

Features of seasonal dynamics of sheep Haemonchosis in the territory of Zaporizhzhya region

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Abstract

The article presents the results of studies on the indicators of invasiveness of domestic sheep *Ovis aries* (Linnaeus, 1758), the causative agent of *Haemonchus contortus* (Rudolphi 1803; Cobb 1898) and its characteristics depending on the season in the climatic and geographical conditions of the Zaporizhzhya region. The research was conducted during 2015–2019 on the basis of laboratories of the departments of parasitology and ichthyopathology of the Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies Lviv and Parasitology and Veterinary-Sanitary Examination of the Poltava State Agrarian Academy. Helminths were isolated by the results of complete helminthological sections of the digestive organs of the dead or slaughtered sheep, and the indicators of the extent and intensity of the invasion were established. Specific identification of the identified nematodes was performed taking into account the morphological features of mature males and females. It is proved that *H. contortus* is a fairly widespread species of nematodes in the population of domestic sheep in the territory of the studied region. The magnitude of the invasion of animals reached 66.36 %, the intensity of the invasion – 25.56 ± 1.51 samples/animal (for fluctuations from 1 to 79 sp./an.). It is noted that the causative agent of Haemonchosis is registered during the year. At the same time, the degree of sheep infection depends on the season of the year and is characterized by certain patterns in the extent and intensity of *H. contortus* invasion of sheep. The peak of the animals with the nematodes was detected in the autumn-winter period of the year, EI ranged from 73.23 to 78.57 %. The decline in invasion magnitude was observed in spring (52.63 %) and summer (59.68 %). Seasonal fluctuations in the infestation rates had some differences and were characterized by maximum values in the summer and autumn seasons ranging from 27.49 ± 2.52 to 37.35 ± 2.36 samples/animal. During the winter, the intensity of *H. contortus* infestation in sheep gradually decreased (13.73 ± 2.12 sp/an) and gained minimum values in the spring of the year (10.85 ± 1.78 sp/an). The conducted researches illuminate the current epizootic condition of sheep haemorrhage in the territory of Zaporizhzhya region, expand and supplement the already existing data that will allow to increase the effectiveness of the use of therapeutic and preventive measures in this invasion.

Key words: *Haemonchus contortus*, sheep, invasion intensity, seasonal dynamics.

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1. Introduction

The study of the fauna of parasites of different species of animals, as well as the issues of the relationship between pathogens, the influence of environmental factors on them, and the peculiarities of their spread, has both theoretical and practical significance. This is especially important when developing measures to combat parasitic diseases in different climatic and geographical regions, including Ukraine.

It is well-known that the spread of parasitic infestations in animals, including sheep, is facilitated by the following factors: absence or poor diagnosis; poor level of sanitary culture in the management of the sheep industry; significant contamination of pastures and places of animal maintenance by exo- and endogenous stages of parasite development;

complete or partial absence of treatment and preventive measures; uncontrolled use of anthelmintic drugs.

Ovis aries Linnaeus domestic sheep, 1758 is one of the most versatile in agriculture, widespread in the globe and cost-effective in caring and keeping animals (Voronenko, 2006; Dankvert et al., 2010; Dyndyn & Tokarchuk, 2016; Ohanesian, 2018). Sheep farming is a universal industry that supplies mutton, by-products, milk and wool, ranking third in the world in statistical terms (Tolera, 1998; Kolosov, 2012; Kawęcka et al., 2014).

Invasive diseases, including nematodes, are one of the reasons that is holding back the development of the sheep industry. The impact of anthropogenic factor on the epizootic situation of sheep nematodes is threatened by an increase in the population of parasite disease agents in the environment and an increased risk of contamination of animals in Ukraine as well as in other countries of the world

(Byrka & Berezovskyi, 2003; Abakar et al., 2008, Bohach et al., 2015).

Intestinal helminthiasis is a major economic disadvantage to the sheep industry, among which digestive organs, including hemonchosis, occupy a leading place (Eslami et al., 1979; Gupta et al., 1987; Idris et al., 2012). Scientists say that hemonchosis is a widespread invasion in many countries. For example, in Ethiopia sheep infectivity of hemonhus fluctuates within 67.2–100 % (Badaso & Addis, 2015; Abdo et al., 2017), in Africa – 68–100 % (Attindehou et al., 2012). According to various researchers, animal infestation in Pakistan ranges from 35.4 to 80.6 % (Asif et al., 2008; Raza et al., 2009; Tasawar et al., 2010). In Iran, the infestation rate was 9.3 % (Tehrani et al., 2012) and up to 19.89 % in Nepal (Adhikari et al., 2017).

In the territory of our country, only available information on the prevalence of Haemonchosis invasion of sheep and goats in the territory of Dnipropetrovsk region was found in the available literature; in general, these animals had an EI of 44.4 % (Boyko, 2015).

Scientists have shown that hemonhus, parasitizing in the digestive canal of ruminants, cause various pathological changes, significantly affect all systems of the body, including the immune system, causing secondary immunodeficiencies, promote the development of secondary infections and anemia, reduce organism resistance (Besier et al., 2016).

In spite of the fact that in the available literature there are many questions about epizootology of sheep canal nematodes in different countries of the world, many questions remain about the peculiarities of their flow in the territory of different regions of Ukraine.

In view of the above, the aim of our research was to find out the rates of infestation of sheep by the causative agent in the territory of Zaporizhzhya region, depending on the season. The aim of the study was to investigate the seasonal dynamics of the extent and intensity of the invasion.

2. Materials and methods

The research was conducted during 2015–2019 on the basis of laboratories of the departments of Parasitology and Ichthyopathology of the Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies Lviv and Parasitology and Veterinary-Sanitary Examination of the Poltava State Agrarian Academy.

The collection of nematodes was carried out by the method of complete helminthological autopsy of the digestive organs of dead or slaughtered sheep coming from the farms of Zaporizhzhya region, according to the conventional method (Skrjabin, 1928). The species of nematodes were determined using a determinant (Ivashkin, 1998). A total of 214 intestines from sheep of different breeds and age groups were examined, and 3629 specimens of *Haemonchus contortus* nematodes were identified. The main indicators of invasiveness of sheep were the extent and intensity of the invasion (EI, %; II, sp./an.).

Microscopy of the preparations was performed using microscopes MICROMed XS 55 (China) and OLYMPUS CX 23 (China). Microphotography was performed using a digital camera using a MICROMed 5 Mpix (China) microscope. Statistical processing of experimental results was performed by determining the arithmetic mean (M) and its error (m).

3. Results and discussion

According to the complete helminthological section of the digestive canal of domestic sheep (*Ovis aries*) from Zaporizhzhia oblasts, nematodes of white color (single specimens had a slightly pinkish tinge), relatively thick and long in shape, were found in the small intestine and abomasum (Fig. 1).

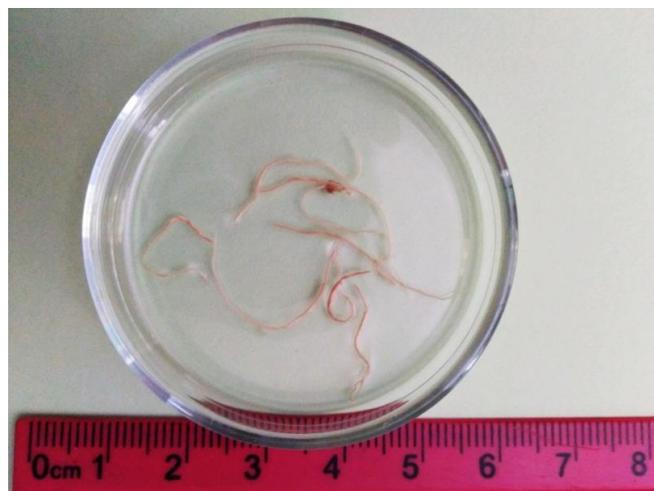


Fig. 1. The appearance of the imagine forms of helminths of the species *H. contortus*

Studies have shown that the identified worms belong to the species *Haemonchus contortus* (Rudolphi 1803; Cobb 1898). Common morphological features for males and females of the nematodes of this species are the presence of a wide and blunt head end (Fig. 2 A.) with a small oral cavity (Fig. 2 B.), in the middle of which there is a small tooth. In addition, at the main end of the parasite are located excretory opening (Fig. 2 B.) and clearly visible cervical papillae (Fig. 2 G.)

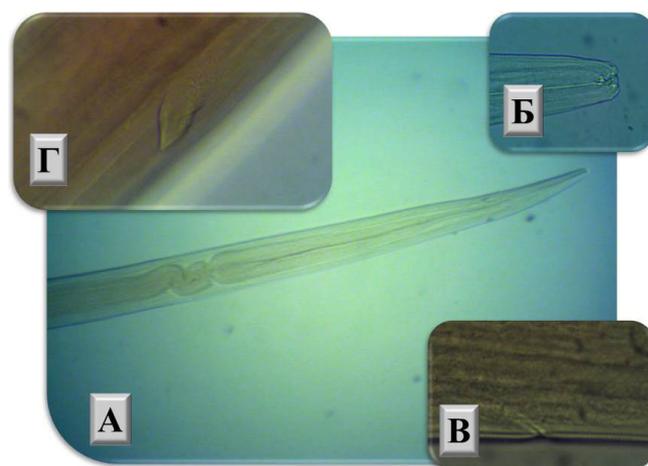


Fig. 2. Main end of *H. contortus* ($\times 100$; $\times 400$)

Differential features for males of this species are the presence of a wide genital bursa with two spicules and a handle between them (Fig. 3 A.), and for females – a section of the vulva (Fig. 3 B.) with a tongue-shaped cuticular valve.

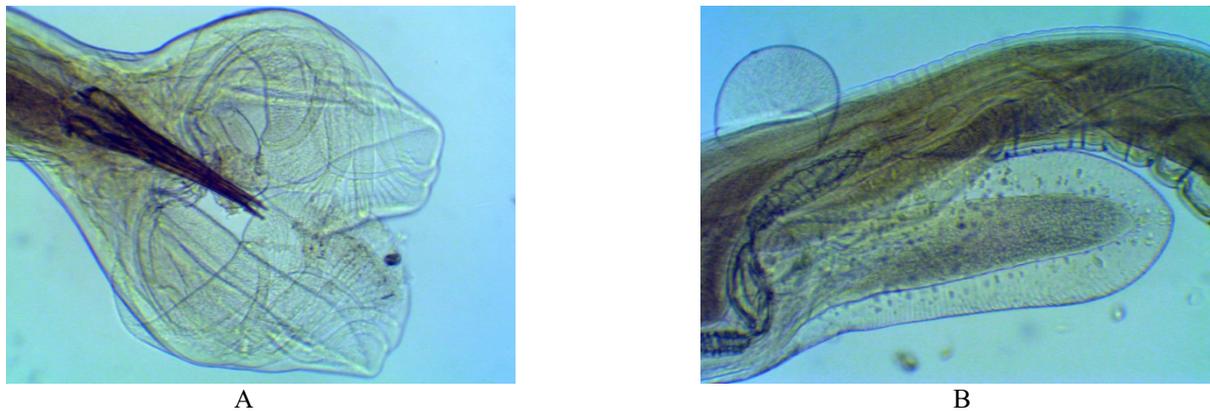


Fig. 3. *H. contortus* ($\times 100$): A – Tail end ♂; B – Vulva ♀

It has been reported that in the region studied, the contagion of animals with the pathogen *H. contortus* reached 66.36 % at an average invasion intensity of 25.56 ± 1.51 sp./an. (for fluctuations from 1 to 79 samples).

Studies have found that hemonchus was detected within a year. At the same time, the degree of affection of sheep depended on the time of year (Table 1).

Table 1

Seasonal dynamics of sheep haemophysysis in the conditions of Zaporizhzhia region farms

Season	Researched	Invaded	EI,%	II, samples/animals	
				M \pm m	min–max
Winter	42	33	78.57	13.73 ± 2.12	1–63
Spring	38	20	52.63	10.85 ± 1.78	1–34
Summer	62	37	59.68	27.49 ± 2.52	3–67
Autumn	71	52	73.23	37.35 ± 2.36	6–79

The maximum number of animals infected with the causative agent of hemonchosis was registered in winter, EI was 78.57 %. In the spring, the number of sick animals was the lowest – up to 52.63 %. Since the summer of the year, the magnitude of invasions has gradually increased, reaching 59.68 %. In the fall, the rates of invasiveness of sheep were 73.23 %.

It should be noted that during the year, the magnitude of the invasion had some fluctuations with two peaks in autumn and winter. As for the indicators of the intensity of the invasion, their seasonal variations had some differences. Thus, in the winter of the year, the invasion intensity was rather low and amounted to 13.73 ± 2.12 sp./an. (for fluctuations from 1 to 63 samples). In spring and summer, the number of nematodes detected averaged 10.85 ± 1.78 and 27.49 ± 2.52 sp./an. (for fluctuations from 1 to 34 and from 3 to 64 specimens), respectively. The maximum value of the indicator of invasion intensity in the autumn period of the year – 37.35 ± 2.36 sp./an. (for fluctuations from 6 to 79 samples).

Thus, it was established that the peak of the extent of Haemonchosis invasion in sheep falls in the autumn-winter period of the year (73.23–78.28 %). At the same time, the maximum values of the invasion intensity were detected in the autumn period of the year (37.35 ± 2.36 sp./an.).

It should be noted that the indicators of invasiveness of sheep on a monthly basis had their own peculiarities (Fig. 4).

Thus, it was found that the highest infestation rate of sheep with the causative agent of hemonchosis is in December

(EI – 86.67 %). In the following months, the number of diseased animals gradually decreased and reached a minimum in May (EI 45.45 %). It should be noted that in general, both in the winter and in the spring months, there is a tendency to reduce the invasiveness of animals. Since the month of June, the number of animals invaded has gradually increased and reached its maximum in November (75.0 %).

A different pattern was observed in the rate of invasion. In December II reached 21.31 ± 4.33 sp./an. (for fluctuations from 3 to 63 sp./an.). It should be noted that from January to April fluctuations in the intensity of Haemonchosis invasion were observed. Thus, compared to December, they decreased slightly to 11.10 ± 1.76 sp./an. (for oscillations from 3 to 19 samples). Further, in February, the lowest animal invasiveness was recorded: 11.10 ± 1.76 animals per head. (for fluctuations from 1 to 17 samples). In March, a slight increase in the invasiveness index was recorded to 9.11 ± 1.81 sp./an. (for fluctuations from 2 to 18 samples), which again fell slightly to 8.17 ± 2.09 sp./an. in April. (for fluctuations from 2 to 18 samples). Since May, the number of nematode sheep found in the body has gradually increased and by the end of summer (August) averaged 33.36 ± 5.11 sp./an. (for fluctuations from 2 to 18 samples). The tendency to increase the number of nematodes of the species *H. contortus* persisted in the autumn months. In November, the highest rate of invasiveness of sheep was observed, reaching 40.28 ± 4.07 sp./an. (for fluctuations from 14 to 79 samples).

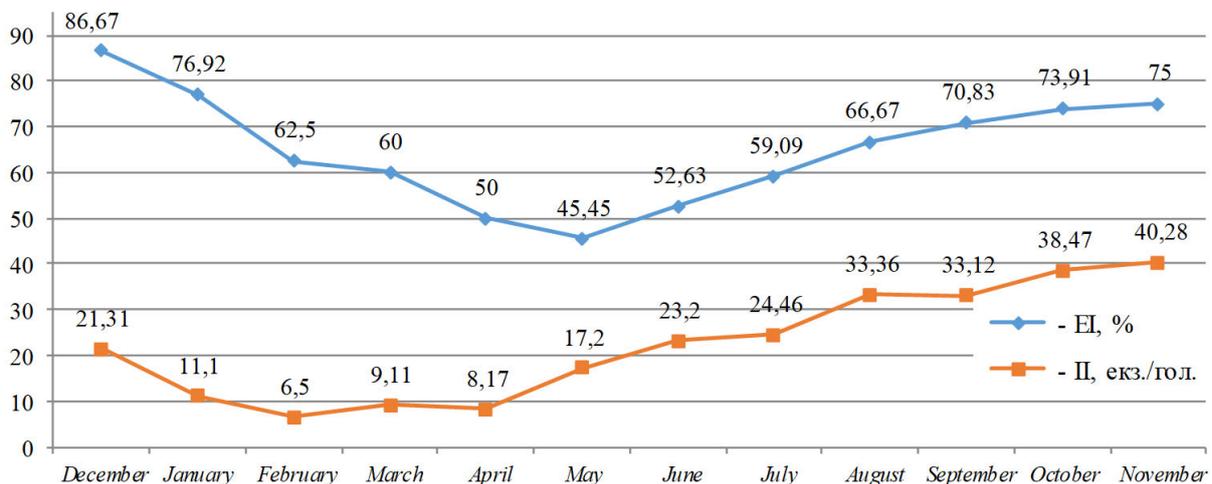


Fig. 4. Indicators of extensiveness and intensity of Haemonchosis invasion of sheep on the territory of Zaporizhzhia region farms during the year

Therefore, as a result of the conducted research, it was established that nematodes of the species *H. contortus* are a fairly common causative agent of Haemonchosis among domestic sheep in the Zaporizhzhya region. The presence of the causative agent of *H. contortus* species and the invasiveness of wild and domestic ruminants in the territory of Ukraine is evidenced by the works of other scientists (Dovgyi et al., 2011; Boyko, 2015; Zvegintsova et al., 2015).

Simultaneously, information on the aspects of the seasonal dynamics of the specified helminthiasis both in the territory of the studied region and Ukraine as a whole was not found in the available scientific literature, so the studies conducted in this direction are relevant.

We established for the first time that Haemonchosis invasion of sheep in the territory of the studied region has a pronounced seasonal dynamics. Thus, a high rate of invasiveness of sheep pathogen in winter with a low intensity of invasion; decrease in indicators of EI and II in the spring; the recurrence of EI and II in the summer-autumn period with the peak of the invasion intensity in November.

The findings obtained confirm the work of scientists from Ethiopia, who recorded the highest number of hemonchus in winter (EI – 66.5 %) (Badaso & Addis, 2015). At the same time, the literature has revealed scientific data on the seasonal dynamics of sheep haemophysis, which are somewhat different from those established by us. Such a high rate of sheep invasiveness was recorded in September (EI – 79.68 %) (Bekuma, 2019). In our opinion, the difference in the rates of infestation of sheep by the causative agent of Haemonchosis is directly related to the research methods. The author used an oesopic method of fecal examination, which in turn reflects only the quantitative index of helminth eggs at one time or another, and cannot be used to calculate the helminths themselves in the animal.

Thus, the data obtained in the experiments are of great theoretical and practical importance in the planning and implementation of diagnostic, as well as therapeutic and prophylactic measures for sheep Haemonchosis.

4. Conclusions

The causative agent of *Haemonchosis contortus* is highly prevalent among domestic sheep in the territory of Zaporizhzhya region (EI – 66.36 %, II – 25.56 ± 1.51 sp./an.).

It is established that the intensity and intensity of hemonchosis invasion has a pronounced seasonal dynamics. It has been found that the peak of hemonchosis invasion occurs in the autumn-winter period (EI – 73.23 and 78.28 %), and the invasion intensity – in the autumn period of the year (37.35 ± 2.36 sp./an.).

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