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Field Study on Prevalence and Risk Factors for Gastrointestinal Nematodes in Selected Herds of Cattle

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Abstract

The purpose of the research is study of the effect of productivity direction and season on cattle contamination with gastrointestinal nematodes.

Materials and methods. Analyzing the criterion of animal husbandry system, two herds of meat cattle of blonde d'aquitaine meat breeds (54 individuals - grazing) of the Limousine breed (53 specimens – rearing without pasture) and two flocks of Holstein-Friesian dairy cattle from three farms (187 – with access to pastures) individuals located in north-western Poland. The research was carried out in 2014–2017. The animals were not dewormed. Attempts for parasitological examinations were collected from January to December from the handpiece or from the bedding immediately after defecation. The study was based on a quantitative method using the McMaster technique, which allowed the number of eggs to be determined in 1 g of feces.

Results and discussion. A high percentage of cattle infection with a mixed infection of GIN was found. The greatest intensity of infection was demonstrated in April, May and June. In these months, the average degree of worming ranged from 58.31 to 92.53 % depending on the type of farm. The lowest level of infection was in winter months: December, January, February. Comparison of the prevalence of invasive endoparasites in dairy and beef cattle showed a higher extensiveness of infection in beef cattle. The increase in the number of eggs was observed along with the increase in the extensiveness of infection in the spring months. During this period, the EPG coefficient ranged from 359–468 eggs/gram. In summer months there was a slight decrease in the number of eggs in the faeces oscillated around 416–325 eggs/gram. Repeated egg expulsion was observed in August. After this period the excretion of eggs decreased. Microclimate factors, especially temperature and atmospheric precipitation, have a huge impact on the spread of helminthosis. Therefore, learning the exact dynamics of infection with endoparasites in an annual cycle has an important practical aspect in the selection of deworming dates.

Keywords: cattle, gastrointestinal nematodes, naturally infection, prevalence.

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Изучение распространения и факторов риска желудочно-кишечных нематодозов у отдельных стад крупного рогатого скота

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Аннотация

Цель исследований: изучение зараженности крупного рогатого скота желудочно-кишечными нематодами в зависимости от направления продуктивности и сезона года.

Материалы и методы. Исследования проводили в 2014–2017 гг. в двух стадах мясного крупного рогатого скота (54 гол. выпасающихся и 53 гол. без выпаса) и двух стадах молочного скота из трех ферм (187 гол. выпасающихся), расположенных на северо-западе Польши. Животные не были дегельминтизированы. Пробы фекалий исследовали с января по декабрь количественным методом МакМастера.

Результаты и обсуждение. Установлена высокая зараженность крупного рогатого скота смешанной инвазией, вызванной желудочно-кишечными нематодами. Наибольшая интенсивность заражения была выявлена в апреле, мае и июне. Экстенсивность инвазии варьировала от 58,31 до 92,53% в зависимости от типа фермы. Низкая зараженность отмечена в зимние месяцы: декабре–феврале. Мясной скот был инвазирован желудочно-кишечными нематодами в большей степени, что, вероятно, связано с тем, что мясной скот выпасают чаще. Увеличение числа яиц в фекалиях наблюдали одновременно с увеличением экстенсивности инвазии в весенние месяцы. В этот период в 1 г фекалий находили 359–468 яиц нематод. В летние месяцы отмечали небольшое уменьшение числа яиц в фекалиях – 416–325 яиц в 1 г фекалий. Повторное снижение числа яиц в фекалиях регистрировали в августе. После этого периода выделение яиц нематод уменьшалось. Температура и атмосферные осадки оказывают огромное влияние на распространение желудочно-кишечных нематодозов. Поэтому изучение динамики заражения эндопаразитами в годовом цикле имеет важный практический аспект при выборе сроков дегельминтизации.

Ключевые слова: крупный рогатый скот, желудочно-кишечные нематоды, зараженность, распространение.

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Introduction

Bovine gastro-intestinal nematodes (GIN) are widely distributed throughout almost the entire globe, regardless of climatic conditions. This feature is due to good adaptation to the host of high resistance to diverse geoclimatic and breeding conditions. Gastro-intestinal nematodes are a parasitic disease of great economic importance. Damage caused to cattle breeding is enormous and can contribute to reducing the profitability of breeding. Economic assessment shows that the

greatest losses caused by parasites occur in the decline of animal production, and not in their mortality. Losses that cause concern both cattle breeders (increased feed consumption, lower milk yield, lower body weight gains, possible falls of animals), industry (confiscation of carcasses and organs infested by the parasite, poorer quality of products) as well as may affect the consumers themselves (reduced value nutritional products [1, 2]).

On German farms, losses caused by GIN per year were estimated at EUR 721.38 and *Fasciola*

hepatica infections (EUR 565.61) [3]. American farmers, on the other hand, suffer more than USD 2 billion a year, which is manifested by the decrease in milk production costs of meat production [4]. In Mexico, damage caused by endo- and ectoparasites of cattle was estimated at USD 1.41 billion per year per one cow amounted to USD 43.57 [5]. Most European herds of cattle are based on pasture grazing, and therefore there is a risk of losses caused by nematodes. Economic evaluation was preceded by an analysis of the distribution of GIN in cattle in a given region [6, 7]. Comprehensive research conducted in European countries: Belgium, Great Britain and Ireland, Germany and Sweden, took into account regional differences in the degree of GIN. These are most often subclinical infections and may still be responsible for production losses [8]. The explanation of cattle infection was explained in different systems in farm management (grazing time, mowing, months of attendance, living conditions and parasitological prophylaxis) [9]. In post-mortem examinations carried out in slaughterhouses in Belgium, the Netherlands and France, nematodes of the gastrointestinal tract were found in 91, 96 and 84 % of beef carcasses tested, with *Ostertagia ostertagi* being the most frequently found species [10–12, 6].

On farms in the northeastern Caucasus where the dynamics of GIN infections were carried out, calves showed that the maximum infection occurred at the end of summer and early autumn. This is evidence that the infection occurs most often during the summer in this region. A known species [13].

Studies on the dependence of the degree of infection and the type of cattle endoparasites and climatic and meteorological conditions in the steppe, semi-arid and desert areas of the region were conducted in the area of Western Kazakhstan. In total, 29 farms were included in the survey, including 8 in the steppe zone, 12 in the sand zone, 9 in the desert in the annual cycle. The seasonality of the GIN infection has been demonstrated during the year. The degree of infection with gut nematodes in winter and before grazing was the smallest and amounted to zones: steppe, desert and desert zones – 27.6% respectively; 14.4 and 11.4%, and in the autumn, at the end of the grazing season, the highest invasiveness was recorded – 44.3; 33.8 and 27.2% [14]. The degree of infection with GIN eggs in Poland, depending on the region, ranged between 46.5–87.0%, native breeds depending on the region 44.3; 33.8 and 27.2% [15]. However, the average frequency of gastrointestinal parasites in heifers imported

to Poland was 83.96% [16]. In addition to serious economic losses, they also cause sanitary problems. Antiparasitic preparations are often given without taking into account regional variables. The research shows that the dynamics of parasite infection in addition to production practices is influenced by seasonal weather patterns, pasture pollution of eggs and larvae of endoparasites that change during the pasture season. Noodles infected with nematodes can excrete up to 2,000 eggs per day in a gram of stool. Adult cattle in Polish conditions staying on a pasture in a system of round-the-clock grazing issued about 43 kg of feces, with a frequency of defecation 10–18 times a day [17, 18].

The outages of these animals lying in the pasture cause various effects both for plants and animals. The plant provides valuable manure contributing to the growth of grass by activating the soil bacterial flora. They are also an unfavorable factor increasing the risk of parasite infection. To infection with parasites, it most often occurs in the pasture, where invasive forms develop on the stems of grasses. Larvae present in the ground soil layer have greater survival, because there are more favorable conditions for survival. (high humidity and less sunlight). Researchers from Liverpool, through the analysis of collective milk samples from ruminant herds in England and Wales, identified factors that increase the risk of infection listed in the tables below (table 1, 2) changing during the pasture season.

Table 1

Factors that increase the risk of parasitism

FACTORS INCREASING THE RISK OF INFECTION	
CLIMATE FACTORS	PHYSICAL FACTORS
Rainy days in summer (from July to October)	The size of pastures on the farm
mild winters	Low-class soils
Chilly spring (May and June)	Presence and number of cattle on the farm
A warm summer	

Table 2

Factors that reduce the risk of parasitism

FACTORS INCREASING THE RISK OF INFECTION	
CLIMATE FACTORS	PHYSICAL FACTORS
Gentle and early spring (February-April)	Slope of the area
Cool summer (July-October)	The size of the cattle herd
Mistrict winter (November-January and February-April)	Soil alkalinity

More than 20 species of nematodes with different degrees of cognition are described in the world literature. In Poland, the GIN belonging to the two families *Trichostrongylidae* (*Trichostrongylus*, *Ostertagia*, *Cooperia*, *Haemonchus* and *Nematodirus*), and *Strongyloidea* (*Strongyloides*) are important. Knowledge of dynamics in the annual cycle of infection with cattle nematodes allows to predict the possibility of parasites appearing at any moment of the year, to plan and implement appropriate time for parasitological prophylaxis.

There is no information on the dynamics of cattle nematode infection in moderate climate.

The present study was therefore conducted in order to obtain information on epidemiology of GIN in cattle for the West Pomeranian region of Poland.

Materials and methods

Individual farms where own research was conducted represented a diversified cast and production profile. Analyzing the criterion of animal husbandry system, two herds of meat cattle of blonde d'aquitaine meat breeds (54 individuals – grazing) of the Limousine breed (53 specimens – rearing without pasture) and two flocks of Holstein-Friesian dairy cattle from three farms (187 – with access to pastures) individuals located in north-western Poland. The research was carried out in 2014–2017. The animals were not dewormed. Attempts for parasitological examinations were collected from January to December from the handpiece or from the bedding immediately after defecation. The study was based on a quantitative method (Fecal Egg Counts – FEC) using the McMaster technique, which allowed the number of eggs to be determined in 1 g of feces (EPG factor) [19].

Results and discussion

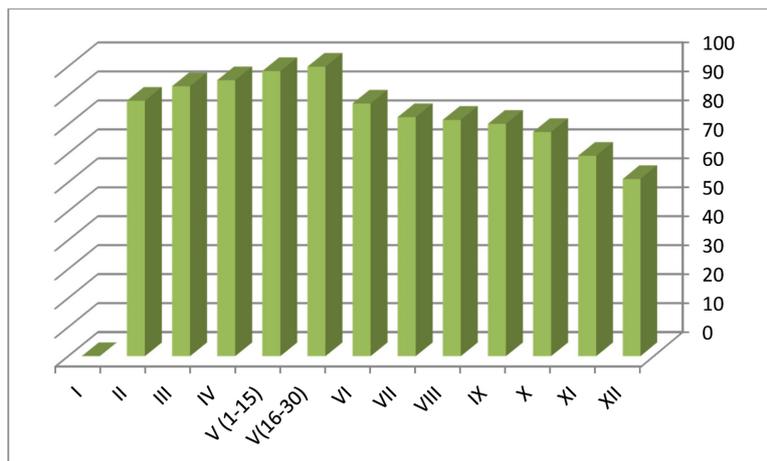
The dynamics of the course of the infection were similar in all the studied groups. In the analyzed flocks, a high percentage of cattle infection with a mixed infection of GIN was found. The greatest intensity of infection was demonstrated in April, May and June. In these months, the average degree of worming ranged from 58.31 to 92.53% depending on the type of farm. The lowest level of infection was in winter months: December, January, February (Fig. 1). Comparison of the prevalence of invasive endoparasites in

dairy and beef cattle showed a higher extensiveness of infection in beef cattle. Such a result of the study is probably a reflection of the fact that meat cattle uses grazing more often, which contributes to the infection of the above-mentioned parasites [20, 21].

The dominant role of GIN in grazing animals is confirmed by other studies conducted in Poland and in neighboring countries. In Western Pomerania, Pilarczyk et al. demonstrated the infection of this group of non-nifty in large herds, at the level of 42%. In addition, they found more than 50% extensiveness of the infection of nematodes from the *Trichostrongylidae* family in animals imported to Poland from Germany, France and the Czech Republic [22]. In regions with a comparable climate in Germany, the prevalence of GIN was confirmed depending on the region of the study in the range from 15.9 to 42.0 % imported to Poland from Germany, France and the Czech Republic [23]. Monitoring in five German herds of dairy cows showed a generally high degree of worming over 70%, including *Eimeria*, GIN and *F. hepatica*. The severity of the infection was related to the strong impacts of the regional and seasonal microclimate. The test results were not confirmed during veterinary visits to the farm [7]. In Belgium, the occurrence of GIN in cattle grazed on pastures was found in 64% of samples [24], in the Netherlands, infection was confirmed in 96% of individuals [25] and in Italy, cattle imported from France, 59% [26].

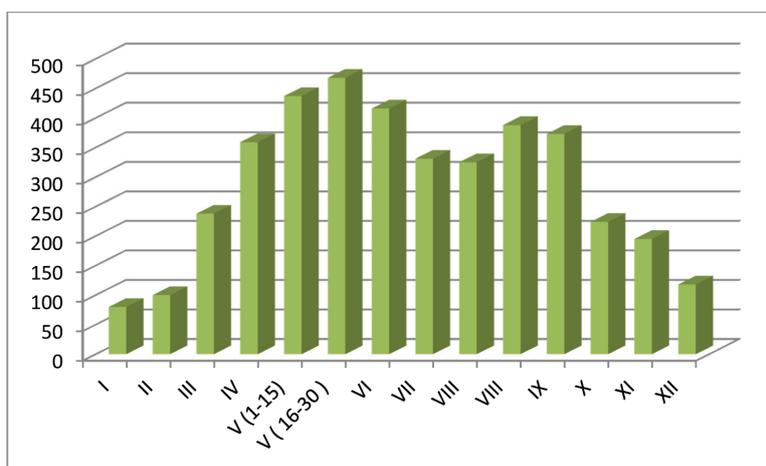
The increase in the number of eggs was observed along with the increase in the extensiveness of infection in the spring months. During this period, the EPG coefficient ranged from 359–468 eggs/gram (Fig. 2). In summer months there was a slight decrease in the number of eggs in the faeces oscillated around 416–325 eggs/gram. Repeated egg expulsion was observed in August. After this period, the excretion of eggs decreased.

In spring period, the infection of GIN in cattle is observed. Spring rise, in which the rapid growth of the larvae dormant occurs. These processes are influenced by both climatic factors (mainly related to temperature and humidity), as well as the infected animal itself (age, decline in immunity and condition, anemia, hormonal regulation related to pregnancies, lactations and the location of the parasite). After this period, the excretion of eggs decreased [27].



Explanation: Vertical axis – prevalence (%), Horizontal axis – months

Fig. 1. Prevalence of GIN infection in cattle in an annual cycle



Explanation: Vertical axis – intensity of infection, Horizontal axis – months

Fig. 2. Intensity (EPG) of infection of GIN in cattle in an annual cycle

Conclusions

Microclimate factors, especially temperature and atmospheric precipitation, have a huge impact on the spread of helminthosis. Therefore, learning the exact dynamics of infection with endoparasites in an annual cycle has an important practical aspect in the selection of deworming dates.

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