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Comparative efficiency of methods of quantitative coproovoscopic diagnostics of strongylidoses of the digestive tract of sheep

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Helminthoses of sheep is widespread in various natural and climatic conditions of many countries of the world, including Ukraine. Among them, strongylidoses of the digestive tract is most often diagnosed. Helminths parasitize in the organs and tissues of animals and cause pathological changes in them, causing a negative impact on all body systems and, in particular, on the immune system, causing secondary immunodeficiencies, contributing to the development of secondary infections, reducing the body's resistance and productivity of sheep. The aim of the work was to determine the effectiveness of the proposed method of quantitative coproovoscopic diagnosis of strongylidoses of the digestive tract of sheep and to compare its sensitivity with commonly known methods. The proposed useful model refers to the field of veterinary medicine, namely, veterinary parasitology, methods of coproovoscopy, in particular, quantitative methods of detecting eggs of strongylides pathogens of the digestive tract of sheep. In laboratory conditions, the proposed method and well-known methods of quantitative coproovoscopy (method of counting helminth eggs in feces according to Liashenko, centrifugal-flotation method according to Taylor) were compared when conducting laboratory diagnostics of strongylidoses of the digestive tract of sheep. It was determined that when using the tested methods, 100 % of strongylides eggs were detected in the digestive tract. The proposed method turned out to be the most effective in terms of indicators of the intensity of strongylidous invasion, where its sensitivity was significantly higher by 1.2 times – compared to the centrifugal-flotation method according to Taylor and by 5.9 times – compared to the method of counting helminth eggs in feces for Liashenko. The flotation liquids used in the proposed method and the centrifuge-flotation method showed the highest coagulation properties relative to undigested fodder residues, where a small amount of small undigested fodder residues were attached to the slide, which increased the efficiency of microscopy. The obtained results of parasitological studies indicate the expediency of using the proposed method of quantitative coproovoscopic diagnosis of strongylidoses of the digestive tract of sheep for a more effective lifetime diagnosis of the aforementioned infestations.

Keywords: parasitology, strongylidoses of the digestive tract, sheep, lifelong diagnosis, coproovoscopy, efficiency.

Порівняльна ефективність методів кількісної копроовоскопічної діагностики стронгілідозів травного тракту овець

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Гельмінтози овець широко розповсюджені у різних природно-кліматичних умовах багатьох країн світу, зокрема й України. З-поміж них найчастіше діагностують стронгілідози травного тракту. Гельмінти паразитують в органах і тканинах тварин та викликають у них патологічні зміни, чим спричинюють негативний вплив на всі системи організму і, зокрема на імунну систему, викликаючи вторинні імунодефіцити, сприяють розвитку секундарних інфекцій, знижують резистентність організму і продуктивність овець. Метою роботи було визначити ефективність запропонованого способу кількісної копроовоскопічної діагностики стронгілідозів травного тракту овець та порівняти його чутливість із загальновідомими способами. Запропонована корисна модель відноситься до галузі ветеринарної медицини, а саме – ветеринарної паразитології, до способів копроовоскопії, зокрема кількісних способів виявлення яєць збудників стронгілід травного тракту овець. У лабораторних умовах порівнювали запропонований спосіб та загальновідомі способи кількісної копроовоскопії (спосіб підрахунку яєць гельмінтів у фекаліях за Ляшенко, центрифужно-флотаційний спосіб за Taylor) при проведенні лабораторної діагностики стронгілідозів травного тракту овець. Визначено, що при використанні випробуваних методів 100 %-во виявляли яйця стронгілід травного тракту. Найбільш ефективним відносно показників інтенсивності стронгілідозної інвазії виявився запропонований спосіб, де його чутливість була достовірно вищою у 1,2 раза – порівняно із центрифужно-флотаційним способом за Taylor та у 5,9 разів – порівняно зі способом підрахунку яєць гельмінтів у фекаліях за Ляшенко. Використовувані у запропонованому способі та центрифужно-флотаційному способі флотаційні рідини проявляли найвищі коагуляційні властивості відносно неперетравлених решток корму, де до предметного скельця прикріплювалася незначна кількість дрібних решток неперетравленого корму, що підвищувало ефективність проведення мікроскопії. Отримані результати паразитологічних досліджень вказують на доцільність використання запропонованого способу кількісної копроовоскопічної діагностики стронгілідозів травного тракту овець для більш ефективної зажиттєвої діагностики вищезазначених інвазій.

Ключові слова: паразитологія, стронгілідози травного тракту, вівці, зажиттєва діагностика, копроовоскопія, ефективність.

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Introduction

Gastrointestinal parasites are one of the most common causative agents of invasive diseases in sheep. Clinical signs and consequences depend on the parasite fauna present and the intensity of the infestation. In sheep, they can vary from a decrease in body weight to lethal consequences caused by anemia, diarrhea, intoxication and inflammatory processes in the digestive tract. In addition, parasites negatively affect the metabolism in the body of the infested animal and lead to a decrease in their resistance, feed consumption due to anorexia, and increased susceptibility to other pathogens [1–5].

In particular, on the territory of Australia, the main nematodes of the digestive tract are causative agents of strongylatoses of 7 genera and 14 species: *Haemonchus* (*H. contortus*), *Teladorsagia* (*T. circumcincta*), *Trichostrongylus* (*T. axei, T. colubriformis, T. vitrinus*), *Cooperia* (*C. curticei*), *Nematodirus* (*N. spathiger, N. fillicollis, N. abnormalis, N. battus*), *Oesophagostomum* (*O. venulosum, O. columbianum*), *Chabertia* (*S. ovina*) *and Vunostomum* (*V. trigonocephalum*) [6, 7].

In some regions of Northern India, South Asia, as well as North-Eastern Brazil, the causative agents of strongylatosis of the species *Haemonchus contortus* (EI up to 82 %), less often – the genera *Nematodirus* (up to 60 %), *Trichostrongylus* (*T. colubriformis, T. axei, T. ovis*) (up to 58 %), *Chabertia* (*Ch. ovina*) (up to 52 %), *Oesophagostomum* (*O. columbianum, O. radiatum*) (up to 46 %), *Ostertagia* (*O. circumcincta, O. oestertagi*) (up to 3.0 %), *Bunostomum* (*V. phlebotomum*) (1.4 %), *Cooperia* (0.2 %) [8–10].

It should be noted that most of the new and well-known flotation methods and methods of coproovoscopic diagnostics described in the literature are qualitative. That is, they allow to detect invasive elements in the researched material, at the same time they do not allow to adequately assess the organism's damage by this or that pathogen of helminths. In this regard, methods of quantitative coproscopic studies are used to determine the exact number of eggs in this or that volumetric amount of feces. They make it possible to relatively accurately determine the intensity of the invasion of helminth embryos (eggs and larvae) in animals and to evaluate the effectiveness of treatment and prevention measures. For this purpose, well-known methods using special counting cameras are used: McMaster's (1976), Halat-Yevstafieva's (2007, 2008), according to Ponomar S. I. (1997), according to Dovhii Yu. Yu. (2004) [11–15]. Quantitative counting of helminth eggs is also carried out without the use of special equipment. For this purpose, the volume of the test material, the area of the test surface and the parasitological loop are taken into account. Such methods include the method of Mazannyi O. V. et al. (2005), Liashenko. Ye. V. et al. (2012), Taylor M. A. et al. (2015) [16–18]. Therefore, it is urgent to introduce new, improved, more effective methods of quantitative coproovoscopy for strongylidoses of the digestive tract of sheep.

The aim of the study

The aim of the research was to determine the effectiveness of the proposed method of quantitative coproovoscopic diagnosis of strongylidoses of the digestive tract of sheep and to compare its sensitivity with commonly known methods.

Materials and methods

The work was carried out during 2024 on the basis of the Laboratory of the Department of Parasitology and Veterinary-Sanitary Examination of the Poltava State Agrarian University and in the conditions of farms of the Poltava district where sheep are kept.

In order to establish the effectiveness of the proposed method in production conditions, an experimental study was conducted. To do this, in the conditions of farms in the Poltava district, feces were collected from sheep, and they were studied by the flotation method according to Kotelnikov-Khrenov [19].

For the experiment, samples were used in which strongylides eggs were found in the digestive tract. In total, 10 samples of feces were collected from sheep known to be infested with eggs of strongylides in the digestive tract. The same sample of feces was thoroughly homogenized in a porcelain mortar and examined: by the method of counting helminth eggs in feces (according to Liashenko et al., 2012) [17], by the centrifugal-flotation method (according to Taylor et al., 2015) [18], as well as the proposed method.

The evaluation criteria were the following indicators: the number of positive samples, the average number of strongylides eggs of the digestive tract in 1 g of faeces and their minimum and maximum values, as well as the presence of foreign remains of different sizes under the microscope of the preparation:

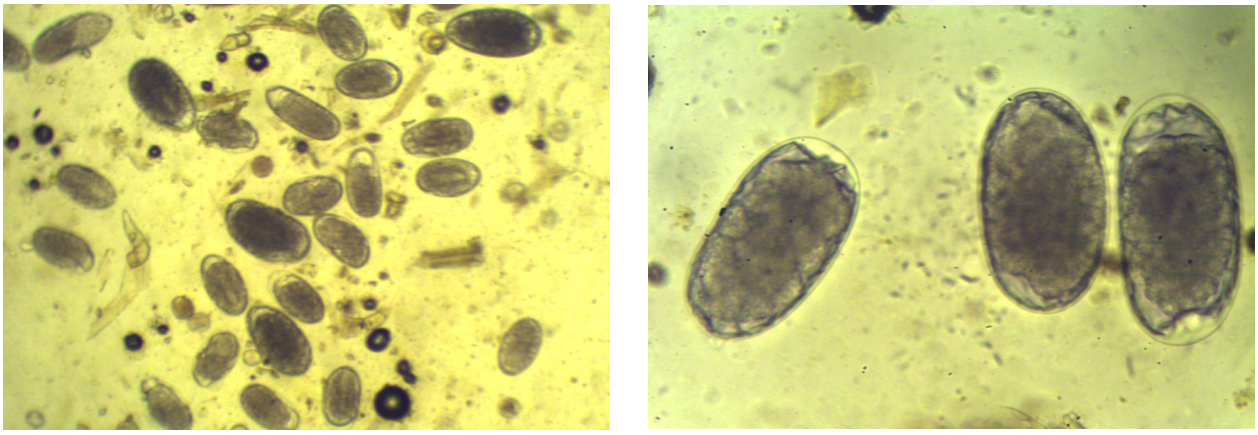
• – a small number of small foreign remains;

•• – simultaneous detection of a large number of small and a small number of large remains.

Statistical processing of the results of experimental studies was carried out by determining the arithmetic mean (M), standard deviation (SD) and probability level (P) using the technique of univariate analysis of variance using Fisher's test.

Results and discussion

The conducted studies established that all the tested methods allowed to detect the eggs of strongylides of the digestive tract (***Fig. 1***), where 100 % of the examined samples revealed the eggs of strongylides of the digestive tract (***Fig. 2***).



a b

Fig. 1. Strongylides eggs of the digestive organs, detected in sheep using proven coproscopic methods: a – × 120, b – × 400

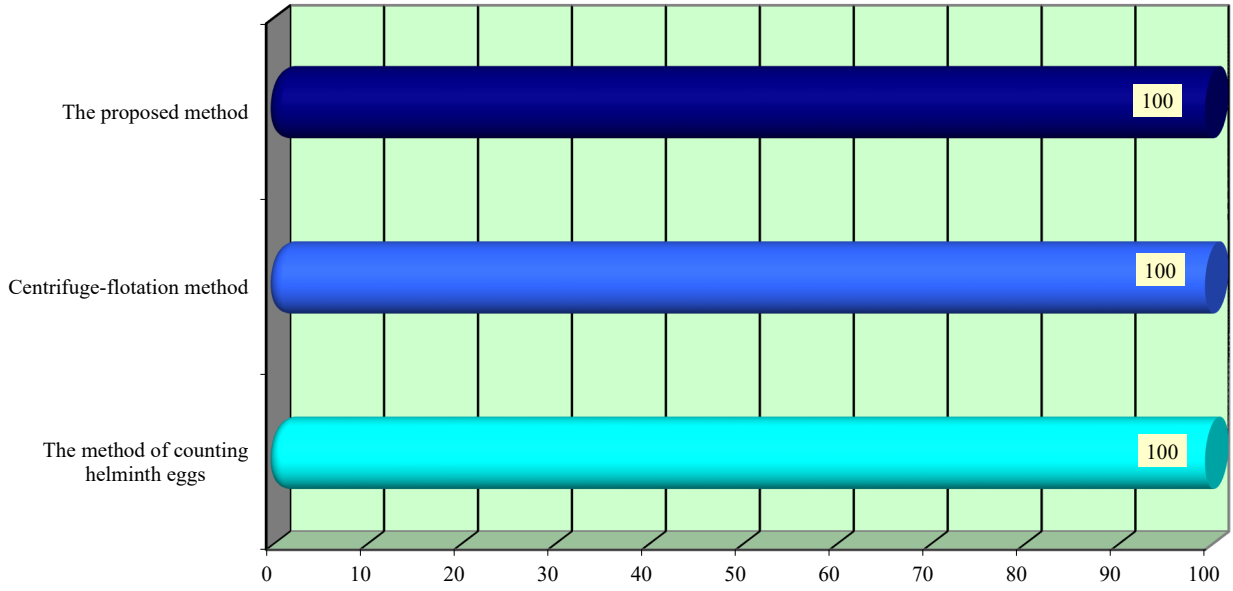


Fig. 2. Sensitivity of methods of quantitative coproovoscopy for strongylidoses of the digestive tract of sheep

It was established that the proposed method was the most effective in terms of indicators of the intensity of strongylidous invasion, where when using the method of counting helminth eggs in feces (according to Liashenko et al., 2012), the number of detected eggs was 51.30±13.41 eggs/g (with variations from 30 to 76 eggs/g), when using the centrifugal-flotation method (according to Taylor et al., 2015) the number of detected eggs was 264.60±118.20 eggs/g (ranging from 144 to 522 eggs/g), when using the proposed method, the number of detected eggs was 304.20±104.42 eggs/g (with fluctuations from 126 to 288 eggs/g). At the same time, the effectiveness of the proposed method was 1.2 times higher compared to the centrifuge-flotation method (***Fig. 3***) and 5.9 times compared to the method of counting helminth eggs in feces, P<0.001 (***Fig. 4***).

It was found that when using the proposed method and the centrifuge-flotation method, flotation liquids showed the highest coagulation properties relative to undigested feed residues, where a small amount of small foreign residues floated to the surface of the flotation fluid. When applying the method of counting helminth eggs in feces, a large number of small and a small number of large remains were simultaneously detected under microscopy, which made the study difficult.

World literature proves the significant distribution and diversity of causative agents of strongylidoses of the digestive tract among sheep throughout the world [6–8]. This, in turn, determines the importance of using inexpensive and highly effective methods of quantitative coproovoscopy, which have different sensitivities relative to one or another causative agent of invasion [16–18]. Therefore, a study was conducted to determine the comparative effectiveness of well-known methods and the proposed method in chronic diagnosis of strongylidoses of the digestive tract in sheep.

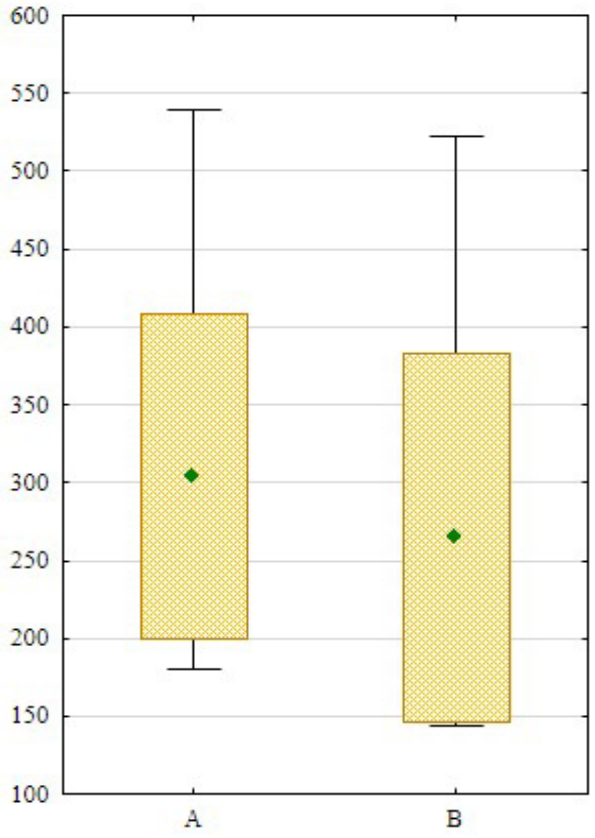


Fig. 3. Comparative efficiency of methods of quantitative coproscopy for strongylidoses of the digestive tract of sheep (n=10):
A – the proposed method, B – centrifugal-flotation method

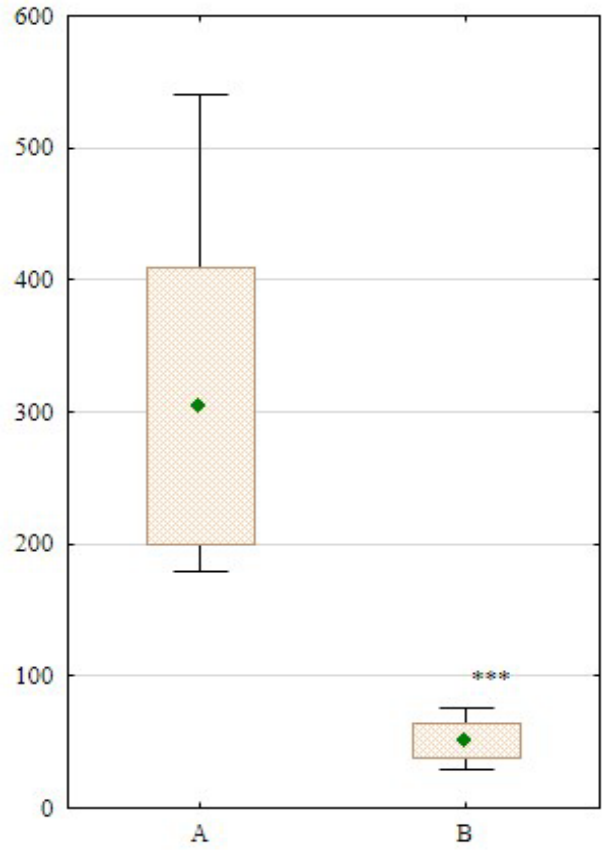


Fig. 4. Comparative effectiveness of methods of quantitative coproscopy for strongylidoses of the digestive tract of sheep (n=10):
A – the proposed method, B – method of counting helminth eggs in feces; P<0.001 – relative to A

The conducted studies determined that the proposed method was the most effective in terms of indicators of the intensity of strongylidous invasion, where its sensitivity was significantly higher by 1.2 times – compared to the centrifugal-flotation method according to Taylor and by 5.9 times (P<0.001) – compared to by Liashenko's method of counting helminth eggs in feces. The flotation liquids used in the proposed method and the centrifugal-flotation method showed the highest coagulation properties relative to undigested feed residues. Where a small amount of small remains of undigested feed was attached to the slide, which increased the efficiency of microscopy.

Similar studies were conducted by scientists, where Trach's method was more effective (P<0.001) than McMaster's method when diagnosing strongylidoses in horses. The authors determined that a greater number of eggs (by 3.26–59.02 %) were detected in faecal samples by the Trach's method than by the McMaster's method, the sensitivity of which was low and was at least 25 eggs/g [20]. Therefore, the detection of parasites in animals is a modern problem in veterinary practice and requires the selection of other, more accurate research methods for the successful fight against animal helminthiasis.

The obtained results of parasitological studies indicate the expediency of using the proposed method of quantitative coproovoscopic diagnosis of strongylidoses of the digestive tract of sheep for a more effective lifetime diagnosis of the aforementioned infestations.

Conclusions

The proposed method of quantitative coproovoscopic diagnosis of sheep to detect eggs of the strongylidic type shows a high index of flotation ability relative to the eggs of the eggs of the strongylidic type (304.20 – 186.30 EGF), where its diagnostic efficiency in relation to the indicators of the intensity of the strongylidous invasion turned out to be higher than the centrifugal-flotation method according to Taylor (by 1.2 times) and method counting of helminth eggs in feces according to Liashenko (by 5.9 times, P<0.001). The effectiveness of the proposed method is confirmed by the high coagulation properties of the used floatant relative to undigested feed residues.

Conflict of interest

The authors state that there is no conflict of interest.

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