Conservation of commercially hunted ungulates biodiversity in Transbaikalia by ensuring efficient veterinary measures

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Abstract. The article is devoted to the conservation of hunting and commercial ungulates biodiversity in Transbaikalia. The results of complex parasitological analysis are described. In hunting and commercial ungulates in the Trans-Baikal Territory, 22 species of helminths and 1 species of protozoa were parasitized. A complex of preventive veterinary measures aimed at maintaining the sanitary well-being of biocenoses is observed.

1. Introduction
Russia has the largest animals and birds biodiversity for commercial hunting. Its territory is inhabited by 23 species of ungulates, more than 100 species of fur-bearing animals, 6 species of upland and more than 200 species of waterfowl, marsh and field game, which are the objects of amateur and commercial hunting [10].

Hunting is gaining importance as a versatile sport, fascinating communication with nature, and healthy recreation. In addition, hunting is a school of knowledge of nature, conservation and its prudent use. Hunting makes it possible to restore mental and physical abilities [1, 3]. Among the hunters there are people of a wide variety of professions, who are united by the need to communicate with nature and for active recreation. A variety of natural conditions and hunting fauna in Russia contribute to the further development of hunting and hunting economy [5].

The hunting economy is important for the country's economy and as an element of the implementation of the food security doctrine. The hunting territories in the Russian Federation cover an area of about 1.5 billion hectares and significantly exceed the area of hunting in other countries of the world. The cost estimate of trophy (commercial) animals for hunting, inhabiting the territory of the Russian Federation, exceeds 87 billion rubles. The total annual turnover in the hunting sector of the Russian Federation is estimated at 80-100 billion rubles, of which 16 billion rubles are for hunting products and services in this area [11].

However, wild animals, like domestic animals, are susceptible to many diseases.

Infectious diseases could appear as isolated cases or infect large groups of animals, acquiring the character of an epizootic [3]. Outbreaks of epizootics of acute infectious diseases in many cases lead to the mass death of wild animals. There are many known cases of boar plague infection in the Far East and Kazakhstan, as well as in the Belovezhskaya Pushcha nature reserve and in hunting farms in the European part of the Russian Federation [2]. The plague epizootic led to the death of a significant
part of the animal population, and it took years to restore their optimal numbers. Outbreaks of foot and mouth disease among artiodactyls led to the same devastating results [3]. Diseases could lead to a sharp decline in the number of inhabited species of wild animals in this area.

Of the whole variety of infectious diseases, the greatest damage to the hunting economy is caused by infectious and invasive diseases, since they are distinguished by a more acute course, a quick transition among susceptible animals and more often lead to the death of animals.

The analysis of domestic scientific papers showed that there are very few researches on ensuring the veterinary efficient measures for commercially hunted animals on the territory of the Russian Federation, most of them were realized in the European part of the Russian Federation [2,7,8] and were practically not organized on the territory of Transbaikalia.

2. Materials and methods.

The current research was carried out from 2014 to 2021 at the Scientific research institute of veterinary in Eastern Siberia - branch of the Siberian Federal Scientific Center of Agrobiotechnology of the Russian Academy of Sciences.

The object of the research was the feces of commercially hunted animals taken in places of their concentration (feeding areas, salt licks) and in natural biotopes, as well as biological material obtained as a result of hunting.

Experimental analysis was examined by incomplete helminthological autopsy of corpses according to K.I. Scriabin. The contents of the gastrointestinal tract were examined by the sequential lavage method and the Darling method. The intestine was opened along its entire length. The detected helminths were washed in running water, fixed in Barbagallo’s liquid or in 70% alcohol. The species of the helminths was established using the indicators from the “Atlas of the most common helminths of farm animals” according to V.F. Kapustin (1953) [6].

3. Results and discussions

On the Trans-Baikal Territory, a parasite fauna has formed in wild ungulates, including 23 species of zooparasites: Cysticercus tenuicollis, Cysticercus cervi, Strongyloides papillosus, Trichocephalus ovis, Moniezia benedeni, Strongylata spp., Echinococcus granulosus larva, Dicyoecalus eckerti, Muellerius capillaries, Setaria spp., Fasciola hepatica, Trichostrongylus spp., Dicrocoelium lanceatum, Paramphistomum spp., Trichinella native, Metastrongylus elongates, Diofilaria repens, Ascaris suum, Trichocephalus suis, Thysaniezia ovilla, Cysticercus cellulosae, Oesophagostomum dentatum, Eimeria (Table 1). The maximum species diversity of 11 parasite species was found in Siberian roe deer, 9 in wild boar, 7 in red deer and 6 in elk. The minimum number of one species is noted in musk deer. Based on the analysis of helminthological materials, results were obtained that indicate a high level of occurrence and intensity of invasion of wild ungulates by individual species, and this primarily refers to Cysticercus tenuicollis, Echinococcus granulosus larva, Muellerius capillaries.

When analyzing the materials of helminthological research collected in the Trans-Baikal Territory over the past 7 years, it was possible to establish that the incidence of certain types of helminthiases in carnivores in the study area is up to 96.6: the extent of invasion (EI) Echinococcus granulosus accounted for 82.6%, Taenia hidatigena up to 72.1%, Taenia pisiformis up to 55.8 %. An increase in the number of ungulates in this area in the 2000s led to a high concentration of the invasive principle in the external environment (water) and an increase in the likelihood of infection of royal stag with helminthiases. So, according to the materials of our research, the extensiveness of the royal stag invasion was - Echinococcus granulosus larva - 81.3, Cysticercus tenuicollis - 86.8 %.

Analysis of the parasite fauna of commercially hunted animals showed that the most affected were roe deer, in which 11 species of different helminths were identified, these are intestinal strongylates, organ cysticercus and one species of protozoa, eimeria. Trichinosis analysis of 272 wild boars revealed infection of two animals Trichinella native, EI was 0.7 %. Of the 14 bears examined, the larvae Trichinella spiralis detected once, Trichinella native were found in three individuals. At the same time, widespread trichinellarity was established in wolves, EI Trichinella nativets - 45.3 %.
Table 1. Parasite fauna of commercially hunted hoofed animals of the Trans-Baikal Territory.

| No. | Parasite                          | Animal          | Number of examined or affected animals, (%) |
|-----|-----------------------------------|-----------------|--------------------------------------------|
| 1.  | *Echinococcus granulosus larva*   | Siberian roe    | 74/63 (85.1)                               |
|     |                                   | Royal stag      | 64/52 (81.3)                               |
|     |                                   | Elk             | 12/7 (58.3)                                |
| 2.  | *Cysticercus tenuicollis*         | Siberian roe    | 73/69 (94.5)                               |
|     |                                   | Royal stag      | 91/79 (86.8)                               |
|     |                                   | Elk             | 12/10 (83.3)                               |
|     |                                   | Boar            | 37/2 (5.4)                                 |
| 3.  | *Cysticercus cervi*               | Siberian roe    | 73/39 (53.4)                               |
| 4.  | *Cysticercus cellulosae*          | Boar            | 37/1 (2.7)                                 |
| 5.  | *Trichinella native*              | Boar            | 272/2 (0.7)                                |
| 6.  | *Strongylodes papillosus*         | Siberian roe    | 73/1 (1.4)                                 |
| 7.  | *Trichocephalus ovis*             | Siberian roe    | 73/3 (4.1)                                 |
| 8.  | *Moniezia benedeni*               | Siberian roe    | 73/5 (6.8)                                 |
|     |                                   | Royal stag      | 49/2 (4.0)                                 |
| 9.  | *Strongylata spp.*                | Siberian roe    | 73/18 (24.6)                               |
|     |                                   | Royal stag      | 91/15 (16.5)                               |
|     |                                   | Elk             | 11/2 (18.2)                                |
|     |                                   | Musk deer       | 6/4 (66.6)                                 |
| 10. | *Dyctyocaulus eckerti*            | Siberian roe    | 32/2 (6.3)                                 |
|     |                                   | Elk             | 17/7 (41.0)                                |
| 11. | *Muellerius capillaris*           | Siberian roe    | 32/6 (18.7)                                |
|     |                                   | Royal stag      | 30/23 (76.7)                               |
|     |                                   | Elk             | 11/2 (18.2)                                |
| 12. | *Setaria spp.*                    | Siberian roe    | 73/1 (1.4)                                 |
| 13. | *Fasciola hepatica*               | Siberian roe    | 73/5 (6.9)                                 |
| 14. | *Trichostrongylus spp.*           | Royal stag      | 91/2 (2.2)                                 |
| 15. | *Dicrocoelium lanceatum*          | Royal stag      | 30/1 (3.3)                                 |
| 16. | *Paramphistomum spp.*             | Elk             | 11/1 (9.0)                                 |
| 17. | *Metastrongylus elongatus*        | Boar            | 37/4 (11.4)                                |
| 18. | *Dirofilaria repens*              | Boar            | 37/12 (32.4)                               |
| 19. | *Ascaris suum*                    | Boar            | 37/4 (10.8)                                |
| 20. | *Trichocephalus suis*             | Boar            | 37/3 (8.1)                                 |
| 21. | *Thysaniezia ovilla*              | Boar            | 37/1 (2.7)                                 |
| 22. | *Oesophagostomum dentatum*        | Boar            | 37/2 (5.4)                                 |
| 23. | *Eimeria*                         | Siberian roe    | 73/4 (5.5)                                 |
|     |                                   | Royal stag      | 91/5 (5.5)                                 |

It should be noted that in the territory of the Trans-Baikal Territory, under conditions of adjacent anthropogenic ecosystems, the invasion of domestic ungulates with strongylates with EI was recorded: cattle - 51.6%, sheep - 61.1% and goats - 41.1%, which confirms the data on the possibility of re-infection of wild ungulates from domestic animals and conversely.

On the basis of the research, practical veterinary efficient measures for the prevention of infectious and invasive diseases of commercially hunted animals were suggested.

Preventive measures to avoid infectious diseases of commercially hunted animals could be conditionally divided into direct and indirect.

Direct interventions are methods of direct impact on wild animals.

When, after a number of productive years, the density of hunting and trade increases, and then lean years come and there is not enough natural fodder, conditions are created that weaken the natural resistance of the animal organism and favor the occurrence of epizootics.
One of the means to prevent the weakening of the body of wild game animals is to carry out biotechnical measures. The most effective means are to artificially increase forage resources by creating forage fields, sowing forage plants and feeding with ready-made forage in winter, especially in the presence of deep snow. These measures are very effective. Thus, it is possible to reduce the influence of pathogens on the organism of wild animals weakened by lack of food.

As agricultural crops, it is most rational to sow oats for brilliant green at a later date (late June, early July), sunflower, goats rue, as well as winter crops (rye) for early spring feeding. These crops are considered to be eaten by such ungulates as roe deer, elk, red deer.

When using ready-made feed, a rational arrangement of feeders is necessary. Their best form is a nursery with canopies of different heights, depending on the type of animal. In the absence of a nursery, branched trees or shrubs are used. In both cases, measures are taken to avoid contamination and trampling of the feed as much as possible.

For feeding wild boars and bears, grain from various types of agricultural crops is used.

4. Conclusions
1. Commercially hunted hoofed animals, on the territory of the Trans-Baikal Karai, are affected by 23 species of various parasites, the extensiveness of the invasion of some of them reaches 86.8%, which indicates the tense sanitary and epidemiological situation in the region. The most dangerous are: *Trichinella spiralis*, *Trichinella native*, *Echinococcus granulosus* larva, *Cysticercus tenuicollis*, *Cysticercus cervi*, since they are anthropozoonoses, and cause human diseases with severe complications.

2. The preservation of the sanitary and epidemiological well-being of biocenoses in a parasitic relation could be achieved by carrying out a complex preventive veterinary and organizational measures with the compulsory inclusion of both direct and indirect measures.

References
[1] Abalikhin B G, Kryuchkova E N et al 2004 Trichinosis of wild animals in the Ivanovo region Food resources of wild nature and ecological safety of the population p 186
[2] Bakulov I A, Vlasova T A, Knise A V and Dmitrienko N V 1993 Epizootic situation on wild animals diseases in Russia and foreign countries in the 90s of the 20th century Diagnostics, prevention and measures to avoid especially dangerous and exotic animal diseases pp 141–142
[3] Vedernikov V A and Chernichenko S A 1992 The most important infections of wild cloven-hoofed animals Diseases and parasites of wild animals 4–11.
[4] Danilkin A A 2009 Population dynamics of wild ungulates in Russia: hypotheses, factors, patterns p 310
[5] Dezhkin V V 1997 Nature management p 88
[6] Kapustin V F 1953 Atlas of the most common helminths of farm animals p 140
[7] Kolomytsev V A, Kalantaenko Yu F, Dubrovin V M and Parkhomtsev S A 2002 Epizootology of classical plague of wild boars and domestic pigs in central Russia. Biological and ecological problems of infectious diseases of wild animals and their role in the pathology of agricultural Animals and people 80–85
[8] Lutovin V I 2004 Biological and ecological analysis of hunting grounds and diseases of wild and domestic animals in the Novgorod region: author's abstract from the thesis p 46
[9] Starodynova A K 1974 Experience of combating metastrongylosis of wild pigs Zavidovsky Scientific Experimental Reserve Issue Z 153–158
[10] Schwartz S S, Mikheeva K V 1976 Theoretical foundations of the rational use of hunting and game animals Zoology of vertebrates Vol. 8 8-67.
[11] The strategy for the development of the hunting economy in the Russian Federation until 2030: the text of the order was published on the official Internet portal of legal information URL: http://www.pravo.gov.ru, 07.07.2014.