Ecological Peculiarities of Moniezia Benedeni and Thysaniezia Giardi in central Yakutia, the Russian Federation

1Alexander Dmitrievich Reshetnikov, 1Anastasia Ivanovna Barashkova, 1Evgeny Semenovich leptsov, 1Nikolay Vasileyevich Vinokurov, 1,2Galina Gavrilyevna Kolesova

1Yakut research institute of agriculture, Yakutsk
2Veterinary administration of Yakutsk, the Republic of Sakha (Yakutia)

ABSTRACT

It has been determined that the species composition of the helminthes Anoplocephalidea Sholodkowsky, 1902 and Avitellinidae Spassky, 1950 verminating cattle in central Yakutia, the Russian Federation is represented by two species: Moniezia benedeni and Thysaniezia giardi. The vermination level based on the results of autopsy at monieziasis is 11.1%, at thyzanieziosis - 23.8% with the intensity of vermination of 3.3 and 1.6 specimens, respectively. The ecology peculiarities of these helminthes species in the region have been studied.

INTRODUCTION

A cattle breeding is the most important sector of animal breeding in the Republic of Sakha (Yakutia), the Russian Federation. One of the adverse factors of breeding cattle under the conditions of the prolonged wintering leading to significant quantitative and qualitative losses of livestock production is the problem of parasites, which is still one of the important problems in the veterinary medicine. The most common vermination diseases of cattle and small ruminants in Russia and other countries are strongylatosis, dictyocaulosis, monieziasis, tizanieziosis, hypodermosis and others [1-3]. Fasciolasis, paramphistomatosis, neoa ascariasis are rare. As a result of widespread use of anthelmintics from the macrocyclic lactone group, the vermination level of nematodes, arahnosis and entonomosis at the cattle has largely decreased, but the vermination level of cestodiasis - anoplocephalidae at the cattle has at the same time increased. The study of the anoplocephalidae problem in Yakutia remains insufficient. There are only some references to Moniezia benedeni and Thysaniezia giardi parasitizing in the cattle [4-6] in the reported information. The spreading and ecological peculiarities of pathogens, the intensity and extent of the vermination, the treatment and prevention of monieziasis and tizanieziosis in the cattle in the Republic of Sakha (Yakutia) have remained open and practically unexplored up to the present. Solving these questions has determined the relevance of the theme and the purpose of our research: the study of anoplocephalidae dissemination and ecological peculiarities at the cattle in Central Yakutia.

MATERIALS AND METHODS

Study Area:

The area of the study is located in Central Yakutia, the Russian Federation. The west point is located on the border with the Krasnoyarsk Territory (109°30' e. l.) the east is on the border of the river Aldan (135°30'e. l.), the south at 60° n. l., the north at 64° n. l. The cattle population currently is 330,000 animals.

The study on dissemination, seasonal and age dynamics of monieziasis and thysanieziasis was conducted in 2002-2010 in the farms in the Yakutsk suburbs. The scatoscopic study of the cattle of different ages was conducted monthly by visual inspection of fecal masses for the presence of cestode segments and by Fulleborn flotation method for the presence of eggs of Moniezia and Thyzaniezia. For 4 years we studied three groups of...
young cattle aging up to 1 year, from 1 up to 2 years and adult cattle older than 2. More than 1,951 fecal samples of the cattle have been studied using these methods.

63 sets of the gastrointestinal tract of the cattle that was slaughtered and fallen directly on the farms of Central Yakutia were studied at slaughterhouses using the method of the complete helminthological enterotomy of individual organs [7].

The cestodes collected at the enterotomy of the adult cattle were counted, measured, the degree of their sexual maturity was determined separately by the animals’ age, and then they were fixed in $70^\text{th}$ spirit for the museum collection. The laboratory inspection of the stuff was made by the conventional in Helminthology method that was followed by the determination of their species [8].

The work on the study of the seasonal dynamics of the oribatid population and establishing the sources of calves’ infection by moniezia was conducted by collecting mites from different locations using the technique of E.M. Bulanova-Zahvatkina [9]. The samples of soil and grass were placed in plastic bags, their location registered and they were taken to the laboratory. The oribatids were isolated using Tulgren apparatus. The samples of soil and grass were examined in the pasture period from May to October 2006. The samples were taken from the territory of the calf house in the Vladimirovka settlement. To study the dynamics of the mites’ infecting by moniezia larvae, the research was carried out by their enterotomy according to the technique [10].

The mites were put on a glass slide and drops of water were added thereto, then they were torn by a fine needle into small pieces that were covered with a cover slide and examined under the microscope of MBS-9 brand. The oribatid mites’ species composition was identified to species by a determinant [11].

Fresh segments taken from the cows naturally infected by thyzanieziosis served as the material for sampling on the survival of Thysaniezia eggs. The segments were stored out of fecal masses without water, in the water and in the fecal masses, in the refrigerator and in the room. The eggs viability was determined by watching the mobility of oncosphere with embryonal hooklets and changes in morphological structures. The eggs with the detected mobile oncosphere with hooklets were considered viable.

In the first series of the experiments for studying the survival of the Thysaniezia eggs in the conditions of Yakutia in winter, the Thysaniezia segments were laid in fecal masses on the soil surface under the snow. To do this, five fecal samples containing 4 Thysaniezia segments were put in plastic bags. Three samples were laid on the soil surface. The snow depth was 29 cm. The fourth sample was laid at temperature $+5^\circ\text{C}$, the fifth - at $+20^\circ\text{C}$. The control viewing of the test samples was conducted after 5, 10 days and after 3.5 months. The data of the surface temperature under the snow in January - April were obtained in Yakutsk Interregional Territorial Administration for Hydrometeorological and Environmental Monitoring. In the second series of the experiments the survival of the eggs was studied in summer. The survival of the Thysaniezia eggs in segments in sunlit dry environment at the temperature of $20^\circ\text{C}$ was studied. For this we used two samples, each containing a segment of Thysaniezia. In the third series of the experiments the Thysaniezia segments were contained in water at the temperature of $5^\circ\text{C}$. The meteorological data was obtained from the weather stations of the Republic of Sakha (Yakutia).

Results:

Dissemination of Moniezia benedeni and Thysaniezia giardi: The retrospective analysis of the cattle parasitosis incidence, according to the statistics from Yakutsk Republican Veterinary Testing Laboratory (YARVTL) and the Veterinary Department of the Ministry of Agriculture of the Sakha Republic (Yakutia), revealed that the cattle infestation with parasitic diseases in Yakutia for the last years has been 5-6%. 60.6% of them is strongylatosis. Eimeriosis is 14.1%, nemathelminthosis - 8.2%, monieziases - 4.2%, dictyocaulosis - 4.9%, neo ascariasis - 2.9%, thyzanieziosis - 2.3%, paramphistomatosis - 1.9%, trichocephalisis - 1.2% and hypodermosis - 0.4%. Cattle anoplocephalidae is widespread in Central Yakutia. The incidence of cattle is most frequently observed in Amginsk, Namsk, Ust-Aldan, Yakutsk, Viliuisk regions.

According to our research conducted using the method of incomplete helminthological enterotomy 30.1% of surveyed livestock were infected (vermination extensity) (VE), with average vermination intensity (VI) of 2.8 specimens. The most disadvantage by anoplocephalidae is the cattle in the Markhinsky livestock complex, Yakutsk region (46.2%), in the villages of Ulakhan-An (40%) and Nemyugyuntsy (38.5%), Hangalassky region. The vermination extensity by tizanieziosis averaged 23.8%, by monieziases - 11.1% with the intensity of the vermination of 1.6 and 3.3 specimens respectively. The maximum vermination of the vermination with tizanieziosis and monieziases is 5 specimens each (fig. 1, 2).

At helminthoovoscopic studies, the average vermination extensity at monieziases was 2.71%, with the highest rate of the vermination level detected in young animals up to a year (5.3%). The vermination level of thyzanieziosis of all livestock is 9.02%, with the highest vermination extensity detected in young animals from 1 to 2 years is 16.9%, in adult cattle - 11.9%, in young animals up to 1 year - 1.02%.

The collected cattle helminths material including the museum exhibits of the Department of Parasitology of Yakutsk Republican Veterinary Testing Laboratory and the Laboratory of Parasitology of Yakutsk Research
Institute was identified to species using specific determinants. Two species of anoplocephalidae parasitize in the cattle in Yakutia: Moniezia benedeni and Thysaniezia giardi.

**Fig. 1:** Moniezia benedeni.

**Fig. 2:** Thysaniezia giardi.

According to the research results it can be stated that anoplocephalidae is widespread in the cattle in Central Yakutia. The species composition of the cattle anoplocephalidae in Yakutia includes 2 types: Moniezia benedeni and Thysaniezia giardi. The vermination extensity of monieziasis is 11.1%, of thyzanieziosis - 23.8% at the helminth vermination intensity of 3.3 and 1.6 specimens, respectively. The highest vermination levels were found in Markhinsky livestock complex, in the villages of Ulakhan-An and Nemyugyuntsy (46.2%, 40% and 38.5%).

*The seasonal age dynamics of the cattle vermination:*

Calves born in the current year start infesting with Moniezia benedeni since June, and adult cattle since the third decade of May. The eggs production by calves can be observed in August, by cows - since July.

The maximum egg production by calves was registered in October-December, by cows - since the second half of August up to the end of December. The calves’ egg production ends in January (Fig. 4), the cows’ - in March (Fig. 3). There was a rare case in the studies in 2006 of finding Moniezia eggs in April and May. We explain this as the vermination in the non-grazing period - infested mites were in the hay. Moniezia benedeni matures in the calves’ body in 2 months, its lifetime is 4-5 months.

When conducting coproovoscopic studies the eggs and the segments of Thysaniezia giardi are found from October to August, the peak of the egg production is from April to June (Fig. 5). In September, the egg production is not observed and studying the small intestine after the animals slaughter, immature specimens is found. Thysaniezia giardi is found in the cattle body in the conditions of Yakutia all year round.

**Fig. 3:** Seasonal dynamics of Moniezia benedeni at cattle in Central Yakutia.

*The anoplocephalidae morphology at the ontogenesis mature phase of naturally infected hosts:*

In the study of the external structure of the mature anoplocephalidae of two species we revealed the following peculiarities of their morphology:
Fig. 4: Seasonal dynamics of Moniezia benedeni at calves born in the current year.

Moniezia benedeni:
Moniezia’s strobila is milky white, firm; with the length of up to 3400 mm. The scolex is wider than the neck, with four round suckers; the diameter is 0.8-1.0 mm, the mature segments are short, wide, the width is 15-21 mm and the ratio of the length to the width is 1:5. The young segments gradually increase in width from 0.8 mm over to hermaphroditic. Each segment has paired genitals. The paired genital papillae are 0.4 mm. The eggs are rectangular, 0.08-0.1 mm in diameter.

Thysaniezia giardi:
The cestode is white. The strobila’s length is up to 6830 mm; the scolex is 0.5-0.8 mm in diameter. The strobila’s neck’s length is up to 3 mm. The segments are provided with a short sail. Mature segments are full of paruterinny organs. Each paruterinny organ has from 3 to 8 eggs. The diameter of the capsules is 0.07-0.1 mm; the mature eggs are oval 0.02-0.03 mm. The genitals interchange in each segment. Thysaniezia is located in the cattle small intestine.

An adult cestode forms up to 4 loops 180-200 cm in length in the lean intestine. The mature segments come off from the strobila with the contents and move to the other parts of the intestine, they are found in the ileac, colon and straight intestine.

The study and the analysis of the morphological characteristics of the mature anoplocephalidae of cattle prove that there are two kinds of anoplocephalidae in Yakutia: Moniezia benedeni and Thysaniezia giardi. The morphological characteristics of thysaniezia differ from those described by other authors characteristics of the strobila length and the other parameters correspond to the reported information.

Species composition of the intermediate hosts of Moniezia: In Central Yakutia 4 superfamilies of oribatid mites were detected: Oribatuloidea Wooley, 1956, Oribatelloidea Wooley, 1956, Galumnoidea Balogh, 1961, Ceratozetoidea Balogh, 1961, 8 families and 11 genera. The most common out of 9 determined species are: Ceratozetella sellnicki (Raiski, 1956), Achipteria coleopt rata (linnaeus, 1758), Liebstadia similis (Michael, 1888), Oribatula tubialis (Nicolet 1855), Minorities - Allozetes latus (Schweizer, 1956) Diopterobates notatus (Thorell, 1872), Galumna rossica (Sellnick, 1926), Neoribates trapezoides eyrish (in litt) and Oribatula pallida (Banks, 1906). The correctness of the species composition of oribatid mites’ determination was confirmed by Cand. L.G. Grishina (Institute of Animal Systematics and Ecology of the Russian Academy of Sciences, the Siberian Branch).

It was determined that 89% of oribatid mites inhabit the depth from 0 to 3 cm, 11% - from 3 to 5 cm, at depth of more than 5 cm the mites were not detected. The number of mites also varies by month; the maximum number of oribatids occurs in August, the minimum number in July, which we associate to a high soil temperature during this period.

The survival of eggs of Thysaniezia in the environment:

When the average temperature of the soil surface in January is minus 42°C under the snow, in February - minus 35°C, the Thysaniezia eggs in the segments were not viable in all samples in 10 days. In a dry medium the eggs in segments turned out dried in 2-3 hours, but after soaking by ordinary water they show viability within a day. In the water at the temperature of 5°C the movement of oncosphere was detected in eggs within 37 days. In the water at the temperature of 20°C the eggs die within 10 days.
Conclusions:
1. The fauna of the families Anoplocephalidae Sholodkowsky, 1902 and Avitellinidae Spassky, 1950, verminating cattle in Central Yakutia is represented by two species: Moniezia benedeni and Thysaniezia giardi. The vermination level based on the results of autopsy at monieziasis is 11.1%, at thyzanieziosis - 23.8% with the intensity of vermination of 3.3 and 1.6 specimens, respectively.
2. Moniezia benedeni egg production by calves is observed from August to January, by cows - from July to February, the maximum egg production by calves is in October-December, by cows - since the second half of August to the end of December. Primary vermination of animals begins with the start of the grazing period, at calves born in the current year - in June, at adult cattle - from the third decade of May.
3. At helminthooovoscopic studies eggs and segments of Thysaniezia giardi are found from October to August, the peak of egg production is from April to June. In September, the egg production is not observed; studying the small intestine after the slaughter of the animals, only immature specimens are found. In conditions of Yakutia, thyzaniezia are found in the cattle all year round.
4. The study of the external structure of mature anoplocephalidae has determined that the morphological characteristics are somewhat different from those described by other authors in terms of thyzaniezia strobila length, and other parameters correspond to the reported information.
5. In Central Yakutia 4 superfamilies of oribatid mites were detected: Oribatuloidea Wooley, 1956, Oribatelloidea Wooley, 1956, Galumnoidea Balogh, 1961, Ceratozetoidea Balogh, 1961; 8 families and 11 genera. The most common out of 9 determined species are: Ceratozetella sellnicki (Raiski, 1956), Achipteria coleopt rata (linnaeus, 1758), Liebstadia similis (Micha.

REFERENCES