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SEASONAL DYNAMICS OF HISTOMONIASIS AND TRICHOMONIASIS IN TURKEYS ON FARMS IN ODESA REGION, UKRAINE

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Summary. The article focuses on the seasonal dynamics of histomoniasis and trichomoniasis in turkeys on farms in Odesa Region. Studies have shown that pathological changes in turkeys have a pronounced seasonal dependence. In the spring and summer, an increase in the intensity of histomoniasis and trichomoniasis lesions was observed, which is associated with optimal conditions for the development of pathogens. The study found that when turkeys are infected, pathological changes are primarily observed in the cecum, and necrotic processes are noted in the liver. In the acute form of histomoniasis, macroscopic changes in the liver are observed. The autopsy revealed significant lesions in the small intestine and liver, accompanied by characteristic changes including hemorrhagic typhlitis, fibrinous ulcerative inflammation, and fibrinous masses. A histological examination confirmed the presence of hyperemia, diffuse infiltrates, fibrinous changes, and necrosis in the intestinal mucosa and liver. A pathological examination of the turkey corpses revealed a pattern similar to that of histomoniasis and trichomoniasis, with hemorrhagic or fibrinous inflammatory changes in the intestines and liver changes. The data suggest that the combination of these infections complicated the disease

Keywords: *Histomonas meleagridis*, pathological changes, acute form

Introduction. The development of industrial poultry farming in Ukraine is rapid. The latest data show a slight lag in gross poultry production in rural areas compared to industrial poultry farms (Bogach, 2011; Daş et al., 2021; McDougald and Hu, 2001).

One poultry industry in Ukraine that has begun to develop rapidly in both private households and industrial farms is turkey farming. This can be interpreted as the importation of early-maturing, highly productive meat breeds of turkeys from abroad. The latest statistics show a slight lag in gross poultry production in households compared to industrial farms (Chadwick et al., 2020; Klodnicki, McDougald and Beckstead, 2013; Abdelhamid et al., 2021).

Poultry farms are often adjacent to private households that use different poultry-keeping technologies. Breeding new turkey breeds makes it possible to produce a significant amount of meat in a short time with minimal labor and feed costs per unit, which was not possible with traditional breeds. However, the breeding of highly productive turkey breeds, especially in private households, has faced the problem of extreme turkey sensitivity to bacterial and, especially, parasitic contaminants, which caused minor damage in native breeds (Abdelhamid et al., 2020; Bilic and Hess, 2020).

Ensuring food safety is a critical challenge for the international agricultural sector, and the poultry industry is one of the key sectors contributing to this goal. In particular, poultry farming — the production of chickens, turkeys, and other poultry species — plays an important role in providing the population with meat, meat products, eggs, and other egg products. The development of this industry is closely linked to improving the diagnosis, treatment, and prevention of diseases, which helps ensure product safety and quality. One of the most pressing issues is combating parasitic diseases, which are becoming increasingly prevalent among poultry, particularly in small-scale poultry operations. The spread of these diseases requires new approaches to diagnosis and prevention, as traditional methods used for large-scale poultry enterprises are often inapplicable to smaller farms (McDougald et al., 2020; Landman et al., 2015; Fudge et al., 2024; Bogach et al., 2016; Jones et al., 2020).

Histomoniasis is a disease that requires special attention. Caused by the parasite *Histomonas meleagridis*, this disease can lead to significant economic losses. Studying its epizootiology and developing effective treatment and prevention methods are important for improving poultry production, especially given the increased interest in farm production and small farms (Jones et al., 2020; Liebhart, Windisch and Hess, 2020).

Poultry histomoniasis is more prevalent during the warm, humid seasons because high temperatures and humidity create ideal conditions for oocyst maturation and preservation in the environment. Under these conditions, oocysts can remain viable for extended periods, thereby increasing the risk of infection in poultry. The high humidity characteristic of summer months, in particular, contributes to infection development by creating favorable conditions for parasite reproduction and survival (Liebhart and Hess, 2009; Daugschies, Bangoura and Lendner, 2013).

On farms where proper veterinary, sanitary, and zoohygienic conditions are not maintained, seasonal fluctuations in disease incidence can be more pronounced. Poor poultry housing conditions increase the risk of infection, especially during periods of high humidity and temperature. Overcrowding, poor ventilation, poor hygiene, and improper feeding also have a negative impact. In industrial poultry farming, seasonality is not always clear. On such farms, the risk of

enzootics depends more on production technology and sanitary conditions. If poultry rearing technology includes proper hygiene, ventilation, and environmental control, infection may be less pronounced, even during periods of high humidity (Badparva and Kheirandish, 2017; Huber et al., 2006).

Turkeys appear to be more susceptible to histomoniasis due to their behavior and greater tendency to congregate. This ensures the parasites' survival, even in the absence of vectors, leading to higher transmission. Outbreaks can be significant in cases with high mortality, such as on organic farms where turkeys and broilers are raised, due to co-infection with trichomoniasis (Hu and McDougald, 2003).

Correlation between age, genetics, and severity of infection: It has been determined that the dynamics of age and genetic differences in birds can affect the frequency and severity of histomoniasis. For instance, chickens are less susceptible to the disease than turkeys. However, despite being previously considered symptom-free carriers, outbreaks have recently been reported among broilers, even under free-range conditions. This suggests that chickens may be infected without showing obvious symptoms, but are not resistant to infection. Different strains of *H. meleagridis* can have different levels of virulence, which affects disease severity in birds. Therefore, the degree of infection depends not only on the species and age of the birds but also on the dose of parasites to which they are exposed. Traditionally, laboratory detection of *H. meleagridis* in poultry has relied on microscopy, clinical symptoms, and culture. However, numerous studies have shown that the morphology of this protozoan is very similar to that of other protozoa, such as the pseudocysts *Tetratrichomonas gallinarum* and *Blastocystis* sp., which can be found in the ceca of poultry. Conversely, an early diagnosis may be ambiguous due to the similarity of symptoms to those of other avian diseases, such as coccidiosis. Additionally, culturing protozoa for diagnostic purposes has proven to be challenging due to the presence of non-pathogenic organisms in poultry feces and ceca that can inhibit *H. meleagridis* growth (Purple et al., 2015).

Further research in this area will enable the development of more effective and cost-efficient strategies to combat histomoniasis, trichomoniasis, and other diseases. This will ultimately lead to increased production stability and improved product quality on an international scale.

The study **aimed** to investigate seasonal dynamics and pathomorphological changes in turkeys with histomoniasis and trichomoniasis, considering the influence of climate in northern and southern districts of Odesa Region.

Materials and methods. The spread of histomoniasis and trichomoniasis in turkeys was studied in the northern and southern districts of Odesa Region (the Podilsk and Bolhrad districts). The research was conducted in several private households and in the Laboratory of Epizootology, Parasitology, Animal Disease Monitoring, and Providing at the Odesa Research Station of the National Scientific Center 'Institute of Experimental and Clinical Veterinary Medicine'.

The study examined the corpses of turkeys that died from histomonosis. Autopsies were performed no later than five hours after death or slaughter. A total of 18 turkeys were examined: 10 aged 45–90 days and 8 aged 5–6 months. During autopsy, pathological tissue samples were collected from the gastrointestinal tract, including the glandular and muscular gizzards, liver, and various parts of the small and large intestines. The samples were fixed in a 10% aqueous solution of neutral formalin. After fixation, the pieces were washed in running water and embedded in paraffin using the conventional method. Histologic sections 5–8 μm thick were made from the paraffin blocks using a sled microtome.

The obtained sections were stained using hematoxylin and eosin, as well as the Van Gieson and Mallory methods. Micrographs were taken with an Olympus 2000 microscope visualization center. Morphometric studies were performed using the VideoTest-Master 4.0 software. Histomoniasis was diagnosed through a parasitological examination of the contents of the small and large intestines. To rule out bacterial diseases, microbiological studies were performed on samples from the cecum, liver, bone marrow, and heart of dead birds, which were cultivated on Levine and Endo media. To exclude fungal infections, the samples were inoculated on Sabouraud's medium. For the bacterioscopic examination, smears and prints were prepared from the mucous membranes of the small intestine and cecum and the affected areas of the liver. These samples were stained using Romanowski–Giemsa, Ziehl–Neelsen, and Gram stains. To exclude eimeriosis, the Fülleborn method was employed.

Results and discussion. We conducted a study on the seasonal dynamics of histomoniasis and trichomoniasis in Odesa Region (Table 1).

The seasonal dynamics of these diseases in turkeys depend significantly on climatic conditions, the type of bird farming, and the regional characteristics of Odesa Region.

Our analysis revealed that during the warm season (spring and summer), the prevalence of infection increases, particularly in regions with high humidity. The relatively high rates of histomoniasis infection in Podilsk District are due to more stable humidity conditions, which create a favorable environment for parasite preservation and reproduction. Conversely, the spread of the disease is less pronounced in Bolhrad District due to its drier climate.

The highest prevalence of histomoniasis infection was recorded in the summer, due to high temperatures and high humidity. These factors create a favorable environment for the maturation of *H. meleagridis* oocysts and ensure their survival for a long time in the environment.

Table 1 — Seasonal dynamics of histomoniasis and trichomoniasis in turkeys on the farms in Odesa Region

Season	District	Examined turkeys	Infected turkeys	Prevalence, %	Histomoniasis		Trichomoniasis	
					Infected turkeys	Prevalence, %	Infected turkeys	Prevalence, %
Winter	Podil	10	4	40.0	3	30.0	1	2.5
	Bolhrad	10	0	0.0	0	0.0	0	0.0
Spring	Podil	15	7	46.7	5	33.3	2	4.3
	Bolhrad	15	3	20.0	3	20.0	0	0.0
Summer	Podil	25	13	52.0	11	44.0	2	3.8
	Bolhrad	25	8	32.0	7	28.0	1	3.1
Autumn	Podil	15	6	40.0	5	33.3	1	2.5
	Bolhrad	15	4	26.7	3	20.0	1	3.8
Total		130	45	34.6	36	27.7	9	6.9

The highest prevalence of histomoniasis infection was recorded in the summer, due to high temperatures and high humidity. These factors create a favorable environment for the maturation of *H. meleagridis* oocysts and ensure their survival for a long time in the environment.

In Podilsk District, where moderate humidity prevails, the peak of infection occurs in the summer (prevalence — 44%). In Bolhrad District, which has a drier climate, prevalence of histomoniasis is slightly lower (28% in the summer), though infection rates remain stable in the spring and summer.

Trichomoniasis, unlike histomoniasis, shows a relatively low prevalence of infection throughout the year. The maximum level of infection (4.3%) was detected in spring, which may be due to the exacerbation of immune processes in birds after the winter period, when the conditions of keeping could be unfavorable. In other seasons, the prevalence of trichomoniasis varies from 2.5% to 3.8%, which confirms a less pronounced seasonal dependence.

The autopsy of turkeys that died from spontaneous histomoniasis showed lesions mainly in the cecum and liver. The cecum was significantly enlarged, containing a dark red semi-liquid mass with gas bubbles, indicating the presence of hemorrhagic typhlitis. With a prolonged course of the disease, fibrinous-hemorrhagic changes were observed in the cecum with the formation of dense grayish-white masses, partially saturated with blood. Fibrinous and ulcerative inflammation was recorded in the blind intestines, which led to an increase in intestinal volume and the accumulation of dense grayish-white masses that were easily removed from the lumen (Fig. 1).

The thickness of the intestinal wall was variable, with areas of varying color ranging from dark red to grayish pink. There were areas with a thin wall that was white or gray and very thin. In 2.5% of cases, necrosis of the walls of the small intestine with fibrinous peritiflite characterized by white-gray films on the serous membrane of the intestine was detected. When the disease progressed to a chronic form, connective tissue overgrowths were observed at the site of the films, and in some cases, perforated ulcers of the cecum, complicated by fibrinous inflammation of the thoracic-abdominal cavity. Significant fibrin accumulations were found between the intestinal loops and on the surface of organs such as the liver and spleen, confirming the complicated course of the disease.

Histological studies revealed the following pathological changes in the gastrointestinal tract of turkeys with histomoniasis: mucocutaneous inflammation of the glandular gizzard and a heterogeneous color of the mucous membrane ranging from grayish pink to dark red. The small intestine exhibited hyperemia of the mesenteric blood vessels, and its lumen contained a yellowish-brown mucous mass. The mucous membrane was swollen and had a heterogeneous color, mostly pink with a gray or red tint.

Microscopic examination revealed hyperemia of the arteries and capillaries. Thickening and homogenization of the arterial vessel walls, partial endothelial desquamation, and focal endothelial cell proliferation were observed in the submucosal layer of the large intestine. Focal infiltrates of macrophages, histiocytes, lymphocytes, and erythrocytes were present around the arteries in the submucosa of the cecum. The venules and capillaries of the mucous membrane were brightly hyperemic with large accumulations of fluid and erythrocytes. Diffuse proliferation of macrophages, histiocytes, and lymphocytes was observed in the mucosa. The glands located closer to the mucosa were compressed by fluid and cell proliferation; some decreased in size, while others completely atrophied. The epithelial cells were in a state of mucosal dystrophy, and most of them had desquamated. Mucus, exfoliated epithelial cells, and macrophages accumulated on the mucosal surface. In longer cases of the disease, coagulation necrosis of the epithelium and of the mucosal layer of the cecum was observed. In some cases, necrosis covered the entire intestinal mucosa and extended to the submucosal and muscular layers.

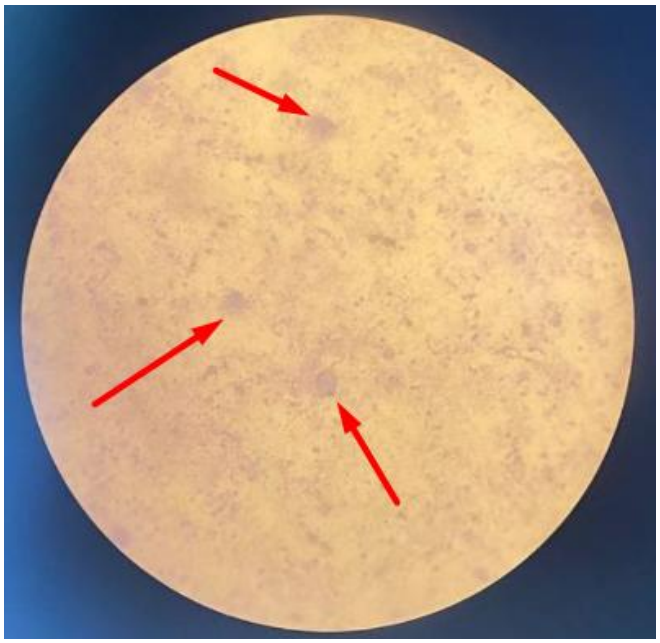

Figure 1. Histomonads in the cecum.

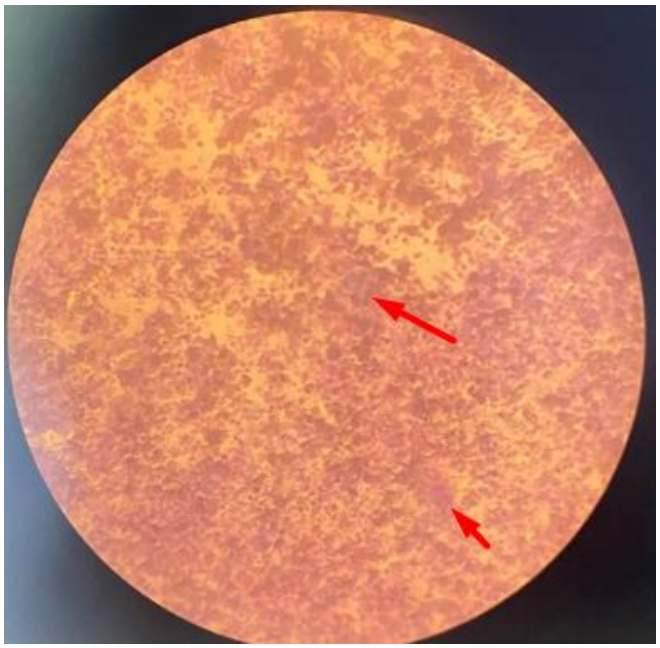

Figure 2. Histological changes in the liver of turkeys with histomoniasis.

These pathomorphological changes confirm that the acute and prolonged course of histomoniasis causes severe dystrophic and inflammatory changes localized in different parts of the turkeys' gastrointestinal tracts.

A study of the pathological and morphological changes in the livers and immunocompetent organs of turkeys with histomoniasis revealed the following characteristic features: necrotizing hepatitis and lymphoid granulomas around histomonads. Diffuse and focal proliferations of lymphoid and histiocytic tissues were also common. These proliferations caused compression, atrophy, and hepatocyte death. They also caused pericholangitis and perivascularitis, which resulted in the formation of bile cylinders and blood clots. In turkeys aged 60–90 days, liver necrosis was observed in only 40% of cases and was mainly represented by miliary and submiliary necrosis up to 2 mm in diameter.

The main macroscopic changes included protein dystrophy and congestive hyperemia. These changes were accompanied by an increase in liver volume and a heterogeneous dark red, brown, or clay color. The liver also had a flaccid consistency.

In 50% of cases, particularly when fibrinous or fibrinous-hemorrhagic typhlitis was present, fibrinous changes and connective tissue proliferation with grayish-white, dense formations were observed on the liver serosa.

Histologic examination revealed congestive hyperemia, protein dystrophy, and the accumulation of cellular infiltrates consisting of macrophages, lymphocytes, and histiocytes surrounding the bile ducts and hepatocytes. The presence of granulomas in some areas resulted in hepatocyte necrosis (Fig. 2).

As the disease progressed, proliferative inflammation characteristic of catarrhal cholangitis formed around the bile ducts.

Conclusions. The highest prevalence of histomoniasis, at 44%, was recorded in summer in Podilsk District, while in Bolhrad District, a maximum of 28% was recorded. Trichomoniasis infection remained relatively low throughout the year, peaking at 4.3% in spring.

The warmer climate in the southern districts (Bolhrad) contributes to the disease spreading more actively in the spring and summer. In the northern districts (Podilsk), higher humidity allows pathogens to survive longer, increasing the risk of infection in the summer and autumn.

Analysis of pathomorphological changes confirmed that histomoniasis causes severe lesions of the cecum, liver, and immunocompetent organs.

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