of equine leptospirosis in Ukraine, according to the results of studies of state veterinary laboratories, the dominant serovars are: Copenhageni (serogroup Icterohaemorrhagiae) (32.8%), Bratislava (serogroup Australis) (16.1%), Grippotyphosa (serogroup Grippotyphosa) (15.4%) and Canicola (serogroup Canicola) (13.2%). Positive reactions with other *Leptospira* serovars were observed much less frequently: Tarassovi (Tarassovi serogroup) (10.7%), Pomona (Pomona serogroup) (7.8%), Polonica (Sejroe serogroup) (2.3%) and Kabura (Hebdomadis serogroup) (1.7%). It should be noted that during the analyzed period, a large number of positive reactions with different serovars of Leptospira (mixed reactions) were observed, which amounted to 55.1% of the total number of positive animals. We also conducted an analysis of the dynamics of the number of seropositive horses during the period 2007–2021 for each of the eight *Leptospira* serovars which are used in the diagnostics of leptospirosis in this animal in Ukraine, particularly during performance of MAT (Fig. 4).

As a result of a thorough retrospective mapping analysis of the circulation of the main diagnostic *Leptospira* serovars among the horse population in Ukraine, it was found that during the analyzed period of 2007–2021, there was a decrease in the number of positive reactions to *Leptospira* serovars Bratislava, Tarassovi, Pomona and Polonica, and an increase in the number of reactions with serovars Grippotyphosa, Canicola and Kabura. The percentage of infection of horses with the dominant serovar Leptospira Copenhageni was approximately the same.

Based on the results of the data analysis, we have compiled "Maps of the distribution of cases of horses seropositive to various *Leptospira* serovars" for eight *Leptospira* serogroups, which visualize the number of positive reactions of horse sera to these serogroups in the context of Ukrainian regions using different color intensities to distinguish the regions.

As illustrated in Figure 5, the highest incidence rates of leptospirosis in horses are observed in the eastern and northern parts of Ukraine. It has also been established that each serovar has its own peculiarities of territorial distribution in Ukraine. Thus, serovars Copenhageni, Bratislava, Grippotyphosa, Canicola and Tarassovi are most common in the eastern and northern parts of Ukraine; serovar Pomona is most common in the northern part of Ukraine; the largest number of positive reactions to serovars Polonica and Kabura were recorded in Sumy, Cherkasy, Kharkiv and Donetsk regions.

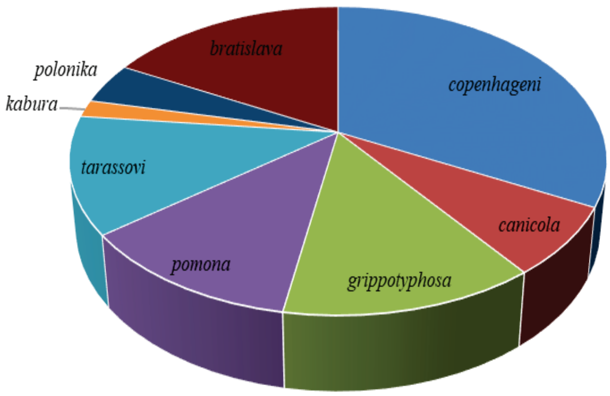

Fig. 3. Etiological structure of leptospirosis in horses in Ukraine (2007–2021 years)

Utilizing the scrutinized data, a comprehensive map illustrating the etiological composition of equine leptospirosis across all Ukrainian regions was constructed. This map visually represents the distribution of eight distinct leptospiral serovars in the period spanning from 2007 to 2021 through the utilization of pie charts, as depicted in Figure 6.

After a thorough retrospective cartographic analysis of the circulation of the main diagnostic serovars of leptospira among horses in Ukraine, it was found that the epizootic situation of leptospirosis of this animal species in different regions of Ukraine is not uniform and has its own characteristics, both in terms of the number of cases of infection of horses and the number of leptospirosis pathogens. For example, in Donetsk, Sumy and Cherkasy regions, cases of infection of horses with Leptospirae of all 8 *Leptospira* serovars officially included in the diagnostic range for leptospirosis testing in Ukraine are recorded, and a significant percentage of animals infected with *Leptospira* of several serogroups is noted simultaneously. Odesa, Zakarpattia, and Chernivtsi regions are characterized by a low level of leptospirosis infection in horses, so the spectrum of *Leptospira* serogroups in these regions is not diverse.

Based on the analyzed data, a map of the density of leptospirosis cases in horses in Ukraine over the past fifteen years (2007–2021) was compiled and is shown in Figure 7. On this map, all regions of the country were divided into five risk zones: very low, low, medium, high and very high.

The very high risk area includes five regions: Donetska (2,848 positive samples), Sumska (2,559), Cherkaska (1,752), Kharkivska (1,514), Chernihivska (756 positive samples). The total number of positive samples for equine leptospirosis in this zone is 9,429, which is 69.6%. The oblasts included in this zone are characterized by a very high probability of leptospirosis in the horse population.

Odeska, Khmelnytska, Chernivetska, Kyivska, Zakarpatska and Lvivska oblasts have had the lowest number of leptospirosis-positive horses over the past fifteen years, and therefore are classified as a low-risk area, with a total incidence of about 1.0% (133 positive samples were detected).

Discussion

The results of the analysis of studies of horses for leptospirosis for the period 2007–2021 showed that the seropositivity was 10.8%. Studies conducted in Brazil suggest that seropositivity among this animal species can be 28% or more (Dewes et al., 2020), 45% or more in Cuba (Rodríguez Torrens et al., 2021). Recent studies conducted in 29 US states have shown a prevalence of leptospirosis in horses of 45% (Wood et al., 2018). The detection of antibodies to the Tarassovi (10.7%), Pomona (7.8%) and Canicola (13.2%) serovars in horses indicates that cattle, pigs and dogs may be sources of the pathogen. The latter indicates the complexity of the problem and the need for preventive measures against leptospirosis in other animal species (Whitwell et al., 2009; Shanahan & Slovis, 2011). As a rule, Canicola serovar is much more serious. After all, a significant number of horses are kept in private households (95% in Ukraine today), where such animals as dogs are necessarily present. Therefore, in some studies, this "canine" serovar accounts for up to 35% or more of animals seropositive for leptospirosis (Dewes et al., 2020).

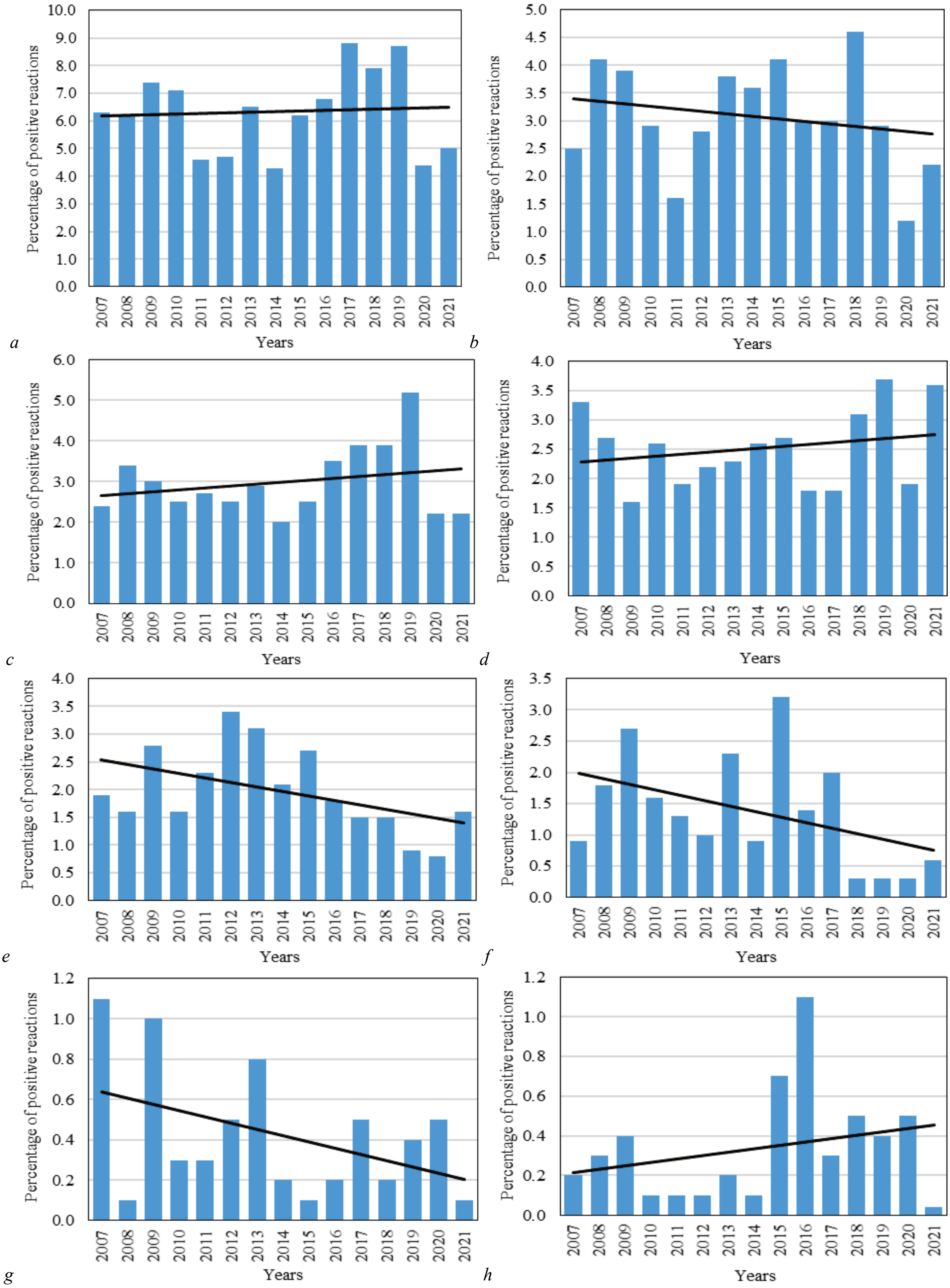

Fig. 4. Dynamics of the number of horses seropositive to various *Leptospira* serovars (2007–2021 years): *a* – sv. Copenhageni (serogroup Icterohaemorrhagiae); *b* – sv. Bratislava (serogroup Australis); *c* – sv. Grippotyphosa (serogroup Grippotyphosa); *d* – sv. Canicola (serogroup Canicola); *e* – sv. Tarassovi (serogroup Tarassovi); *f* – sv. Pomona (serogroup Pomona); *g* – sv. Polonica (serogroup Sejroe); *h* – sv. Kabura (serogroup Hebdomadis)

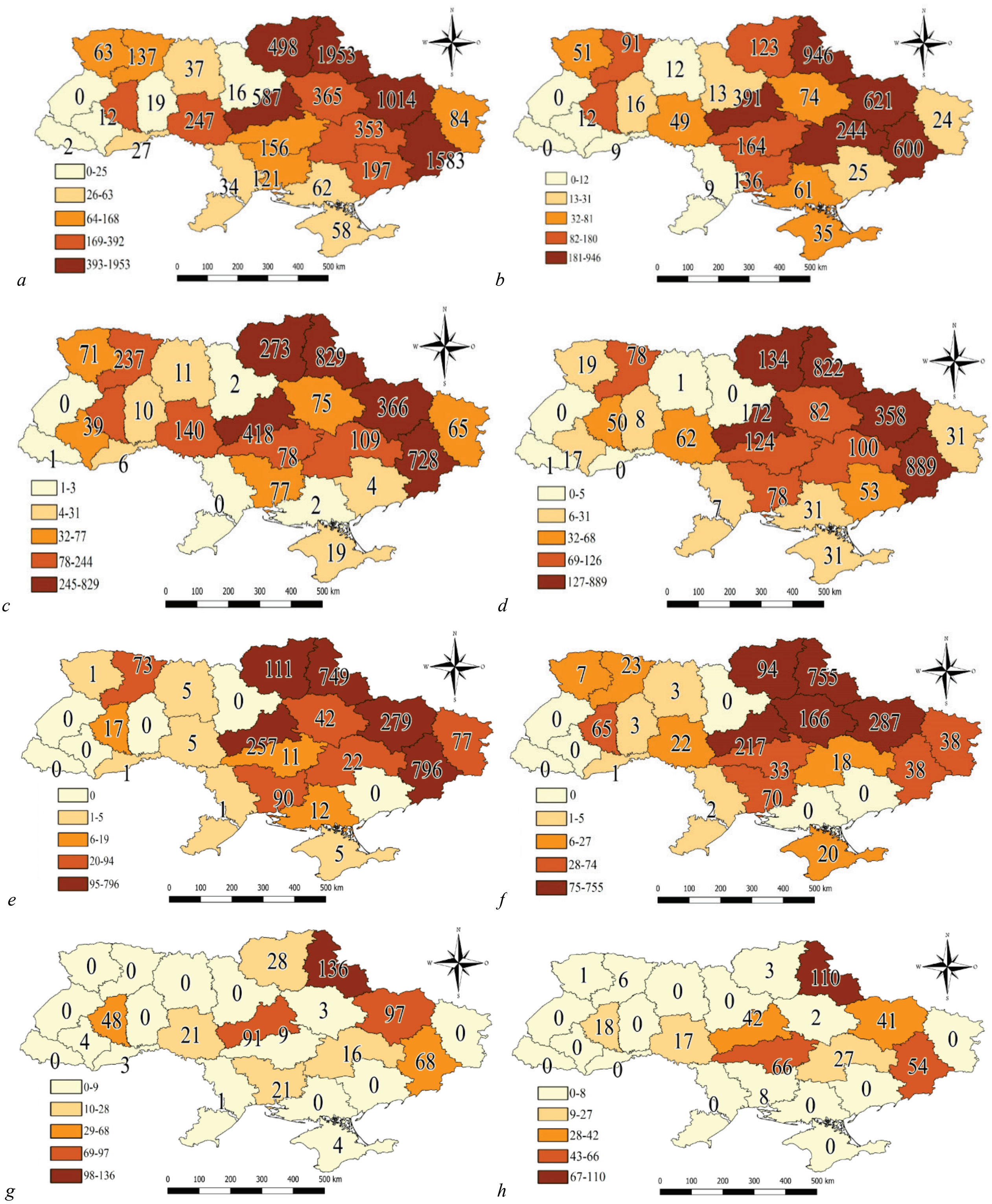

Fig. 5. Maps of the distribution of cases of horses seropositive to various *Leptospira* serovars (2007–2021 years): *a* – sv. Copenhageni (serogroup Icterohaemorrhagiae); *b* – sv. Bratislava (serogroup Australis); *c* – sv. Grippotyphosa (serogroup Grippotyphosa); *d* – sv. Canicola (serogroup Canicola); *e* – sv. Tarassovi (serogroup Tarassovi); *f* – sv. Pomona (serogroup Pomona); *g* – sv. Polonica (serogroup Sejroe); *h* – sv. Kabura (serogroup Hebdomadis)

The dominant serovar in horses in our study was Copenhageni (serogroup Icterohaemorrhagiae), with a seropositivity rate of 32.8% during the analyzed period. This serovar is associated with rodents worldwide. The latter indicates close contact of horses with rodents (mice, rats), which are the main reservoirs of this serogroup (Martins & Lilenbaum, 2013; De Souza et al., 2016). It is the Icterohaemorrhagiae serogroup that causes the highest mortality from leptospirosis in humans (Faria et al., 2008). In our studies, the second place was taken by serovar Bratislava (serogroup Australis) (16.1%), because a significant number of researchers believe that this serovar is adapted to horses (Pinna et al., 2014; Aymée et al., 2021; de Vasconcelos et al., 2023). In the case of uveitis of leptospirosis etiology in horses, serovars Pomona, Tarassovi, Grippotyphosa, Icterohaemorrhagiae and Hardjo are mainly detected (Gilger, 2010; Dorrego-Keiter et al., 2016).

The variety of serovars detected in horses suggests that they come into contact with different species of animals (domestic, wild, companion) and thus acquire *Leptospira* spp. Domestic and wild animals are reservoirs of the pathogen in rural areas, while rats and dogs are important reservoirs in urban areas (Meites et al., 2004; Verma et al., 2013). In general, the spectrum of *Leptospira* serovars detected in Ukraine: Copenhageni (serogroup Icterohaemorrhagiae), Bratislava (serogroup Australis), Grippotyphosa (serogroup Grippotyphosa), Canicola (serogroup Canicola), Tarassovi (serogroup Tarassovi), Pomona (serogroup Pomona), Polonica (serogroup Sejroe), Kabura (serogroup Hebdomadis) coincides with variants found in horses worldwide (Broux et al., 2012; Hamond et al., 2013; Wangdi et al., 2013; Divers et al., 2019; Muller et al., 2021).

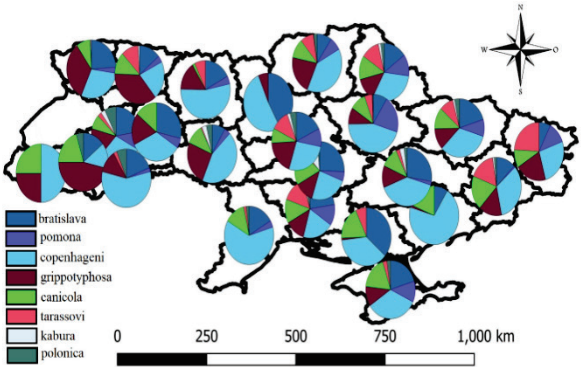

Fig. 6. Map of the etiological structure of leptospirosis of horses in Ukraine (2007–2021 years)

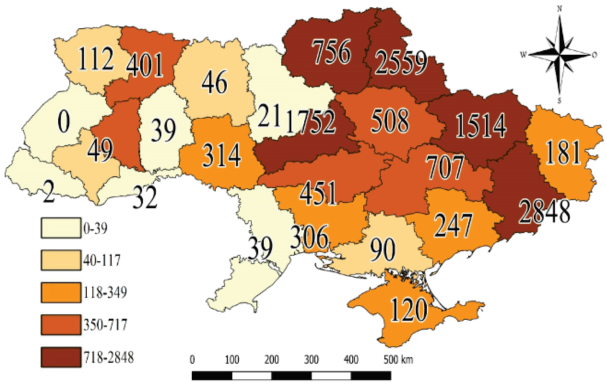

Fig. 7. Map of the density of cases of horse leptospirosis in Ukraine (2007–2021 years)

We found the most significant incidence of leptospirosis in horses in the eastern and northern regions of Ukraine. There are peculiarities of a certain territorial affiliation of serovars to different regions of Ukraine. For example, serovars such as Copenhageni, Bratislava, Grippotyphosa, Canicola and Tarassovi are most common in Eastern and Northern Ukraine. The Pomona serovar has a geographical distribution in Northern Ukraine. A significant number of seropositive horses for the Polonica and Kabura serovars were detected in Sumy, Cherkasy, Kharkiv and Donetsk regions. An analysis of the specialized literature shows that the dominant serovars in Germany and many neighboring countries are Grippotyphosa and Icterohaemorrhagiae, followed by serovar Bratislava (Yan et al., 2010; Voelter et al., 2020). In countries further to the east of Europe and in the United States of America, infections with serovars from the Pomona serogroup have been described (Divers et al., 2019). Our research and the research of these authors confirm the complexity of the leptospirosis problem. After all, it is impossible to fight only leptospirosis in horses. Control measures should be aimed at controlling leptospirosis-carrying animals, as in agricultural enterprises, where any species of animals, domestic or wild, especially rodents, can be carriers of the pathogen.

The impact of different serovars of the leptospirosis pathogen in different regions of Ukraine has regional characteristics. These include different environments where horses are kept, the presence of animals carrying the pathogen (which act as reservoirs), or its individual serovars. Consequently, significant differences in the incidence and prevalence of serovars in horses largely depend on the geographical region. Horses are often infected with Leptospirae when drinking water contaminated with the pathogen. It should be noted that the pressure of this pathogen on horses is constant, but systemic diseases are rarely recorded, the degree of severity of the infection varies, from asymptomatic to various manifestations.

In general, it is believed that older and middle-aged horses are more likely to be carriers of *Leptospira* than younger animals, and that their antibody titers are significantly higher (Båverud et al., 2009). In this case, the age of horses is almost always significantly associated with the presence of antibody titers to *Leptospira*. In general, the chances of being seropositive in this species of animal increase by about 10% with each year of life (Lees & Gale, 1994). The latter means that five-year-old horses have approximately 40% higher seroprevalence for any given serovar than yearlings. The authors confirm that similar results were obtained for almost all serovars. The latter means that as horses grow older, they are more likely to come into contact with Leptospirae and, accordingly, to form antibodies after exposure to the pathogen. Similar results were also obtained in thoroughbred horses, which at the age of 2–3 years were seropositive for *L. bratislava* in only 5% of cases, horses older than 7 years had a seropositivity of 52% (Kitson-Piggot & Prescott, 1987). This factor also affects the decrease in the number of seropositive animals among horses in Ukraine. Not only does the reduction in the number of horses by almost 3.5 times since independence (since 1991) lead to a decrease in the number of leptospirosis carriers, but in this situation the herd is significantly rejuvenated and the number of positive animals decreases.

The analysis of the incidence of leptospirosis in horses showed a heterogeneous distribution of *Leptospira* serogroups in different regions of Ukraine. Differences in natural conditions, housing conditions, and environmental factors in which the epizootic process of leptospirosis occurs affect its manifestation and intensity in different geographical areas. At present, the issue of the etiology of leptospirosis infection requires constant monitoring and analysis of the spread of *Leptospira* serovars among the horse population to determine the antigenic composition of leptospirosis pathogens in order to adjust preventive measures.

It should also be noted that serological monitoring studies are not enough to control this disease; attention should also be paid to sanitary measures, disinfection and deratization, vaccination of horses and other animal species (if necessary) to mitigate the effects of the disease in horses. The triadic approach – antibiotic therapy, vaccination and environmental management – is important in controlling the disease (Verma et al., 2013).

Therefore, our research confirms that the epizootic situation with regard to equine leptospirosis in different regions of Ukraine is not homogeneous. The information obtained can be used in the work of veterinarians working with this species of animals and taking measures to prevent and control leptospirosis. They will help in the development of specific health improvement measures in the areas (regions) of Ukraine that are unfavorable for this disease.

Conclusion

We conducted an ecological and geographical analysis of outbreaks of equine leptospirosis for each of the eight *Leptospira* serovars used in the diagnosis of leptospirosis in farm animals in Ukraine. During the period 2007–2021, 125,101 samples of equine blood sera were tested for leptospirosis, of which 13,543 were positive, which is 10.8% of the total number of samples tested. In the etiological structure of equine leptospirosis in Ukraine, the dominant serovars were: Copenhageni (serogroup Icterohaemorrhagiae) (32.8%), Bratislava (serogroup Australis) (16.1%), Grippotyphosa (serogroup Grippotyphosa) (15.4%) and Canicola (serogroup Canicola) (13.2%). Positive reactions were also obtained for the serovars Tarassovi (serogroup Tarassovi) (10.7%), Pomona (serogroup Pomona) (7.8%), Polonica (serogroup Sejroe) (2.3%) and Kabura (serogroup Hebdomadis) (1.7%). It should be noted that during the analyzed period, a significant number of positive reactions with different serovars of *Leptospira* (mixed reactions) were observed, which accounted for 55.1% of the total number of positive animals. The serovars Copenhageni, Bratislava, Grippotyphosa, Canicola and Tarassovi were most common in the eastern and northern parts of Ukraine, and the serovar Pomona was most common in the northern part of Ukraine.

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The authors declare that there is no competing of interest.

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