

Testing the efficiency of the improved method of coproovoscopy for gastrointestinal nematodes of dogs

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Article info

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Dogs are an important component of established parasitic systems. At the same time, the unregulated accounting system and the lack of data on their number in specific regions make it difficult to imagine the objective epizootological parameters of this population and, in particular, their epidemic danger. Parasitic systems function in the dog population, the co-members of which are gastrointestinal nematodes, where the causative agents of trichurosis and uncinariasis are the most common. The aim of the work was to improve, test and determine the effectiveness of the method of lifelong coproovoscopic diagnosis of nematodes of the digestive tract of dogs. The improved method refers to the field of veterinary medicine, namely veterinary parasitology, to methods of coproscopy, in particular, to methods of detecting eggs of causative agents of nematodes of the digestive tract of dogs. We conducted tests of flotation methods of coproovoscopy, such as: Fulleborn's, Kotelnikov-Khrenov's, the method of coproovoscopy for trichurosis in sheep and the improved method for laboratory diagnosis of nematodes of the digestive tract of dogs. It was found that 80 and 86.7 % of positive samples were detected for trichurosis and uncinariasis in dogs by the Fulleborn's method, 93.3 and 100 % of positive samples were detected by the Kotelnikov-Khrenov's method, and 100 % of positive samples were detected by the coproovoscopy method for sheep trichurosis and the improved method. When using the Fulleborn's method, the indicators of the intensity of trichurosis and uncinariasis invasion were on average 69.7 and 44.9 eggs/g, Kotelnikov-Khrenov's – 98.6 and 64.8 eggs/g, and the coproovoscopy method for sheep trichurosis – 106.7 and 68.0 eggs/g, improved method – 130.7 and 80.3 eggs/g. The improved method of lifelong coproovoscopy diagnosis of trichurosis and uncinariasis in dogs was more effective compared to the Fulleborn's method by 46.7 and 44.1 %, Kotelnikov-Khrenov's – by 24.6 and 19.3 %, the coproovoscopy method for sheep trichurosis – by 18.4 and 15.3 %. The improved method and method of coproovoscopy for trichurosis of sheep showed the highest coagulation properties in relation to undigested fodder residues, where a small amount of small undigested fodder residues surfaced during the research. The obtained results allow recommending an improved method of coproovoscopy for effective laboratory diagnosis of trichurosis and uncinariasis in dogs.

Keywords: parasitology, gastrointestinal nematodes, dogs, diagnostic methods, effectiveness.

Випробування ефективності удосконаленого способу копроовоскопії за шлунково-кишкових нематодозів собак

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Собаки є важливою складовою сформованих паразитарних систем. У той же час, неналагоджена система обліку та відсутність даних про їх кількість у конкретних регіонах ускладнює уявлення про об'єктивні епізоотологічні параметри цієї популяції і, зокрема, про їх епідемічну небезпеку. У популяції собак функціонують паразитарні системи, співчленами яких є шлунково-кишкові нематодози, де найбільш поширеними є збудники трихуриду та унцинаріозу. Метою роботи було удосконалити, випробувати та визначити ефективність способу захиттєвої копроовоскопічної діагностики нематодозів травного тракту собак. Удосконалений спосіб відноситься до галузі ветеринарної медицини, а саме – ветеринарної паразитології, до способів копроскопії, зокрема, способів виявлення яєць збудників нематодозів травного тракту собак. Проводили випробування флотацийних методів копроовоскопії таких як: Фюллеборна, Котельникова-Хренова, способу копроовоскопії за трихуриду овець та удосконаленого способу при лабораторній діагностиці нематодозів травного тракту собак. Виявлено, що за трихуриду та унцинаріозу собак методом Фюллеборна виявлено 80 та 86,7 % позитивних проб, методом Котельникова-Хренова – 93,3 та 100 % позитивних проб, методом копроовоскопії за трихуриду овець та удосконаленим способом – 100 % позитивних проб відповідно. При використанні методу Фюллеборна показники інтенсивності трихуридної та унцинаріозної інвазії у середньому становили 69,7 та 44,9 яєць/г, Котельникова-Хренова – 98,6 та 64,8 яєць/г, способу копроовоскопії за трихуриду овець – 106,7 та 68,0 яєць/г, удосконаленого способу – 130,7 та 80,3 яєць/г. Удосконалений спосіб захиттєвої копроовоскопічної діагностики трихуриду та унцинаріозу у собак виявився ефективнішим порівняно зі способом Фюллеборна відповідно на 46,7 та 44,1 %, Котельникова-Хренова – на 24,6 та 19,3 %, способу копроовоскопії за трихуриду овець – на 18,4 та 15,3 %. Удосконалений спосіб та спосіб копроовоскопії за трихуриду овець проявили найвищі коагуляційні властивості відносно неперетравлених решток корму, де у процесі дослідження спливали незначна кількість дрібних решток неперетравленого корму. Отримані результати дозволяють рекомендувати удосконалений спосіб копроовоскопії для ефективного проведення лабораторної діагностики трихуриду та унцинаріозу собак.

Ключові слова: паразитологія, шлунково-кишкові нематодози, собаки, методи діагностики, ефективність.

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Introduction

Scientific literature shows that a significant number of helminth species parasitize the dog population, the largest part of which in the sexually mature stage parasitizes in the gastrointestinal tract of animals. These helminths cause significant damage to the health of dogs, and also contaminate environmental objects, contributing to the spread of infestation. The most common of them are nematodes of the species *Trichuris vulpis*, *Uncinaria stenocephala*, and *Toxocara canis*. Some of them are dangerous for humans and farm animals [1–6].

Methods of lifelong and postmortem (postmortem) diagnostics are used to identify and determine the species composition of parasites. Lifelong laboratory diagnostics is based on three main approaches: direct detection and identification of parasites at various stages of their development; detection of their antigens; detection of genetic material of pathogens [7–11].

In clinical practice, the methods of diagnosing parasitic diseases are selected depending on the localization of pathogens and taking into account the peculiarities of their biological development cycle. The most common method of laboratory diagnosis of gastrointestinal parasitoses is the examination of animal feces. Relatively inexpensive and simple coprological studies allow to detect not only parasites of the gastrointestinal tract, but also parasites of the liver, as well as the respiratory system, the eggs or larvae of which are swallowed with sputum. The methods of examining feces are based on the detection and identification of various stages of pathogens and the study of their characteristic morphological features [12–17].

To overcome certain shortcomings of well-known methods of coproovoscopy, scientists are constantly developing new technical solutions for processing feces samples and isolating parasites in feces based on the physicochemical principles of separating solid and liquid compounds [18, 19]. Currently, new systems based on capturing images by automatically scanning microscopic slides. During experimental testing of the above method, its sensitivity ranged from 74 to 99 % for the simultaneous detection of up to 15 types of parasites [20, 21]. However, these computational methods achieve these diagnostic rates only by processing faecal samples for parasite detection and producing thick drops on slides with high removal of fecal debris [22].

The aim of the study

The aim of the research was to improve, test and determine the effectiveness of the method of lifelong coproovoscopy diagnosis of nematodoses of the digestive tract of dogs.

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 the conditions of the private veterinary clinic "Dovira" (Kharkiv).

In order to establish the effectiveness of the proposed method of coproscopic examination of dogs for the presence of nematode eggs, a comparison was made between the proposed method and the well-known Fulleborn's, Kotelnikov-Khrenov's [23] method of coproovoscopy for sheep trichurosis [24].

Feces from dogs spontaneously infected with the causative agent of trichurosis and uncinariosis were used for the experiment. With each flotation solution, 15 samples of feces were examined according to the technique proposed in the method of coproscopic examination of dogs for the presence of nematode eggs. Samples were settled in each of the flotation solutions for 10 minutes. The number of detected nematode eggs was counted in 1 g of feces.

Evaluation of the methods was carried out according to the indicators of:

- actual specific gravity of the flotation solution;
- flotation capacity (number of positive samples and average number of detected nematode eggs);
- coagulation ability:
 - – a small number of small foreign remains;
 - – simultaneous detection of a large number of small and a small number of large-sized remains;
 - – a large number of both small and significant foreign 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

It was determined that all tested methods allowed detection of nematode eggs of *Trichuris vulpis* species (**Fig. 1 a**) and *Uncinaria stenocephala* (**Fig. 1 b**).

It was found that 80 and 86.7 % of positive samples were detected for trichurosis and uncinariosis in dogs by the Fulleborn's method, 93.3 and 100 % of positive samples were detected by the Kotelnikov-Khrenov's method, and 100 % of positive samples were detected by the coproovoscopy method for sheep trichurosis and the improved method (**Fig. 2**).

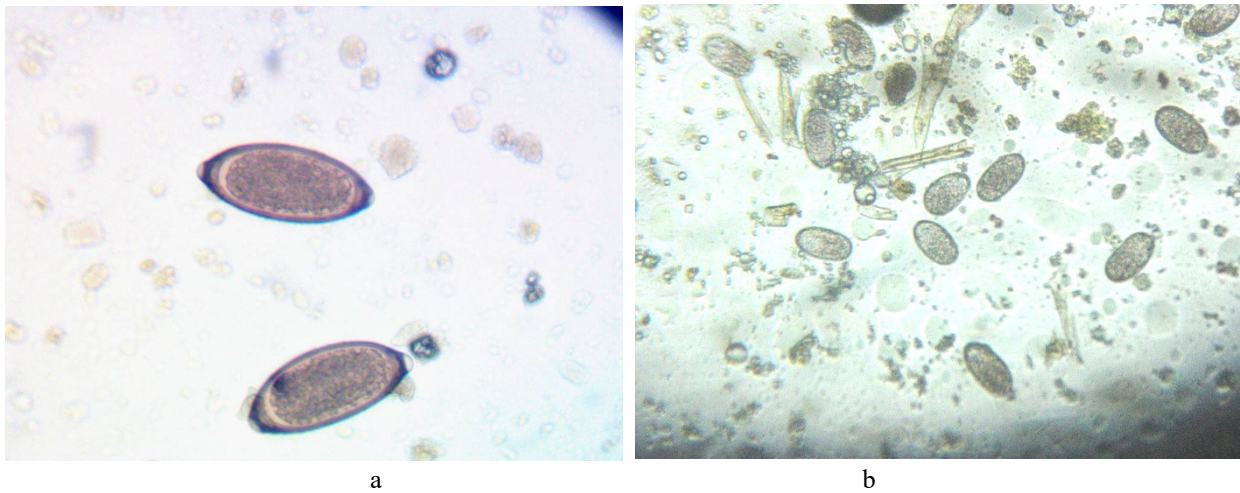


Fig. 1. Nematode eggs detected during coproscopic examination of dogs:
a – Trichuris vulpis ($\times 400$); *b – Uncinaria stenocephala* ($\times 150$)

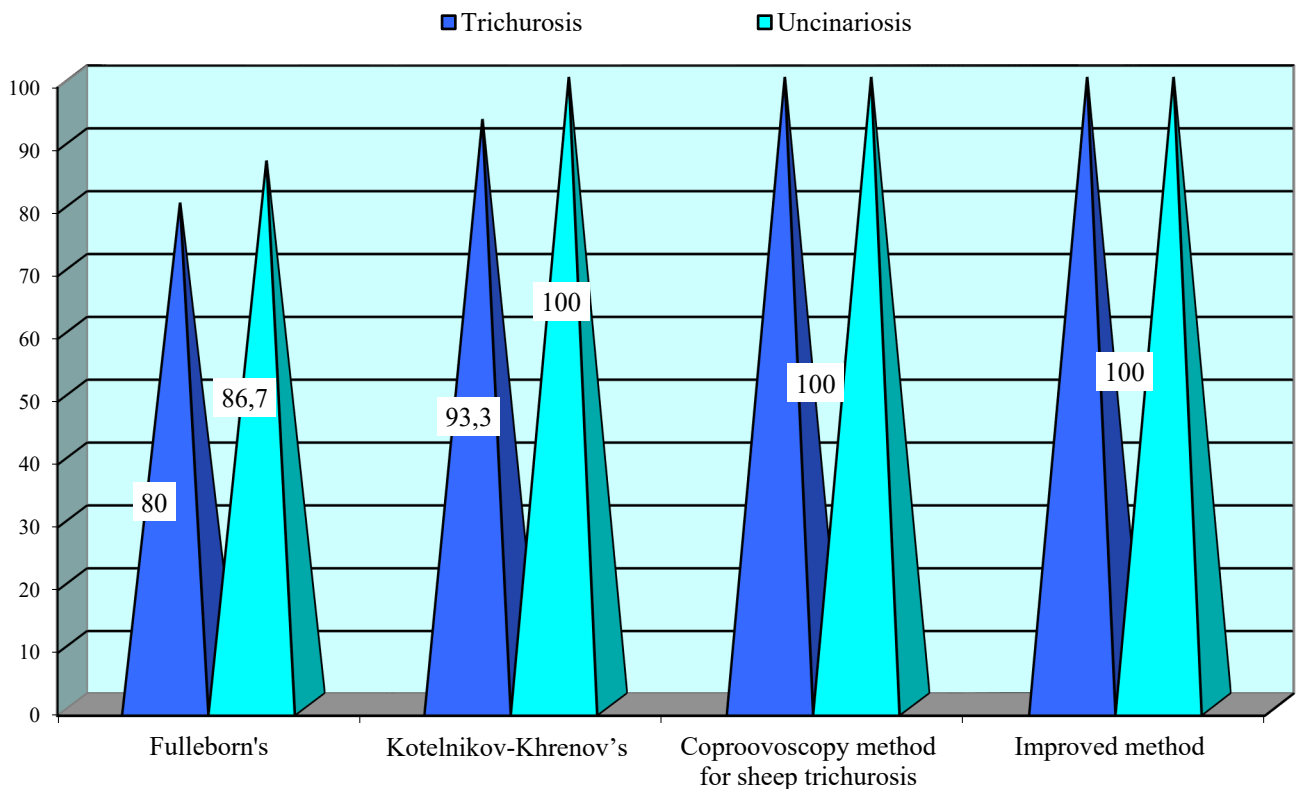


Fig. 2. The number of detected positive samples during laboratory diagnostics nematodoses of the digestive tract of dogs (%)

At the same time, indicators of the intensity of trichurous and uncinariosis invasion differed significantly depending on the method of coproovoscopy used. When using the Fulleborn's method, the indicators of the intensity of trichurous and uncinariosis infestation were 69.7 ± 11.1 and 44.9 ± 12.2 eggs/g, respectively, Kotelnikov-Khrenov's – 98.6 ± 17.9 and 64.8 ± 12.9 eggs/g, the method of coproovoscopy for sheep trichurosis – 106.7 ± 24.8 and 68.0 ± 12.3 eggs/g, improved method – 130.7 ± 30.7 and 80.3 ± 17.1 eggs/g.

It was established that the improved method was the most effective in terms of indicators of the intensity of trichurous and uncinariosis infestation. The latter exceeded the effectiveness compared to the Fulleborn's method by 46.7 and 44.1 % ($P < 0.001$), the Kotelnikov-Khrenov's method by 24.6 % ($P < 0.001$) and 19.3 % ($P < 0.01$), the method coproovoscopy for sheep trichurosis – by 18.4 and 11.7 % ($P < 0.05$) (**Fig. 3** and **Fig. 4**).

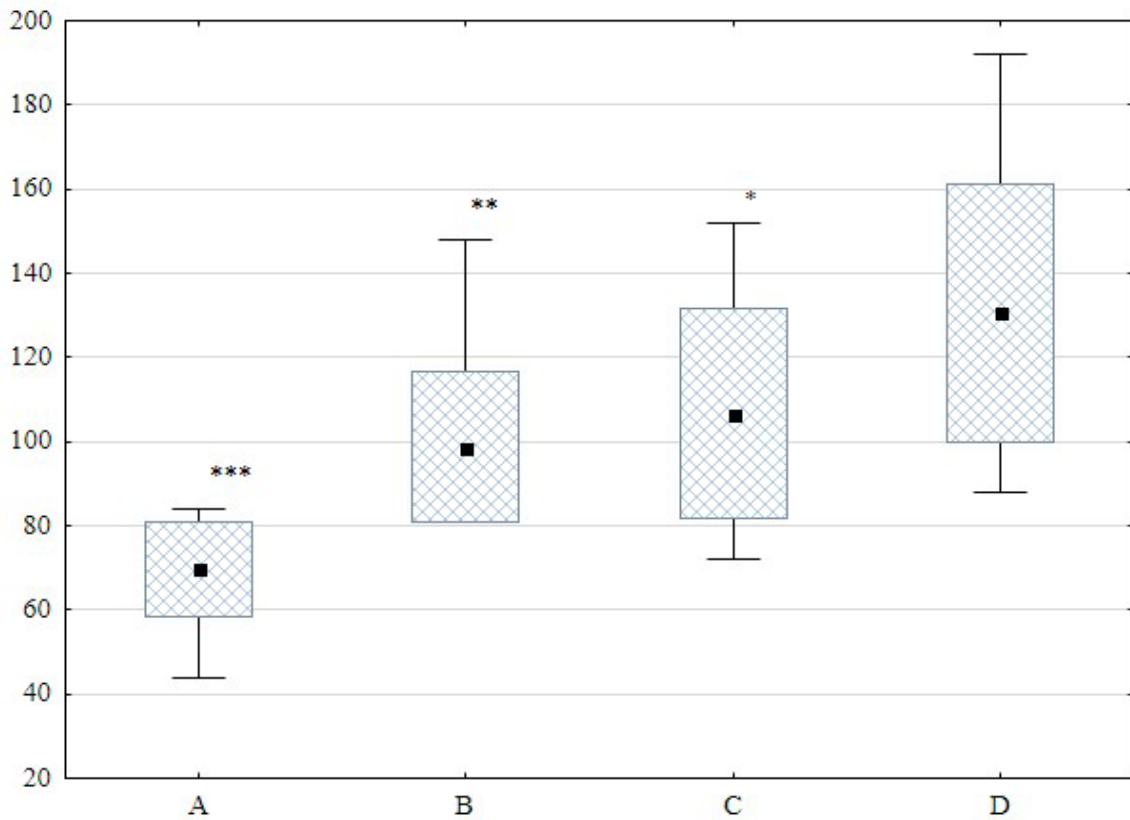


Fig. 3. Comparative effectiveness of coproscopy methods for trichurosis in dogs (n=15):
 A – Fulleborn’s method; B– Kotelnikov-Khrenov’s method; C – method of coproovoscopy for trichurosis of sheep;
 D – improved method; P<0.05; P<0.01; P<0.001 – relative to D

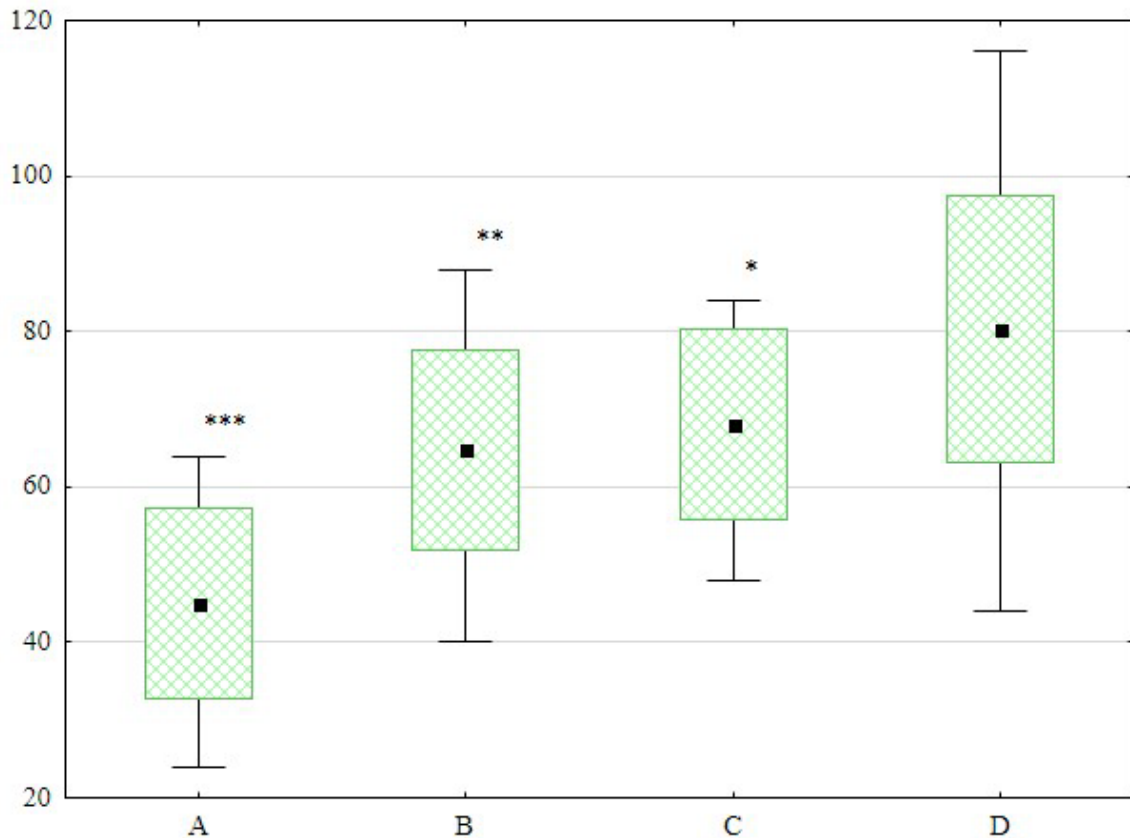


Fig. 4. Comparative effectiveness of coproscopy methods for uncinariasis in dogs (n=15):
 A – Fulleborn’s method; B– Kotelnikov-Khrenov’s method; C – method of coproovoscopy for trichurosis of sheep;
 D – improved method; P<0.05; P<0.01; P<0.001 – relative to D

The improved method and method of coproovoscopy for trichurosis of sheep showed the highest coagulation properties in relation to undigested fodder residues, where a small amount of small undigested fodder residues surfaced during the research.

Lifetime laboratory diagnosis of gastrointestinal helminthiasis in animals is mainly based on direct detection and identification of parasites at various stages of their development through the use of coproovoscopy methods [7–11]. Therefore, it is urgent to test and determine the effectiveness of new, more modern methods of laboratory diagnosis of trichurosis and uncinariosis in dogs.

It was revealed that 80 and 86.7 % of positive samples were found for trichurosis and uncinariosis in dogs by the Fulleborn's method, 93.3 and 100 % by the Kotelnikov-Khrenov's method, and 100 % by the coproovoscopy method for sheep trichurosis and the improved method, respectively. The improved method of lifelong coproovoscopic diagnosis of trichurosis and uncinariosis in dogs was more effective compared to the Fulleborn's method by 46.7 and 44.1 %, Kotelnikov-Khrenov's – by 24.6 and 19.3 %, the coproovoscopy method for sheep trichurosis – by 18.4 and 15.3 %.

Scientific results of domestic researchers testify to the expediency of using modern flotation methods of coproovoscopy for certain animal parasitoses. In particular, they found that the most effective flotation method of lifelong coproovoscopic diagnosis of trichurosis in dogs is the method of Galat and Melnychuk (with a urea solution), which exceeded ($P < 0.001$) the effectiveness of the Kotelnikov-Khrenov's method (with an ammonium nitrate solution) – at 4.8–5.2 times, Fuleborn's (with sodium chloride solution) – at 5.0–10.2 times, Mallory's (with sugar solution) – at 4.8 times, Dakhno's (with bischofite solution) – at 6.0–7.2 times [25].

The obtained results allow recommending an improved method of coproovoscopy for effective laboratory diagnosis of trichurosis and uncinariosis in dogs.

Conclusions

The improved method refers to the field of veterinary medicine, namely veterinary parasitology, to methods of coproscopy, in particular to methods of detecting eggs of causative agents of trichurosis and uncinariosis in dogs. It was established that the improved method for diagnosing trichurosis and uncinariosis in dogs exceeds the effectiveness of Fulleborn's method – by 46.7 % and 44.1 % ($P < 0.001$), Kotelnikov-Khrenov's – by 24.6 % ($P < 0.001$) and 19.3 % ($P < 0.01$), the method of coproovoscopy for sheep trichurosis – by 18.4 and 11.7 % ($P < 0.05$).

Conflict of interest

The author state that there is no conflict of interest.

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