Helminthiasis of Swine in Central Yakutia, Russian Federation

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ABSTRACT

It was found that the species composition of helminths of swine in central Yakutia, Russian Federation consists of four species of nematodes and 3 species of cestodes. Infection rate of pigs with ascaridosis is equal to 19.75% while the intensity of infestation is 9.85 ± 0.54, esophagostomosis – 9.55% and 8.98 ± 0.93, trichocephalosis – 5.1% and 356.8 ± 76.4 specimens respectively. The eggs of Ascaris suum do not survive on the earth surface in the terms of the Yakut winter with an average monthly temperatures minus 35-42 °C and two-months exposure. An efficacy of the active substance of albendazole in the dose of 10 mg/kg is equal to 92.1-93.4%.

INTRODUCTION

Pig production is an important industry of the livestock sector of the Russian Federation and other countries. One of the factors that reduce the rate of development of pig production is the mass distribution of parasitic diseases [1-7]. In the Russian Federation an infection rate of esophagostomosis in pigs in the Ivanovo region, Krasnodar and Stavropol regions, Middle Volga and Siberia reaches 63.4-100%, ascaris – 52.4-78.9%, trichocephalosis – 16.7-83.3% with the high rates of intensity of infestation. According to some experts such unfavorable epizootic picture on swine helminthiasis is explained by the insufficiency of conducted studies on the ecology of the causative agents of parasitic diseases and low efficiency of the used means and the methods of treatment and prevention [8-9].

Questions regarding distribution of helminth species in pigs, the intensity and extent of infestation, treatment and prevention of parasitic diseases were not studied with respect to Yakutia. The necessity for detailed study of epizootology of swine helminthiasis dictates the presence of different types of enterprises, ranging from small farms to the large industrial pig farms of the Republic of Sakha (Yakutia). Solving these questions will determine the relevance of the topic and the purpose of our research.

MATERIALS AND METHODS

Field of study:

Yakutia is located in North-East Asia within 76°3'-55°29' N latitude and 105°13'-162°51' E longitude. Area of Yakutia (3 103 200 sq. km.) occupies 18% or almost one fifth of the whole territory of the Russian Federation. The study area is located in the territory of Central Yakutia, Russian Federation. The western point of the study area lies on the border with the Krasnoyarsk region (109°, 30° E longitude), eastern point - on the border of the river Aldan (135°, 30° E longitude), south point - 60° N latitude, north point - 64° N latitude. It’s an area of the rigorous climate - pole of cold in the northern hemisphere, the territory of extreme low temperature fluctuations. An average long-term temperature in January in Oymyakon and Verkhoyansk is minus 49-50 °C. In Oymyakon kette the minimum temperatures reach minus 71 °C, in Verkhoyansk minus 68 °C, and in the central regions down to minus 66 °C. Summer is short, but relatively hot (in most of the territory plus 36-38 °C, in the coast
Eggs and analyzed to combat helminth infection thoroughly recruited animals from 2 helminths in 1 g of feces and imaginal forms of helminths found VIGIS one drop. 

Village Yakutia March 11 cultured funnels following by addition of solution with eggs Shumakovich [12]. 

Feeders, walls and machines of the industrial pig farm, 

Animals of the experimental part of the experimental part of the pigs of the experimental part of the control group were kept in similar conditions with the experimental animals. They received regular feed without anthelmintics.

The drugs benzimidazole alben and albendazole 2.5% at the dose of 10 mg/kg by an active ingredient were thoroughly mixed with half of the norm feed ration provided, using a feed mixer. The resulting mixture was put in a laboratory feeders providing free access to animals. Animals of the control received a normal diet. Drug efficacy was assessed by copro-ovoscopic method with detection of helminth eggs in 1 g. Totally 29 pigs were

The study of seasonal and age dynamics of swine ascarids, trichocephales and esophagostomes was conducted in farms of Numsky ulus with total number of 2,097 heads, Hangalassky ulus - 844 heads, Megino-Kangalassky ulus – 2,055 heads, Churapchinsky ulus – 1,891 heads, Olekminsky – 1,335 ulus, Tattinsky ulus – 1,888 heads, and on the territory of Yakutsk town hall – 14,034 pigs by a quarterly copro-ovoscopic methods.

Contamination of environmental objects by eggs and larvae of nematodes was determined in the Hatassky industrial pig farm, collective farm "Uchur" of the gas industry, subsidiary farm houses in the boarding school of the village of Kapitonovka and in the private sector of the village of Picefabrika. Scrapings from the floor, feeders, walls and machines, swabs from care items were taken in different production areas. Then scrapings were examined using the flotation method and swabs - using the method of O.V. Teplov [11]. In summer camps and free-range areas of near-farm territory we took soil samples and analyzed them using the method of E.E. Shumakovichi [12].

Determination of ascarid eggs survival in the environment was performed in comparison with non-segmented and segmented eggs. For this we collected fecal samples from spontaneously infested pigs of subsidiary farm house of the boarding school in the village of Kapitonovka. The number and type of worm eggs were determined. Eggs were accumulated using the flotation method by Fyulleborn. An upper layer of the solution with eggs was separated, last were repeatedly washed. Eggs slurry was placed in glass cylinders following by addition of water and setting for 2-3 hours. Then, supernatant was poured out. The washed eggs were transferred by pipette onto the wet membrane filters in form of the funnel. After transferring eggs, edges of funnels were folded. Folded filters with washed eggs were used for laying eggs samples. Some of the eggs were cultured up to the infestation stage in the thermostat at a temperature of 26 °C for 45-60 days. Then invasive and non-segmented eggs were mixed with faeces of pigs, laid out separately in nylon bags and from January 8 to March 11 they were left on the soil surface under the snow at a temperature of -35 ... -40 °C.

In order to develop appropriate and effective system to combat helminth infestations of pigs in terms of Yakutia we tested a number of drugs and methods. Experiments were carried out on the farm of V.I. Treyakov in the village of Tabaga and in the subsidiary farm house of the boarding school for disabled persons of the village of Kangalass. Before performing the experiments we used coproscopic study by Fyulleborn for three times. The number of helminth eggs was counted in three drops followed by counting their average number in one drop. In order to count the number of eggs and larvae per 1 g of feces we used special counting chamber VIGIS [13]. The results obtained were treated statistically by calculating the mean number of eggs, larvae of helminths in 1 g of feces and imaginal forms of helminths found in one animal. By analogy principle we recruited animals from 2-4 months of age spontaneously infested with ascarids and trichocephalus. Anthelmintics test was performed according to the seasonal and age dynamics of intestinal nematodes, mainly in a moment of increasing the invasion rate. During the experiments the pigs of the control group were kept in similar conditions with the experimental animals. They received regular feed without anthelmintics.

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RESULTS AND DISCUSSION

Prevalence of ascariosis and esophagostomosis of pigs in the Central Yakutia:

The systematic study of helminth fauna of agricultural, hunting and homestead animals of Yakutia was launched in 1951 [14-15]. However, in these studies helminth fauna in pigs remained unexplored, and that was the basis for our research work. In the years 2001-2004 we studied the helminth infestation of pigs in different types of farms in the central Yakutia by incomplete helminthological autopsies of 157 pigs and helminthovooscopy research methods in 1,236 fecal samples using the method of Fyulleborn, and Darling. We identified the species of the collected material of helminths in pigs, including museum exhibits of the Department of Parasitology of the Yakut Republican Veterinary Testing Laboratory and the Laboratory of Parasitology of the Yakut Research Institute. During identification of the species we used special determinants (the correctness of the species determination was confirmed by the doctor of veterinary sciences, professor R.T. Safiullin). 4 species of nematodes parasitize in Yakutia pigs: Ascaris suum, Trichocephalus suis, Oesophagostomum dentatum, Metastrongylus elongatus and 3 species of cestodes: Cysticercus cellulosae, Cysticercus tenuicollis and Diphyllobothrium latum (Table 1). We detected Metastrongylus elongatus in pigs of the other areas brought in 2000-2002. In the last two years this parasitic helminth in local pigs was not revealed. Diphyllobothrium latum was found in two pigs from the homestead farms in the suburbs of Yakutsk. These pigs were fed by tugun fish (Coregonus tugun Pallas).

Table 1: Species composition of pig helminthes.

<table>
<thead>
<tr>
<th>Name of species</th>
<th>Prevalence of helminths</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nematodes</strong></td>
<td></td>
</tr>
<tr>
<td>Ascaris suum</td>
<td>+++</td>
</tr>
<tr>
<td>Trichocephalus suis</td>
<td>+</td>
</tr>
<tr>
<td>Oesophagostomum dentatum</td>
<td>+++</td>
</tr>
<tr>
<td>Metastrongylus elongatus</td>
<td>+</td>
</tr>
<tr>
<td>Cestodes</td>
<td></td>
</tr>
<tr>
<td>Cysticercus cellulosae</td>
<td>+</td>
</tr>
<tr>
<td>Cysticercus tenuicollis</td>
<td>+</td>
</tr>
<tr>
<td>Diphyllobothrium latum</td>
<td>+</td>
</tr>
</tbody>
</table>


According to our studies performed in farms of the Republic of Sakha (Yakutia) using the method of partial helminthological autopsies by K.I. Scriabin in 2001-2004 we revealed that the infestation of pigs (EI) by ascaridosis was 19.75% with an intensity of infection (II) being at 9.85 ± 0.54, esophagostomosis - 9.55% and 8.98 ± 0.93, trichocephalosis – 5.1%, and 356.8 ± 76.4 specimens (Table 2). In different types of farms the invasiveness of pigs by helminths is unequal. For example in Hatassy pig farm of industrial type, in the private sector of the village of Volodzymyrivka, in the subsidiary farm at the colony settlement in New Tabaga and in homestead farms of the village of Hatassy pigs no helminth infestation was found. An invasiveness is most strongly expressed in subsidiary and traditional farms of the villages of Old Tabaga and Uchur where an infection rate of ascaridosis, esophagostomosis and trichocephalosis reaches up to 100% with a high degree of intensity of infection. In the village of Kapitonovka in a collective farm "Siberia" and in the private sector of the village of Pricefabrika an extent of infestation is equal to 50-87%.

Autopsy results show that in industrial farms, traditional farms, subsidiary farm houses and homestead farms helminthose occur as a mixed infestation. So in the farm of V.I. Tretyakov, the village of Old Tabaga there’s a mixed invasion of pigs in the form of ascaridosis-trichocephalosis and in subsidiary farm "Uchur" and in the boarding house of the village of Kapitonovka variations in the form of ascaridosis-trichocephalosis-esophagostomosis.

Seasonally-age dynamics of swine ascariosis and esophagostomes in different types of farms:

The surveyed farms are engaged in their own reproduction, pigs growing and fattening. No piglets are bought from the outside. The number of pigs in these farms ranges from 60 to 250 heads. Animal feeding is performed twice a day. It’s based on food waste with an addition of animal feed up to 40%. The animals are kept in machine all the year-round by 15-20 goals without walking yards, playgrounds and summer camps. Manure is evacuated manually using brooms and rakes. Floors have slits and therefore part of the manure remains in machines. So there’re conditions for the accumulation and development of eggs and larvae of helminths. Manure is stored in a pile outside the premises.
Quarterly research in the subsidiary farms showed that infection of 3-7 months young growth by *Ascaris* esophagostomy remains high regardless of the season. Infection of the young growth occurs through contact of young piglets with sows being either infected with intestinal nematodes or contaminated with invasive elements. Epizootic process in ascaridosis, esophagostomosis, and trichocephalosis in these farms is continuous. So in these farms there are three parts of epizootic chain: a) source of infestation - infected animals; b) transmission factors - contaminated of the environment objects by invasive elements, and c) susceptible young growth. Consequently invasion is circulating in farms throughout the whole year, regardless of the season. All the surveyed objects of external environment objects in these farms are contaminated with eggs of ascarids, trichocephals and esophagostomes. According to the degree of contamination these invasive elements were listed as follows: floor of the machines, products for animal care, walls and feeding machines. Due to the severe contamination of environmental objects in subsidiary farms, traditional farms and private households we can see an infection of young growth by helminths. The degree of contamination by eggs of ascarids, trichocephals and esophagostomes of floors of the piggeries, products for animal care in subsidiary farms, traditional farms and private households is 10.9-15.6%, 12.5-15.0% and 4.1%, respectively.

**Survival of helminth eggs in the environment:**

The results showed that no viable eggs after 61 days of exposure were found in the following conditions: an average January temperature of the soil surface is -42 °C, -35 °C in February. 374 eggs of *Ascaris suum* were segmented and 243 were non-segmented. The study of the control non-segmented eggs of ascarids after cultivation at 5 °C revealed that 82% of them were viable, and 74% were from the segmented ones. Thus, non-segmented and segmented eggs of *Ascaris suum* do not survive on the soil surface under the conditions of the Yakut winter with an average monthly temperature of minus 35-42 °C and exposure for two months.

**An efficacy of albendazole against ascaridosis and trichocephalosis in pigs:**

In the central Yakutia the problem of treatment and preventive measures against swine helminthes remains open. This situation is explained by the fact that the pig is a new, rapidly growing field of animal husbandry of the Sakha Republic (Yakutia).

An effectiveness of albendazole in the tablet form (alben) and 2.5% solution at the dose of 10 mg/kg of body weight by an active substance was tested at the farm of the village of Old Tabaga. The test group included animals at the age from 2 to 4 months, spontaneously infected by a mixed invasion in the form of ascaridosis-trichocephalosis. Animals tolerated the drug, there was no poisoning. Objective clinical indicators: body temperature, pulse, breathing – there were no change during the experiment in either group. In the first 2-3 days

<table>
<thead>
<tr>
<th>Farm</th>
<th>Examin ed</th>
<th>Infected</th>
<th>Ascaridosis</th>
<th>Esophagostomosis</th>
<th>Trichocephalosis</th>
<th>Extensity of infection, %</th>
<th>Intensity of infection, M ± m</th>
<th>Extensity of infection, %</th>
<th>Intensity of infection, M ± m</th>
<th>Extensity of infection, %</th>
<th>Intensity of infection, M ± m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm of the village of Old Tabaga</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>100</td>
<td>-</td>
<td>7.12±1.2</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>356.8±7.6</td>
<td></td>
</tr>
<tr>
<td>Subsidiary farm &quot;Uchur&quot;</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>-</td>
<td>100</td>
<td>4.58±0.56</td>
<td>100</td>
<td>10.75±1.64</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Collective farm &quot;Siberia&quot;</td>
<td>4</td>
<td>2</td>
<td>-</td>
<td>50</td>
<td>-</td>
<td>2.5±0.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Subsidiary farm of the boarding house at the village of Kapitonovka</td>
<td>8</td>
<td>7</td>
<td>3</td>
<td>87.5</td>
<td>5.12±1.17</td>
<td>37.5</td>
<td>6.33±0.87</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Private sector of the village of Vladymyrovka</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Subsidiary farm at the colony of the village of New Tabaga</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Private sector at the village of Pincefabeka</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>66.6</td>
<td>14±2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
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<tr>
<td>Homestead farm at the village of Hatassky</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Hatassky pig complex</td>
<td>81</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>157</td>
<td>31</td>
<td>15</td>
<td>8</td>
<td>19.75</td>
<td>9.85±0.54</td>
<td>9.55</td>
<td>8.98±0.93</td>
<td>5.1</td>
<td>356.8±7.6</td>
<td></td>
</tr>
</tbody>
</table>
after drug administration dead ascarids were isolated. The final assessment of the drug efficacy was performed on the day 22. An efficacy of alben (tablets) and albendazole 2.5% in the dose of 10 mg/kg by an active substance was equal to 85.1-90.1% in ascaridosis and 92.1-93.4% in trichocephalosis.

Conclusions:
1. The helminth species composition of pigs in Yakutia consists of four species of nematodes: Ascaris suum, Trichocephalus suis, Oesophagostomum dentatum, Metastrongylus elongatus and 3 species of cestodes: Cysticercus cellulosae, Cysticercus tenuicollis, Diphyllobothrium latum.
2. An infection rate of pigs with ascaridosis was 19.75% with intensity of infestation (II) – 9.85 ± 0.54, esophagostomosis – 9.55% and 8.98 ± 0.93, trichocephalosis - 5.1% and 356.8 ± 76.4 specimens, respectively. Infestation indicators vary greatly depending on the types of farms. The infection rate in subsidiary farms and traditional farms is the largest, and an infection rate of ascaridosis, trichocephalosis, esophagostomosis ranges from 0 to 100%. Pigs from the industrial farms are free from helminths.
3. In traditional, subsidiary farms, and private households helminthoses occur as a mixed infestations. An infection rate of pigs with mixed ascaridosis-trichocephalasis and ascaridosis-esophagostomosis infestations was detected in 50% of cases, with the intensity of the former one of 7.12 ± 1.2 – 356.8 ± 53.7 specimens, in the second one – 8.2 ± 0.86 – 6.3 ± 0.8 parasites.
4. The degree of contamination by the eggs of ascarids, esophagostomes and trichocephals of floors in piggeries and products of animal care of subsidiary traditional farms and private households is equal to 10.9-15.6%, 12.5-15.0% and 4.1%, respectively.
5. Ascaris suum eggs do not survive on the soil surface under the conditions of Yakut winter at the average monthly temperature of minus 35-42 °C and exposure of two months.
6. Alben and albendazole -2.5% in the dose of 10 mg/kg by an active substance are effective against askaridosis and trichocephalosis of pigs with an efficiency of 92.1-93.4%.

REFERENCES