Ecological and epizootological characteristics of the main helminthiasis of pigs in farms of the Altai Krai

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Abstract. Animal parasites cause significant economic damage to pig farming. Of the parasitic diseases common to humans and animals, trichinosis is the most dangerous. The purpose of this work is to study the ecological and epizootological distribution of the main helminths of pigs in farms in the Altai Krai. Helminthoscopic studies to detect the spread of ascaris, metastrongyls, esophagostomas and trichocephalians were carried out in the same farms and in the same pigs. The viability of the detected ascaris eggs was determined bytheir appearance , as well as by culturing the eggs in a wet chamber in a thermostat at a temperature of 25-30C for 15-20 days. In pigs in the Altai Krai, according to CHA (complete helminthological autopsy) data, 3 types of metastrongyls are parasitized in the lungs: M. salmi, M. elongatus and M. pudentotectus. The dominant species is M. elongatus. The conducted studies showed that the objects of the external environment were strongly infected with ascaris eggs. According to the practical significance of pig nematodes in the Altai Krai, ascaris, metastrongyls, trichocephalians and trichinella should be considered. Thus, on the basis of the conducted studies, the assessment of helminthiasis of pigs in farms of the Altai Krai is given.

1 Introduction

One of the main reasons hindering the development of pig breeding are diseases of various etiologies, including invasive ones [1].

Currently, pig breeding is an important and highly profitable industry in agriculture, but helminthic diseases play a negative role in increasing the number of livestock and production [1,2,5]. In the farms of the forest-steppe zone of the Altai Krai, ascariasis, metastrongylosis, trichocephalosis, cysticercosis, trichinosis is of the main importance in the pathogenesis of pigs, as infestations are widespread and cause the greatest economic damage to farms of any form of ownership.

These invasions delay the growth and development of young animals, cause massive damage and death of piglets from various invasive diseases.

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Among the zooanthroponoses, trichinosis is common among the pig population. It is supported by a natural hearth located out in the wild. It is known that the epizootology of any disease depends on a complex and diverse set of environmental factors that create the peculiarity of epizootological patterns peculiar only to a particular geographical zone, so it is necessary to study the epizootology of the most common types of pig helminths in the conditions of South-Western Siberia [2,7,8,9,10].

The purpose of work is to study the ecological and epizootological distribution of the main helminthiasis of pigs in farms in the Altai Krai.

2 Materials and methods

Helminthic ovoscopic studies were performed using the Fulleborn method in the Kotelnikov modification (1974), larvoscopic studies using the Shilnikov method and a complete helminthological autopsy according to I.K. Scryabin (1928) [3].

Five groups of pigs were examined by autopsies and ovoscopy: prenursery pigs (up to 2 months of life), post-weaning pigs (from 2 to 4 months), piglets (from 4 to 6 months), fattening young (from 6 to 10 months) and adult pigs (older than 12 months).

The work was carried out in the farms of the forest-steppe zone of the Altai Krai. The number of pigs ranged from 50 to 250 heads of different age groups.

Helminthoscopic studies to detect the spread of ascaris, metastrongyls, esophagostomas and trichocephalians were carried out in the same farms and in the same pigs.

The distribution of trichinella was established according to the data of veterinary and sanitary examination laboratories.

Scrapings taken with a metal spatula from the floor and walls were studied by flotation (Kotelnikova G A., 1974) with a saturated solution of ammonium nitrate. The animal care equipment (broom, buckets, scrapers) was washed with water, then the wash was settled for 4 hours. After that, the top layer was drained, and the sediment was poured into chemical glasses and examined by flotation. The viability of the detected ascaris eggs was determined by their appearance , as well as by cultivating them in a wet chamber in a thermostat at t 25-30°C for twenty days. To identify the influence of soil conditions on the survival of ascaris eggs, three sites were selected in the shade and three sites on the sunny side (with sandy, clay and chernozem topsoil). Feces samples infested with a saturated amount of ascaris eggs were placed on the surface or at a depth of 10-15 cm of the experimental sites.

3 Research results

In pigs in the Altai Krai, according to CHA (complete helminthological autopsy) data, 3 types of metastrongyls are parasitized in the lungs: M. salmi, M. elongatus and M. pudentotectus. The dominant species is M. elongatus. This helminth was detected in 48.3 % of the invaded pigs with an invasion intensity of 18 nematodes, M. pudentotectus in 32.6 % (II-14 ind\head) and M. salmi in 2.3 % (II-2 ind\head).

Monoinvasia in pigs was rather rare than in the association: M. elongatus + M. pudentotectus was found in 30.4 %. Therefore, the main role in the spread of metastrongylosis is played by two species, M. salmi has no practical significance. According to the natural and climatic zones, the most metastrongylosis was detected in the forest-steppe zone in 6.4 % of pigs by the method of complete helminthological autopsies. By age groups, the infestation of animals is as follows: post-weaned pigs 0.2 %, piglets 2.4 % and fattening young 2.2%, which in our opinion is associated with the wide spread of earthworms and the wide cultivation of pigs in this zone. From the clinical signs of metastrongylosis, cough, shortness of breath, refusal of food was noted.

Table 1. Infection of pigs with Ascaris suis depending on age.

Animal age	Pigs studied, heads	Of them infected, heads	Extent of invasion, %	Intensity of invasion, ind\head
0-2	47	4	8.5	121.0±9.3
2-4	43	14	32.6	187.6±12.4
4-6	77	36	46.8	176.4±9.1
Fattening	62	22	35.5	154.4±18.2
Sows	28	8	28.6	147.6±14.7
Boars	4	1	25.0	158.3±13.9
Total	261	85	-	-
On average	-	-	32.6	157.6±12.9

In all places, and a strong distribution of ascaris is associated, in our opinion, with the high resistance of eggs to the effects of environmental conditions: drying, high and low temperature differences. All favorable conditions for the development of nematodes have been created in the forest-steppe zone [1,4].

In the studied farms, the intensity of invasion varied from single specimens to 50 ind/head.

The conducted studies showed that the objects of the external environment were strongly infected with ascaris eggs, so scrapings taken from the floor, walls at the height of pigs, as well as from inventory (scrapers, brooms, shovels) were found eggs at different stages of development (EI – 22.5% with II – 18.2±0.5 eggs) Ascaris suum eggs were found in washes from flies, and 7.1±0.4 eggs were found from one fly.

A study of the soil layer near the pig farm showed that 5.2±0.2 Ascaris suum eggs were found in 370g of soil, and all of them were viable. According to the effect of low temperatures, our data are consistent with the data of a number of authors who claim high stability of ascaris eggs [3].

In our experiments, the ascaris eggs at the pre-larval stage of development were under the snow for 60 days, maintaining the viability of the different physical properties of the soil, by 67%, and on the snow - by 65.2%.

In this way, the effect of low temperatures does not affect the morphological parameters of ascaris eggs.

In experiments on soils (sandy, clay and chernozem), death of ascaris eggs at the pre-larval stage of development, frequent death of invaded eggs, as well as a weakening of larvae mobility and their migration ability occurred at different times.

The difference in the periods of the death of ascaris eggs can be explained by the heterogeneous physical properties of the soils, which created different microclimatic conditions in different soils. A faster death of A. suum eggs was observed on sandy soil, since the temperature (in the sun) increased to 44.2°C and there was a strong drying of feces.

The longest survival of A. suum eggs is in chernozem soil. At a maximum soil temperature of 27.0 °C and exposure to direct sunlight, the ascaris eggs at the pre-larval stage of development remained viable for up to one month.

According to the data of helminthic ovoscopy in the forest-steppe zone Trichocechalus suis are distributed by 10.8% with deviations in individual farms up to 34.2%, and by the method of complete helminthological autopsy by 14.6% with an increase in individual pig farms up to 37.4%. In the age aspect, extensinvasiveness is expressed as follows: adult pigs - 17.6%, post-weaned pigs - 37.7%. The intensity of invasion at autopsy ranged from 12 to 98 ind/head.

Table 2. Infection of pigs with Trichocehalus suis depending on ageю.

Age of animals	Heads studied	Of them infected,	EI, %	II, ind/head
0-2	47	4	8.5	19.0±0.9
2-4	43	22	51.2	28.8±3.1
4-6	77	29	37.7	32.0±3.0
Fattening	62	28	45.2	47.6±3.7
Sows	28	5	17.6	44.2±4.6
Total	257	88	-	-
On average	-	-	34.2	34.2±3.06

Of the clinical signs, the pigs were emaciated and more often they had diarrhea. Nevertheless, these phenomena cannot be attributed, due to the fact that up to five other types of pig helminths were detected in pigs during ovoscopic studies and methods of complete helminthological autopsy.

In the forest-steppe zone, tenuicollic cysticercus (Cysticercus tenuicollis) were registered in 1.2% of the number studied at slaughter sites.

The greatest extent of invasion was noted in fattening young animals - 1.7%. Adult pigs and post-weaned pigs are infected, respectively, by 1.2 and 0.6%. Prenursery pigs and piglets were free from this invasion. Infection, in our opinion, is associated with the presence of carnivorous (dogs) of service personnel.

Thus, according to the data of N.M. Ponamarev et al., who note a high incidence of trichinosis in pigs in the Ust-Pristansk and Aleysk districts [2, 7, 8].

Over the past 10 years, trichinosis has been registered in 23 districts of the region. 2010-2014 in 18 districts - 61 unfavorable settlements, 2015-2020 in 23 districts – 34 unfavorable settlements. There are 95 unfavorable settlements in total.

The coverage of the greatest distribution among settlements is noted in the Aleysk district - Priyatelsky village (2010; 2012;2018), Tolstaya Dubrava village (2013; 2019), Novonikolaevsky village (2019); in the Ust-Pristansk district, Korobeynikovo village (2010; 2012; 2013; 2015; 2019) Krasnodarskoe village (2017; 2019), PSP Nizhneozernoye village (2015; 2016; 2020), Nizhnyaya Gusikha village (2012; 2014; 2020).

Currently, there are 6 unfavorable settlements in 4 districts in the Altai Krai (Kamensky - 1, Topchikhinsky - 1, Ust-Pristansky - 3; Shelabolikhinsky - 1) [6, 7].

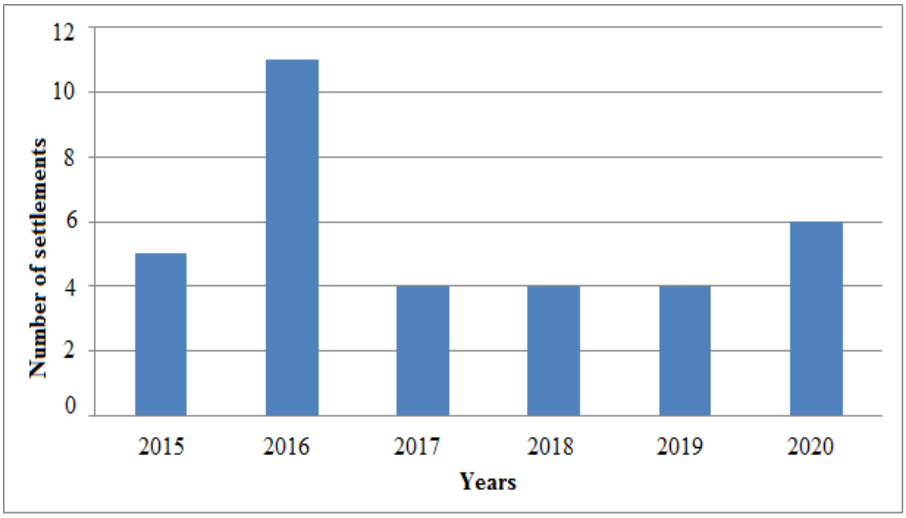

Fig. 1. Dynamics of unfavorable settlements for 2015-2020 in the Altai Territory.

Trichinosis among pigs was registered for 6 years in different regions of the Krai. Many unfavorable settlements 33.0% fall on Ust-Pristansk and Aleysk districts and 67% on the rest of the Krai (Fig. 1) [2].

In the seasonal dynamics of pig infestation, it is noted that the greatest extent of mixinvasion occurs mainly in the autumn-winter time, i.e., the period of mass slaughter of animals and veterinary and sanitary examination of meat [7, 8].

In case of trichocephalosis mainly animals at a young age are affected. The decrease in the infection of pigs occurs with increasing age.

Mouse-like rodents and gray rats are extremely important in the formation, maintenance and functioning of synanthropic foci of trichinosis in the region, with their infection rate up to 7% of the examined ones.

4 Conclusion

Thus, on the basis of the conducted studies, an assessment of the infection with helminthiasis of pigs in farms of the Altai Krai is given.

According to the practical significance of pig nematodes in the Altai Krai, ascaris, metastrongyls, trichocephalians and trichinella should be considered.

Depending on the age of the animals, we have established significant changes in the invasion of trichocephalosis. With increasing age, there is a gradual decrease in the extent of invasion with trichocephals.

The results of the study showed that the extensiveness and intensity of invasion of most nematodes increases in the summer period, this is due to the intensive release of helminth eggs.

References

1. P.I. Gnedina, V.I. Podyapolsky, etc., Veterinary science – production **24**, 127-129 (1986)
2. N.M. Ponamarev, N.V. Tikhaya, The spread of pig trichinosis in some areas of the Altai Krai, *Agrarian science – agriculture: collection of materials: in 2 books, XVI International Scientific and Practical Conference-Barnaul: Institute of the Altai State University*, **2**, 184-186 (2021).
3. G.A. Kotelnikov, Helminthological studies of animals and the environment: a reference book, 280 (M: Kolos, 1984)
4. N.M. Ponamarev, A.N. Ponomarev, Assessment of the parasitic situation on pig farms in the Altai Krai, *Actual problems of animal pathology: materials of the international congress of therapists, diagnosticians 6-9 July 2005*, 141-142 (Barnaul: publishing house of ASAU, 2005)
5. N.M. Ponamarev, N.V. Tikhaya, A.N. Ponomarev, Bulletin of the Altai State Agrarian University, **7 (81),** 71-75 (2011)
6. A.G. Smirnov, Proc. of the All-Union Inst. of Helminthol **16**, 227-230 (1970)
7. N.M. Ponamarev, M.A. Kostyukov, On the epizootology of animal trichinosis in the Altai Territory, *Agrarian Science to Agriculture – V International Scientific and practical Conference,* Book 3 Barnaul, 383-386 (2010)
8. N.M. Ponamarev, M.A. Kostyukov, A.N. Ponamarev, Bulletin of the ASAU, **75**, 69-74 (2011)
9. N.V. Tikhaya, N.M. Ponamarev, M.Yu. Novikova, Yu.N. Fisenko, and S.L. Plotnikova E3S Web Conf., **282**, 03005 (2021) DOI: 10.1051/e3sconf/20212_820.

10. A.D.M. Dove, T.H. Cribb, Parasitology Today **22** (12), 568–574 (2006) https://doi.org/10.1016/j.pt.2006.09.008.