REPUBLIC OF AZERBAIJAN

On the rights of a manuscript

ABSTRACT

of the dissertation for the degree of Doctor of Philosophy

THE STUDY OF BIOECOLOGICAL PROPERTIES OF MAIN HELMINTHIASIS CAUSATIVE AGENTS IN SHEEP IN THE ABSHERON REGION

Specialty: 2429.01- Parasitology

Science field: Biology

Applicant: **Aysel Nuhbala Aghayeva**

Baku – 2021

The dissertation work was carried out in the Parasitology Department of the Azerbaijan Scientific-Research Veterinary Institute.

Scientific supervisor: Doctor of sciences in biology, professor, Correspondent member of ANAS, Honored Scientist
Saleh Heydar Maharramov

Official opponents: Doctor of Biological sciences, Associate Prof.
Gara Huseyn Fataliyev

Doctor of Biological sciences, Associate Prof.
Etibar Nasrulla Mammadov

PhD on Biological sciences, Associate Prof.
Amaliya Murad Hasanova

Dissertation Council FD 1.071 of the Higher Attestation Commission under the President of the Republic of Azerbaijan operating under the Institute of Zoology of the Azerbaijan National Academy of Sciences

Chairman of the Dissertation Council:

Doctor of sciences in biology, associate professor
Elshad Ilyas Ahmadov

Scientific Secretary of the Dissertation Council:

Doctor of sciences in biology, associate professor
Guler Aydin Huseynzade

Chairman of the scientific seminar:

Doctor of sciences in biology, associate professor
Ali Mammad Nasirov

INTRODUCTION

Relevance of the topic and completion degree. In modern times, when most areas of agriculture are intensified and comprehensively developed, the main action plan of our state has always been to implement the sustainable development of agricultural animals, as well as small horned domestic animals, to obtain ecologically clean animal products. State Programs and Orders have been adopted in this direction. Therefore, it is scientifically and practically important to protect ruminant animals from causative agents of infectious and invasive diseases, especially helminths, in order to comply with the provisions of the State Program and Orders. It is very important to improve the health of animals fed on livestock farms against helminthiasis, to take effective control measures against diseases, to identify the sources of the spread of these parasites on farms and in nature, and the environmental factors that affect the spread. As a component of the biocenosis, helminths not only play an important role in its dynamics, they enter organisms of primary and intermediate hosts in various biocenotic ways, significantly inhibit their normal development, reproductive ability, reproduction, and productivity by parasitizing various organs and tissues.

As we know, when our republic gained independence for the second time, both social and economic conditions have changed due to the transition to a market economy. Collective farms and state farms established on the basis of public property were abolished and many small peasant farms based on private property were established instead. In addition to several advantages, such farms also have a number of shortcomings. Thus, unlike collective and state farms, most of these farms do not have qualified specialists (zootechnician veterinarian, etc.). In this case, timely treatment and preventive measures against pests, diseases, especially helminths are not carried out. Also, due to some difficulties in the irrigation systems, various problems have arisen in pastures and areas around the barns. In recent years, there are meat sale points in large cities and settlements. In many cases, animals are slaughtered and meat is sold under conditions that do not meet veterinary and sanitary requirements. All this has led to the spread and multiplication of various helminthiasis pathogens in

the areas where private and farmer farms are located. Issues such as the helminth fauna of ruminants fed in such newly established farms, the identification of newly formed foci of disease, the implementation of effective control measures against them, etc., have not been sufficiently studied until recently, with a few exceptions. Besides, during the Soviet period, both in Azerbaijan and other surrounding regions, large natural pastures, shrubs, water supply networks, etc. was available. At that time, agriculture was one of the leading sectors of the country. Besides, sheep and cattle herds had a large number of animals (1000-3000 animals per herd), and pastures were larger. All of these factors contribute to the widespread of disease causative agents and infection by invasive pathogens in pastures. Transformation of pastures into arable lands after gaining independence, some problems in the irrigation system, expansion of tourism and catering network, have also the effect on the spread of helminthiasis. Besides, in recent years, global warming is taking place on our planet, which is one of the abiotic factors that lead to the destruction of helminth eggs, larvae, and intermediate hosts.

Object and goal of the research. The object of the study was sheep (*Ovis aries*) fed on private and farmer sheep farms in the Absheron region. The goal of the study was to give the bioecological characteristics of the main helminths that parasitize sheep in the area and to carry out preventive control measures against them.

The purpose and tasks of the research.

1. Study of the species composition of the main helminthic pathogens, extensiveness and intensity of the invasion in the Absheron Peninsula and Khizi region and performing a comparative analysis;
2. Identification of areas where helminthiasis is widespread and dominant helminths in the region;
3. To study the distribution of the main pathogenic helminths in the Absheron region in different landscape-ecological zones, as well as the seasonal dynamics of helminths widely spread in the region and damage sheep farms;
4. Analyzing changes in the blood parameters of sick sheep;
5. To determine the epizootiological role of the main helminths found in the region;

6. Development of preventive measures against helminth eggs, estimation of economic efficiency;

To achieve these goals, the following tasks were set:

- To analyze the physical, geographical, and helminthological condition of the research areas;
- To determine the study level of the main pathogenic helminths of sheep in Azerbaijan and adjacent regions;
- To study and analyze the species composition, extensiveness, and intensity of the distribution of main helminths of sheep by systematic groups, landscape-ecological zones, and seasons in the Absheron Peninsula and Khizi region;
- Comparative analysis of the hemoglobin amount, erythrocyte sedimentation rate (ESR), erythrocyte and leukocyte count by taking blood from sick and healthy sheep;
- To determine the distribution of the main causative agents of helminthiasis among domestic and wild mammals;
- To find the effective substance and calculate the economic efficiency by laboratory testing different desinvasion substances and in various concentrations against the eggs of pathogenic helminths widespread in the Absheron region;

Research methods. To study the distribution of the main causative agents of sheep helminthiasis in different landscape-ecological zones of the Absheron region, the location and grazing areas of private farms engaged in sheep breeding in different villages and settlements, the number of sheep, etc. were determined in 2015-2020. The permission of entrepreneurs was received to conduct research in farms. Coprological examination and complete helminthological dissection were performed with samples collected from these farms, helminths were collected and preserved.

Physical, chemical, and morphological examinations of blood were also performed in healthy and sick sheep.

Helminthiases cause serious damage to livestock and farms due to the loss in live weight and wool of sick sheep, and damage to internal organs. In this case, the economic efficiency gained as a result of our preventive measures was calculated using appropriate formulas.

Main points presented to the defense of the dissertation:

1. Species composition and bioecological features of the main helminthiasis causative agents of sheep in the Absheron region;

2. Comparative analysis of helminth distribution in the Absheron peninsula and Khizi region;

3. Changes in the blood parameters of sick sheep;

4. Study of the effect of desinvasion substances on helminth eggs of sheep, their application and estimation of economic efficiency;

Scientific novelty of the research. For the first time since our republic gained independence, we have studied the species composition, intensity, and extensiveness of the main helminthiasis causative agents of sheep in private and farmer farms in the Absheron region. The helminth fauna was found to consist of 4 species of trematodes, 6 species of cestodes, and 8 species of nematodes: trematodes-*Fasciola hepatica, F.gigantica, Dicrocoelium lanceatum, Paramphistomum cervi*, cestodes-*Moniezia expansa, M.benedeni, Taenia hydatigena, T.ovis, Multiceps multiceps, Echinococcus granulosus,* nematodes - T*richocephalus ovis, Chabertia ovina, Haemonchus contortus, Protostrongylus hobmaieri, P.kochi, P.railleti, Dictyocaulus filaria, Mullerius capillaris.* Besides, 5 species of nematodes and 1 species of cestodes (*Trichostrondylus axei, Tr.skrjabini, Ostertagia ostertagi, Marshallagia marshalli, Nematodirus abnormalis* və *Avitellina centripunctata)* were found in this area, which had not been included in the list of main helminths because they did not cause serious complications and were not widespread.

For the first time, a comparative analysis of the infection was conducted in the Absheron Peninsula and Khizi region, and it was found that both the extensiveness and intensity of the invasion were higher in the Khizi region. Therefore, veterinary and sanitary measures, as well as the prevention and treatment of helminth infections, should be started, first of all, in the Khizi region.

For the first time, areas of widespread helminthiasis and dominant helminth species have been identified in the region

For the first time, the distribution of helminths in the region was studied at different altitudes and during various seasons. High extensiveness and intensity of the main helminths were found in the areas included in the low mountain belt.

For the first time in the Absheron region, a comparative analysis of the blood parameters of sheep invaded by widespread nematodes (*H.contortus* and *D.filaria*) and healthy sheep was performed. Decreased hemoglobin amount and erythrocyte count, and increased leukocyte count and ESR were observed in sick sheep.

For the first time, the effect of different concentrations of desinvasion substances on helminth eggs in sheep (*H.contortus* and *D.filaria*) was studied. It was determined that the application of a 6% solution of sodium hydroxide was more effective and gives an economic benefit of 13 manats 60 kopecks per sheep. Preventive control measures (recommendations) against helminth eggs in sheep (*H.contortus* and *D.filaria*) were developed on a scientific basis.

Theoretical and practical significance of the research. As helminths have not been studied in detail in the study areas, the results obtained are new and are of great importance not only for the region but also as a theoretical and scientific basis for the fauna of Azerbaijan. The study of the main helminthiasis causative agents of sheep in private and farmer farms in the Absheron region will play an important role in determining the patterns of the geographical distribution of helminths, populations of pathogens in altitude zones, and ways of formation of complex helminthiasis causative agents, and in determining their role in the biocenoses in which sheep are fed.

During the research, a key role of various biotic (vegetation, the number of sheep, etc.), abiotic (seasons), and to some extent anthropogenic factors were found in the formation of the main helminthiasis causative agents in different landscape-ecological areas of altitude zones.

Thus, determining the number of main helminthiasis causative agents found in sheep farms in the Absheron region, their distribution in different landscape-ecological zones and the identification of biotic, abiotic factors that cause the spread will play an important role in solving a number of biological and environmental problems.

Measures to prevent helminthiasis in sheep have been developed on a scientific basis. As a result of the research, a recommendation entitled "Measures to combat haemonchosis and dictyocaulus in sheep" (2021) was prepared.

Regarding the practical significance of the study, it should be noted that 18 species of main helminthiasis causative agents found in sheep in the Absheron region play also an epizootiological role for other domestic animals and wild mammals. Studies conducted in the Absheron region have shown that domestic animals and sometimes wild animals play a role in the storage and transmission of causative agents of helminthiasis. In particular, sheepdogs, stray dogs, and wild canidae are mainly involved in the storage and transmission of teniidosis causative agents.

Thus, the results obtained by addressing the issues will be used in the development of preventive control against main causative agents of helminthiasis of epizootological importance and environmental rehabilitation measures. The scientific results obtained can also be used in the teaching of Parasitology related subjects in higher and secondary special schools, and can be referred to when writing works on the helminthological study of ruminants in Azerbaijan.

Approbation and application of the dissertation work. The main provisions of the research were presented and discussed in the annual reports of the Department of Parasitology of the Veterinary Research Institute, as well as in the following Republican and International (local and foreign) scientific conferences:

1. International scientific conference "Actual problems of modern natural and economic sciences" (GSU, Ganja, May 3-04, 2019);
2. International scientific conference “IV INSAC International Educational Sciences Congress” (Turkey, Kayseri, 2019);
3. International scientific-practical conference "Application of innovations in the development of veterinary science" (Baku, November 25-27, 2019);
4. Republican scientific conference "Ecology and protection of life activities: achievements, problems" (SSU, Sumgayit, March 12-13, 2020);
5. The first republican scientific conference "Fundamentals of natural sciences" (Baku, June 24, 2020);
6. Multidisciplinary International Conference “Pontokaspi and Caucasus Region: Changes in the Connection and Isolation of

Ecosystems, Phylogeny, Geology, Ecology and Geography" (WCU, Baku, November 27-28, 2020);

7. International scientific-practical conference "Modern trends and successes in the fight against zooanthroponoses of agricultural animals and birds" (Makhachkala, December 3-4, 2020);

8. Republican scientific conference "Modern problems of chemistry" (SSU, Sumgayit, April 15-16, 2021);

9. Veterinary science in the XXI century - innovations for the future (Baku, November 25-26, 2021);

On the basis of the research results, 9 articles (3 abroad), 9 conference materials (2 abroad), and 1 recommendation covering the main content of the dissertation were published.

Name of the organization where the dissertation work was performed. The research was carried out in the laboratory of the Parasitology Department of the Azerbaijan Veterinary Research Institute.

Total volume of the dissertation in characters with an indication of the separate volumes of the structural units. The dissertation is commented on 167 computer-printed pages consisting of 174554 characters. The dissertation contains the introduction (15630), 6 chapters (I chapter 33624, II chapter 9470, III chapter 17102, IV chapter 70925, V chapters 6380, VI chapters 16855), results (3584), practical recommendations (984), a bibliography, appendices, 27 figures, 52 tables, and 11 diagrams. The list of literature includes 166 sources cited in the dissertation. 50 of them are in Azerbaijani, 88 in Russian, and 28 are from other foreign sources.

CHAPTER I. STUDY OF HELMINTHIASIS CAUSATIVE AGENTS OF SHEEP IN AZERBAIJAN AND FOREIGN COUNTRIES

This chapter provides information on the history of the study of helminthiasis in small horned animals in Azerbaijan and abroad, bioecological features of helminthiasis causative agents, their identification by modern diagnostic methods, regional distribution, age and seasonal dynamics, changes in blood parameters, testing of preventive measures.

CHAPTER II. PHYSICAL-GEOGRAPHICAL AND HELMINTHOLOGICAL SITUATION OF RESEARCH AREAS

In this chapter, on the basis of literary data, the geographical location, structure, physical and geographical features of the Absheron region, land cover, flora, fauna, altitude landscapes, climate indicators, and other features formed during the long historical evolutionary process are described[1].

CHAPTER III. MATERIALS AND METHODS

The research was conducted on sheep farms located in the Absheron region in 2015-2020 (Figure 1). To determine the mass infection of the herd with the main causative agents of helminthiasis, 1589 feces samples were examined using coprological[2] methods such as Vishnyauskas, Fulleborn methods. Using the complete helminthological dissection method, 771 dead and slaughtered sheep were examined[3].

Figure1. Researched Absheron region

[1] Məmmədov, Q.Ş. Azərbaycanın torpaq ehtiyatlarından səmərəli istifadənin sosial- iqtisadi və ekoloji əsəsları / Q.Ş.Məmmədov. - Bakı: Elm, - 2007. -856 s.

[2] Baytarlıq parazitologiyası / A.Q.Məmmədov, Y.H.Hacıyev, N.M.Şirinov [və b.] . – Bakı: Azərnəşr, - 1986, - 428 s.

[3] Боев, С.Н., Соколова, И.В, Панин, В.Я. Гельминты копытных животных Казахстана: [в 2 томах] / С.Н.Боев, И.В.Соколова, В.Я.Панин. - Алма-Ата: АН Казах. ССР, - т. 2. – 1962. - с. 373.

The collected helminthological materials were analyzed in a faunistic aspect. The determination and systematization of helminths were carried out mainly according to R.S. Schultz, Y.V. Gvozdev[4].

The distribution of the main helminthiasis causative agents was analyzed according to the nature of the landscape and the seasons.

Amscope, Motic microscopes, magnifiers, and a camera were used to determine the species composition of helminths.

Physical, chemical, and morphological examination of the blood was also performed by appropriate methods[5].

For the first time, sodium hydroxide and formaldehyde solutions of various concentrations were tested against haemonchosis and dictyocaulosis as desinvasion substances[6] in the laboratory, an effective desinvasion substance was found and tested on the farm and the economic efficiency was estimated[7].

CHAPTER IV. MAIN HELMINTHIASIS CAUSATIVE AGENTS DETECTED IN SHEEP IN THE ABSHERON REGION

In the paragraphs of the dissertation entitled **4.1 Trematodes; 4.2. Cestodes; 4.3. Nematodes,** the main causative agents of helminthiasis found in the Absheron region, their extensiveness and intensity in villages and settlements, landscape-ecological zones (altitude zones), seasonal nature of their distribution and helminths with high infection rate in the region that highly damage sheep farms are described based on personal materials.

The research revealed main 18 species of the helminth fauna in sheep of the Absheron region consisting of 4 trematode species (*Fasciola hepatica, F.gigantica, Paramphistomum cervi, Dicrocoelium lanceatum*), 6 cestode species *(Moniezia benedeni, M.expansa, Cysti-*

[4] Шульц, Р.С., Гвоздев, Е.В. Основы общей гельминтологии [в 2-х томах] / Р.С.Шульц, Е.В.Гвоздев, - Москва: Наука, - т. 1. – 1970. - 481 с.

[5] Hacıyev, H. Klinik diaqnostika / H.Hacıyev. – Bakı: Maarif, - 1985. – 356 s.

[6] Якубовский, М.В. Диагностика, терапия и профилактика паразитарных болезней животных / Н.Ф. Карасев; - Минск: “Хата”, - 2001. – 375 с.

[7] Hacıyev, Y.H. Helmintozlarda tətbiq işlərinin iqtisadi səmərəsinin hesablanması // - Bakı: Azərbaycan Aqrar Elm Jurnalı, - 2000. № 1-2, - s.66-70.

cercus tenuiocollis, C.ovis, Echinococcus granulosus, Conerus cerebralis) və 8 nematode species (*Chabertia ovina, Trichosephalus ovis, Dictyocaulus filaria, Protostrongylus hobmaieri, P.kochi, P.railleti, Haemonchus contortus, Muellerius capillaris)*[8,9,10].

4.4. Comparative analysis of the distribution of the main helminthiasis causative agents in the Absheron Peninsula and Khizi region. In this paragraph, we have conducted a comparative analysis of the prevalence of main causative agents of helminthiasis in the Absheron Peninsula and Khizi region.

The extensiveness and intensity of the distribution of the 18 main helminths detected in the region by the complete helminthological dissection method in 19 research areas (14 in the Absheron peninsula - Zire, Hovsan, Mashtagha, Mehdiabad, Gobu, Sulutepe, Z.Taghiyev, Fatmayi, Novkhani, Mammadli, Khirdalan, Jeyranbatan, Mushvigabad, Guzdek; 5 in the Khizi region- Yeni Yashma, Shorabad, Altiaghaj, Gizilgazma, Tudar) are described in Tables 1 and 2.

Table 1 presents the number of causative agents of helminthiasis in the Absheron peninsula based on the complete helminthological dissection method: *F.hepatica* 12.7% (2-64 samples), *F.gigantic*a 9.8% (2-42 samples), *D.lanceatum* 19.8% (3-51 samples), *P.cervi* 4.5% (3-25 samples), *M.expansa* 13.3% (1-9 samples), *M.benedeni* 13.4% (1-5 samples), *T.hydatigena* 13.4% (1-24 samples), *T.ovis* 7.6% (1-8 samples), *M.multiceps* 1.4% (1-2 samples), *E.granulosus* 36.8% (1-14 samples), *Tr.ovis* 39.8% (1-38 samples), *Ch.ovina* 22.1% (1-51

---

[8] Агаева, А.Н. Распространение возбудителя фасциолеза *(Fasciola hepatica* l.*)* по зонам на территориях Апшеронского полуострова Хызинского района Азербайджанской республики. Бюллетень науки и практики // - Нижневартовск: Bulletin of Science and Practice, - 2019. Т.5, № 3, - с. 188-193.

[9] Агаева, А.Н. Распространение возбудителя эхинококкоза овец (*Echinococcus granulosus*) на территориях Апшеронского полуострова и Хызынского района Азербайджанской республики // - Москва: Аграрная наука, - 2020. №1, - с.43-45.

[10] Агаева, А.Н. Протострongилез овец Апшеронского полуострова и Хызынского района Азербайджанской республики // -Саратов: Аграрный научный журнал, - 2020. № 3, - с. 36-40.

samples), *H.contortus* 28.9% (2-53 samples), *P.hobmaieri* 10.5% (1-16 samples), *P.kochi* 27.4% (2-25 samples), *P.railleti* 16.2% (1-18 samples), *D.filaria* 27.0% (2-3 samples), *M.capillaris* 14.6% (1-19 samples); The number of helminthiasis pathogens in the Khizi region is given in Table 2: *F.hepatica* 18.7% (2-83 samples), *F.gigantic*a 18.1% (6-63 samples), *D.lanceatum* 30.7% (3-63 samples), *P.cervi* 14.0% (6-39 samples), *M.expansa* 30.6% (2-15 samples), *M.benedeni* 26.6% (1-8 samples), *T.hydatigena* 16.2% (1-34 samples), *T.ovis* 32.6% (1-19 samples), *M.multiceps* 3.0% (1-2 samples), *E.granulosus* 38.0% (1-18 samples), *Tr.ovis* 47.6% (2-53 samples), *Ch.ovina* 32.2% (1-74 samples), *H.contortus* 43.2% (5-56 samples). *P.hobmaieri* 22.8% (4-31 samples), *P.kochi* 37.3% (5-44 samples), *P.railleti* 38.9% (1-54 samples), *D.filaria* 32.9% (2-36 samples), *M.capillaris* 34.4% (2-34 samples).

Besides, based on a complete helminthological dissection, the average extensiveness and final intensity of the invasion of the main helminths in the villages and settlements of the region were calculated. Thus, in the Absheron peninsula, in Zire 11.6% (2-51 samples), Hovsan 11.1% (1-34 samples), Mashtagha 13.5% (1-43 samples), Mehdiabad 19.7% (1-31 samples), Gobu 22.7% (1-35 samples), Sulutepe 10.8% (1-46 samples), Z.Taghiyev 18.2% (1-37 samples), Fatmayi 17.8% (1-38 samples), Novkhani 14.9% (1-48 samples), Mammmadli 15.1% (1-34 samples), Khirdalan 21.5% (2-39 samples), Jeyranbatan 28.0% (1-63 samples), Mushvigabad 20.6% (1-64 samples), Guzdek 22.7% (1-23 samples)[11] (Table 1).

The following results were obtained in the Khizi region: in Shorabad 21.3% (1-38 samples), Yeni Yashma 12.2% (1-36 samples), Altiaghaj 36.3% (1-54 samples), Tudar 38.0% (1-68 samples), Gizılgazma 36.1% (1-83 samples) (Table 2). Thus, the infection was found to be higher in Jeyranbatan, Gobu, and Guzdek settlements of the Absheron Peninsula, in Tudar and Altiaghaj villages of the Khizi region.

[11] Ağayeva, A.N. Abşeron yarımadası və Xızı rayonu qoyunçuluq təsərrüfatlarında başlıca helmintlər // - Gəncə: Azərbaycan Texnologiya Univeristeti Elmi xəbərlər, - 2021. №2, - s. 58-52.

Table 1

Distribution of main helminths on research areas in the Absheron Peninsula (based on the Method of complete helminthological dissection)

№	Helminth species	Zire		Hovsan		Mashtagha		Mehdiabad		Gobu		Sulutepe		Z.Taghyeri	
		IE	II	IE	II	IE	II	IE	II	IE	II	IE	II	IE	II
1	*F.hepatica*	9.0	11-51	9.1	8-27	14.3	2-43	15.0	9-18	16.7	14-35	15.1	7-46	7.2	13-21
2	*F.gigantica*	2.5	4-11	5.5	4-19	16.7	13-41	-	-	19.4	2-7	-	-	8.7	5-25
3	*D. lanceatum*	21.5	14-51	-	-	-	-	30.0	3-19	30.6	3-8	-	-	23.2	5-17
4	*P.cervi*	3.8	6-12	3.6	7-13	-	-	-	-	11.1	3-25	6.1	12-15	-	-
5	*M.expansa*	5.1	2-5	9.1	1-2	7.1	3-4	15.0	2-3	16.7	2-9	15.2	3-7	10.1	1-4
6	*M.benedini*	7.6	2-3	7.3	2-3	16.7	1-2	15.0	1-2	19.4	1-3	9.1	2-4	8.7	1-4
7	*T.hydatigena*	8.8	3-14	9.1	2-7	16.6	5-11	10.0	2-5	13.9	1-9	12.1	3-10	11.6	1-10
8	*T.ovis*	2.5	1	3.6	2-7	4.8	2-5	-	-	5.5	3	-	-	13.0	1-3
9	*M.multiceps*	-	-	-	-	-	-	-	-	5.5	2	-	-	2.8	1
10	*E.granulosus*	35.4	2-8	21.8	4-13	35.7	1-7	40.0	2-6	36.8	1-7	39.4	2-6	40.5	4-8
11	*Tr.ovis*	35.4	5-27	41.8	1-19	45.2	2-31	30.0	1-7	41.6	3-27	24.2	5-18	49.3	5-28
12	*Ch.ovina*	20.2	3-51	32.7	2-34	28.6	2-19	30.0	1-31	13.9	2-20	21.2	1-16	18.8	2-18
13	*H.contortus*	15.2	17-53	10.9	8-19	11.9	11-24	40.0	7-23	36.1	3-12	15.1	2-13	31.9	16-37
14	*P.hobmaieri*	2.5	2-3	5.4	2-3	2.4	2	15.0	1-8	11.1	3-14	-	-	7.2	2-8
15	*P.kochi*	3.8	2-3	3.6	2-3	2.4	2	45.0	2-13	50.0	2-19	-	-	34.8	4-11
16	*P.raillieti*	6.3	2-3	5.4	1-4	4.7	2-3	25.0	2-8	19.4	2-18	12.1	2-7	13.0	5-16
17	*D.filaria*	21.5	7-19	23.6	14-23	26.2	4-23	35.0	8-25	36.1	4-11	6.0	2-4	33.3	11-36
18	*M.capillaris*	7.6	1-3	7.3	2-3	9.5	3-7	10.0	4-6	25.0	5-13	18.2	4-15	13.0	3-11
	TOTAL	***11.6***	***2-51***	***11.1***	***1-34***	***13.5***	***1-43***	***19.7***	***1-31***	***22.7***	***1-35***	***10.8***	***1-46***	***18.2***	***1-37***

Continuation of Table 1

№	Helminth species	Fatmayi		Novxani		Mammadli		Khirdalan		Jeyranbatan		Mushvigabad		Guzdek		TOTAL	
		IE	II	IE	II	IE	II	IE	II	IE	II	IE	II	IE	II	**IE**	**II**
1	*F.hepatica*	14.6	15-38	5.9	7-48	10.3	8-34	-	-	28.6	24-63	15.0	23-64	16.7	10-21	***12.7***	***2-64***
2	*F.gigantica*	14.6	8-31	9.5	2-13	10.3	3-27	-	-	23.8	21-42	10.0	14-23	16.7	9-18	***9.8***	***2-42***
3	*D. lanceatum*	35.4	14-32	16.7	3-12	24.1	12-27	35.3	29-39	-	-	35.0	5-37	25.0	7-19	***19.8***	***3-51***
4	*P.cervi*	-	-	-	-	-	-	11.8	9-12	9.5	5-12	-	-	16.6	4-17	***4.5***	***3-25***
5	*M.expansa*	14.6	3-7	10.7	3-6	-	-	23.5	3-4	23.8	3-5	15.0	2-8	20.8	4-7	***13.3***	***1-9***
6	*M.benedini*	14.6	1-3	6.0	2-3	6.9	1-3	29.4	2-5	28.6	2-4	10.0	2-5	8.3	2-5	***13.4***	***1-5***
7	*T.hydatigena*	16.6	5-11	13.1	2-24	17.2	3-7	11.7	5-10	19.0	2-23	20.0	3-8	8.3	1-12	***13.4***	***1-24***
8	*T.ovis*	-	-	2.4	1	6.9	3	11.8	2-4	19.0	3-8	20.0	2-4	16.7	2-3	***7.6***	***1-8***
9	*M.multiceps*	-	-	2.4	1	-	-	-	-	4.7	1	-	-	4.2	1	***1.4***	***1-2***
10	*E.granulosus*	45.8	1-9	40.5	3-14	34.5	2-11	35.3	2-13	47.6	5-12	25.0	1-5	37.5	4-10	***36.8***	***1-14***
11	*Tr.ovis*	45.8	1-38	36.9	2-31	31.0	4-33	52.9	6-29	66.7	8-34	35.0	2-8	20.8	3-17	***39.8***	***1-38***
12	*Ch.ovina*	12.5	3-9	17.8	2-43	13.8	1-14	17.6	2-8	33.3	4-37	15.0	1-11	33.3	5-24	***22.1***	***1-51***
13	*H.contortus*	29.2	6-23	33.3	18-35	27.6	13-27	29.4	11-20	57.1	19-34	25.0	2-9	41.6	8-23	***28.9***	***2-53***
14	*P.hobmaieri*	6.2	2-4	4.8	3-15	13.8	3-7	23.5	4-10	9.5	2-4	20.0	2-16	25.0	5-13	***10.5***	***1-16***
15	*P.kochi*	31.2	4-14	21.4	3-21	24.1	5-9	40.6	5-10	42.8	3-7	50.0	3-25	33.3	4-16	***27.4***	***2-25***
16	*P.raillieti*	12.5	1-5	10.7	3-7	17.2	4-10	23.5	3-12	14.3	4-9	30.0	3-18	33.3	5-17	***16.2***	***1-18***
17	*D.filaria*	18.7	2-14	26.2	18-35	24.1	5-18	29.4	3-10	52.4	14-37	20.0	3-7	25.0	7-18	***27.0***	***2-37***
18	*M.capillaris*	8.3	1-2	9.5	3-6	10.3	3-5	11.8	3-5	23.8	4-8	25.0	2-5	25.0	3-19	***14.6***	***1-19***
	TOTAL	***17.8***	***1-38***	***14.9***	***1-48***	***15.1***	***1-34***	***21.5***	***2-39***	***28.0***	***1-63***	***20.6***	***1-64***	***22.7***	***1-23***	***17.7***	***1-64***

Table 2

Distribution of main helminths on research areas in the Khizi region (based on the Method of complete helminthological dissection)

№	Helminth species	Yeni Yashma		Shorabad		Altiaghaj		Gizilgazma		Tudar		TOTAL	
		IE	II	IE	II	IE	II	IE	II	IE	II	IE	II
1	*F.hepatica*	-	-	-	-	30.2	10-47	33.9	2-83	29.2	17-68	***18.7***	***2-83***
2	*F.gigantica*	-	-	-	-	32.6	6-42	30.6	12-63	27.1	17-62	***18.1***	***6-63***
3	*D. lanceatum*	-	-	33.3	3-9	41.9	11-35	38.7	13-55	39.6	14-63	***30.7***	***3-63***
4	*P.cervi*	12.4	5-12	16.6	19-22	14.7	8-36	13.7	7-39	12.6	6-32	***14.0***	***6-39***
5	*M.expansa*	-	-	-	-	46.5	4-12	48.4	5-11	58.3	2-15	***30.6***	***2-15***
6	*M.benedini*	6.9	1-2	8.3	1	37.2	1-3	38.7	2-4	41.7	1-8	***26.6***	***1-8***
7	*T.hydatigena*	10.3	4-7	16.6	2-3	16.3	1-34	21.0	1-15	16.7	3-32	***16.2***	***1-34***
8	*T.ovis*	27.6	3-8	33.3	3-7	34.9	2-17	33.9	2-19	33.3	1-14	***32.6***	***1-19***
9	*M.multiceps*	3.4	1	-	-	4.6	2	4.8	1-2	2.1	1	***3.0***	***1-2***
10	*E.granulosus*	20.6	1-4	33.3	3-8	46.5	5-14	41.9	4-16	47.9	5-18	***38.0***	***1-18***
11	*Tr.ovis*	41.4	2-36	25.0	2-38	53.5	5-38	59.7	2-53	58.3	4-41	***47.6***	***2-53***
12	*Ch.ovina*	24.1	3-28	16.6	1-7	39.5	7-54	37.1	4-63	43.7	2-74	***32.2***	***1-74***
13	*H.contortus*	24.1	5-17	50.0	5-21	44.2	18-37	50.0	8-44	47.9	22-56	***43.2***	***5-56***
14	*P.hobmaieri*	-	-	16.6	4-9	37.2	7-19	29.0	6-24	31.2	4-31	***22.8***	***4-31***
15	*P.kochi*	-	-	41.6	5-22	48.8	9-44	48.3	8-37	47.9	12-30	***37.3***	***5-44***
16	*P.raillieti*	6.9	1-2	41.6	4-11	41.9	5-53	43.5	4-48	60.4	6-54	***38.9***	***1-54***
17	*D.filaria*	20.7	5-16	25.0	2-13	39.5	8-36	35.5	17-34	43.7	12-18	***32.9***	***2-36***
18	*M.capillaris*	20.7	2-7	25.0	4-7	44.2	7-34	40.3	5-28	41.7	4-32	***34.4***	***2-34***
	TOTAL	***12.2***	***1-36***	***21.3***	***1-38***	***36.3***	***1-54***	***36.1***	***1-83***	***38.0***	***1-68***	***29.0***	***1-83***

As seen in Tables 1 and 2, based on the Method of complete helminthological dissection, the average extensiveness of invasion for main helminths was 17.7% (1-64 samples) in the Absheron Peninsula and 29.0% (1-83 samples) in the Khizi region.

We also performed coprologic examinations and calculated the average extensiveness of invasion (Tables 3 and 4). So, in the Absheron peninsula *F.hepatica* 13.7%, *F.gigantic*a 10.3%, *D.lanceatum* 20.9%, *P.cervi* 5.3%, *M.expansa* 14.0%, *M.benedeni* 14.9%, *P.hobmaieri* 10.6%, *P.kochi* 30.1%, *P.railleti* 18.1%, *D.filaria* 28.0%, *M.capillaris* 15.3%, *Tr.ovis* 38.7%, *Ch.ovina* 21.7%, *H.contortus* 30.5%; In the Khizi region *F.hepatica* 19.5%, *F.gigantic*a 18.9%, *D.lanceatum* 31.4%, *P.cervi* 13.7%, *M.expansa* 31.6%, *M.benedeni* 27.0%, *P.hobmaieri* 23.3%, *P.kochi* 37.2%, *P.railleti* 41.6%, *D.filaria* 34.3%, *M.capillaris* 35.7%, *Tr.ovis* 49.4%, *Ch.ovina 3*2.5%, *H.contortus* 44.0%.

Based on coprological examinations of sheep infected with main helminths in the Absheron peninsula and Khizi region, the average extensiveness of invasion in villages and settlements was calculated. Thus, in the Absheron peninsula: in Zira 12.0%, Hovsan 10.8%, Mashtagha 13.3%, Mehdiabad 22.6%, Gobu 26.6%, Sulutepe 11.6%, Z.Taghiyev 19.8%, Fatmayi 18.1%, Novkhani 15.2%, Mammmadli 17.8%, Khirdalan 24.4%, Jeyranbatan 29.5%, Mushvigabad 24.5%, Guzdek 26.0%; in the Khizi region: in Shorabad 21.8%, Yeni Yashma 11.3%, Altiaghaj 40.9%, Tudar 43.2%, Gizilgazma 40.1%.

As seen in Tables 3 and 4, based on coprological examinations, the average extensiveness of invasion in the Absheron peninsula was 19.4% and in the Khizi region, this value was higher and amounted to 31.4%.

The comparison of infection rates with the main helminths in the research areas of the Absheron peninsula and Khizi region is described in diagrams (Diagrams 1 and 2). As seen in both diagrams, the infection rate with all helminths was higher in the Khizi region compared to the Absheron Peninsula.

Table 3

Results of coprological examinations in research areas of the Absheron peninsula

№	Helminth species	Zire	Hovsan	Mashtagha	Mehdiabad	Gobu	Sulutepe	Z.Tagiyev	Fatmayi	Novxani	Mammadli	Khirdalan	Jeyranbatan	Mushvigabad	Guzdek	TOTAL
		IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	**IE**
1	*F.hepatica*	10.8	11.8	15.4	12.8	18.5	16.2	8.4	15.2	7.2	12.9	-	28.5	16.2	18.2	***13.7***
2	*F.gigantica*	2.2	7.1	18.2	-	21.5	-	8.4	13.0	11.2	12.9	-	20.0	11.7	18.2	***10.3***
2	*D. lanceatum*	20.7	-	-	32.6	30.7	-	24.2	36.9	17.6	27.4	37.5	-	38.2	27.3	***20.9***
2	*P.cervi*	4.3	4.7	-		13.8	8.8	-	-	-	-	14.0	10.0	-	18.2	***5.3***
5	*M.expansa*	7.6	11.8	9.1	16.3	18.5	16.2	13.7	-	12.8	-	25.0	25.7	17.6	21.2	***14.0***
6	*M.benedini*	8.7	9.4	17.3	16.3	21.5	11.8	10.5	16.3	8.0	8.1	28.1	28.6	13.2	10.6	***14.9***
7	*P.hobmaieri*	-	5.9	-	16.3	12.3	-	8.4	7.6	7.2	12.9	25.0	8.6	19.1	25.6	***10.6***
8	*P.kochi*	-	-	-	46.5	51.0	-	38.9	29.3	21.6	48.4	45.3	44.2	61.8	34.8	***30.1***
9	*P.raillieti*	8.7	4.7	7.3	26.7	21.5	14.7	15.8	14.1	11.2	19.4	25.0	15.7	32.4	36.4	***18.1***
10	*D.filaria*	22.8	24.7	27.3	36.0	37.0	7.4	35.8	19.6	26.4	24.2	31.2	52.9	20.6	25.8	***28.0***
11	*M.capillaris*	8.7	9.4	8.2	9.3	27.7	19.1	14.7	9.8	9.6	9.7	10.9	24.3	25.0	27.3	***15.3***
12	*Tr.ovis*	36.9	37.6	42.7	30.2	43.0	26.5	46.6	46.7	24.0	32.3	48.4	65.7	36.8	24.2	***38.7***
13	*Ch.ovina*	20.7	12.9	28.2	31.4	15.4	22.1	20.0	13.0	20.0	14.5	20.3	32.9	19.1	33.3	***21.7***
14	*H.contortus*	16.3	11.7	11.8	41.9	39.9	20.2	31.6	31.3	35.4	26.8	31.3	55.7	30.9	42.4	***30.5***
	TOTAL	***12.0***	***10.8***	***13.3***	***22.6***	***26.6***	***11.6***	***19.8***	***18.1***	***15.2***	***17.8***	***24.4***	***29.5***	***24.5***	***26.0***	***19.4***

Table 4

Results of the coprological examination in the research areas of the Khizi region

No	Helminth species	Shorabad	Yeni Yashma	Altiaghaj	Tudar	Gizilgazma	TOTAL
		IE,%	IE,%	IE,%	IE,%	IE,%	**IE,%**
1	*F.hepatica*	-	-	33.3	30.6	33.7	***19.5***
2	*F.gigantica*	-	-	33.3	28.6	32.6	***18.9***
3	*D.lanceatum*	35.9	-	43.1	38.8	39.3	***31.4***
4	*P.cervi*	18.8	-	16.7	17.3	15.7	***13.7***
5	*M.expansa*	-	-	47.1	60.2	50.6	***31.6***
6	*M.benedini*	11.0	10.2	39.2	42.0	32.6	***27.0***
7	*P.hobmaieri*	17.2	-	38.2	30.6	30.3	***23.3***
8	*P.kochi*	31.3	-	50.9	50.0	54.0	***37.2***
9	*P.raillieti*	43.6	10.2	47.1	61.2	46.1	***41.6***
10	*D.filaria*	26.6	21.6	40.2	45.9	37.1	***34.3***
11	*M.capillaris*	25.0	22.7	45.1	43.9	41.6	***35.7***
12	*Tr.ovis*	26.6	43.2	54.9	62.2	60.0	***49.4***
13	*Ch.ovina*	17.2	23.9	39.2	43.9	38.2	***32.5***
14	*H.contortus*	51.5	26.1	44.1	49.0	49.4	***44.0***
	TOTAL	***21.8***	***11.3***	***40.9***	***43.2***	***40.1***	***31.4***

The local foci of distribution of the main helminths were studied at the research areas in the Absheron region. Based on the results of both coprological examination and complete helminthological dissection method, the higher infection rates with the main helminths were found in Jeyranbatan, Gizilgazma, Altiaghaj, and Tudar villages of the region. Besides, with the help of research methods, the most common species of helminths found in sheep in the Absheron region were identified: trematode - *D.lanceatum,* cestodes - *E.granulosus,* nematode - *Tr.ovis.* In general, among all the main helminths we have identified, the species *Tr.ovis* and *H.contortus* are dominant.

Of the 18 main helminths we found in the region, 4 were identified as geohelminths and 14 as biohelminths. T*richocephalus ovis, Chabertia ovina, Haemoinchus contortus, Dictyocaulus filaria* belong to geohelminths, the rest to biohelminths. As a result of our research, it was determined that the highest infection rate in the region occurs by geohelminths - *Tr.ovis* (IE 43.2%).

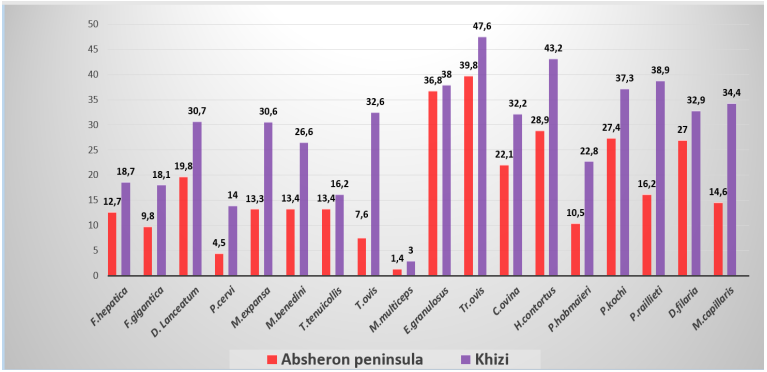

Diagram 1. Comparative description of the distribution of the main causative agents of helminthiasis in sheep in the Absheron peninsula and Khizi region (based on the Method of complete helminthological dissection)

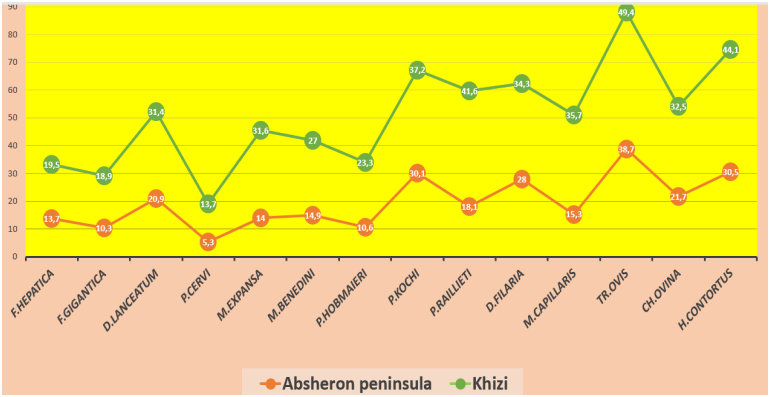

Diagram 2. Comparative description of the distribution of the main causative agents of helminthiasis of sheep in the Absheron peninsula and Khizi region (based on coprological examinations)

According to both coprological and complete helminthological examination methods, we conclude that the infection rate was higher in the Khizi region, and both the extensiveness and intensity of the invasion were high. Thus, according to the methods of coprological examination in the Absheron peninsula, IE was 19.4%, according to the complete helminthological dissection IE was 17.7%, and II was 1-64 samples. In the Khizi region, IE determined by the methods of copro-

logical examination was 31.4%, and by the complete helminthological dissection, IE was 29.0% and II amounted to 1-83 samples.

During the study, the average infection rate with the main helminths in the plains, foothills, and low mountainous areas of the region was determined (Table 5). The table presents the invasion parameters for the main helminths. In the plain zone, IE was 15.1%, II was 1-51 samples, in the foothills, IE-19.2%, II-1-64 samples, and in the low mountainous zone IE-37.1%, II-1-83 samples (Figure 5). Thus, both the extensiveness and intensity of the invasion were highest in the low mountainous zone (Diagram 5).

Table 5

Distribution of main helminths in altitude zones of the Absheron region (based on the Method of complete helminthological dissection)

№	Helminth species	Plain zone		Foothill zone		Low mountainous zone	
		IE	II	IE	II	IE	II
1	*F.hepatica*	8.6	2-51	12.4	7-64	31.4	10-83
2	*F.gigantica*	9.6	2-42	7.8	2-31	30.1	6-63
3	*D.lanceatum*	13.2	3-37	22.4	5-41	39.9	11-63
4	*P.cervi*	4.1	5-13	7.0	3-25	13.7	6-39
5	*M.expansa*	12.2	1-5	16.5	2-9	35.9	2-15
6	*M.benedini*	11.5	1-4	14.3	1-5	32.0	1-8
7	*T.hydatigena*	13.4	1-23	13.4	1-24	18.0	1-34
8	*T.ovis*	8.8	1-8	11.7	1-8	34.0	1-19
9	*M.multiceps*	1.1	1	1.7	1-2	3.8	1-2
10	*E.granulosus*	32.7	1-13	42.5	1-14	45.1	4-18
11	*Tr.ovis*	41.2	1-36	38.1	1-38	57.5	2-53
12	*Ch.ovina*	23.1	1-51	19.7	1-43	39.8	1-74
13	*H.contortus*	26.3	3-51	32.7	2-35	47.4	8-56
14	*P.hobmaieri*	4.9	1-5	10.2	2-6	32.0	4-31
15	*P.kochi*	18.8	2-11	35.2	2-25	75.2	8-44
16	*P.raillieti*	8.6	1-16	18.1	1-18	48.4	4-54
17	*D.filaria*	25.7	2-17	25.1	5-22	40.5	8-36
18	*M.capillaris*	8.6	1-13	17.1	1-18	43.1	4-34
	TOTAL	***15.1***	***1-51***	***19.2***	***1-64***	***37.1***	***1-83***

As a result of our research, 18 helminths found in the region were grouped into 3 classes of 2 types: *Nematoda (Nemathelminthes), Trematoda,* and *Cestoda (Plathelminthes).* According to Tables 1 and 2, the

highest infection rate was in the Khizi region for all 3 classes (20.4%, 24.5%, 36.2%). The highest infection rate in both the Absheron Peninsula and the Khizi region was observed for the *Cestoda* class.

Thus, coprological and complete helminthological examination methods, as well as the analysis of the distribution of helminths in the altitude zones, allowed us to conclude that the infection rate in the Khizi region is higher than in the Absheron Peninsula. This makes it necessary for farmers and veterinarians to start veterinary-sanitary measures, both prophylactic and treatment measures against helminths in the Khizi region (Figure 4).

Figure 4. A red zone of high rate infection in the Absheron peninsula

4.4. Epizootiological role of the main causative agents of helminthiasis detected in the Absheron region

This paragraph of the dissertation is about the spread of the main causative agents of helminthiasis found in sheep among other domestic and wild animals in the region.

By comparing the main helminths that parasitize sheep with those found in domestic animals in the Absheron region we have found that 10 species of domestic animals (goat, cattle, buffalo, zebu, camel, domestic pig, domestic cat, dog, horse, rabbit) and 16 species of wild mammals (brown hare, coypu, jackal, wolf, fox, lynx, brown bear, wildcat, jungle cat, boar, roe deer, gazelle, Daghestan tur, deer, chamois, mountain goat) are involved in their development cycle and distribution to some extent (Table 6).

Table 6

Distribution of the main causative agents of helminthiasis found in sheep among domestic animals and wild mammals in the Absheron region

	Helminths / Animal species	*F.hepatic*	*F.giganti*	*D.lancea*	*P.cervi*	*M.expan*	*M.benedi*	*T.hydatig*	*T.ovis*	*M.multic*	*E.granul*	*Tr.ovis*	*Ch.ovina*	*H.contor*	*P.hobma*	*P.kochi*	*P.railliet*	*D.filaria*	*M.capill*
Domestic animals	Goat	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Cattle	+	+	+	+	+	+	+		+	+	+	+	+					
	Buffalo	+	+	+	+	+	+	+			+	+	+	+					
	Zebu	+	+	+		+	+					+	+	+					
	Camel		+	+		+	+	+	+	+	+	+		+					
	Domestic pig	+	+	+					+		+			+					
	Domestic cat							+	+		+								
	Dog			+				+		+	+								
	Horse	+	+	+															
	Rabbit		+	+							+								
Wild mammals	Brown hare	+		+							+								
	Coypu	+									+								
	Jackal							+	+		+								
	Wolf							+	+	+	+								
	Fox							+	+	+	+								
	Lynx							+											
	Brown bear			+							+								
	Wildcat							+			+								
	Jungle cat							+			+								
	Boar	+		+		+		+			+								
	Roe deer	+	+			+	+	+		+	+	+	+	+	+				+
	Gazelle	+	+	+		+		+	+	+	+	+	+					+	
	Daghestan tur	+	+	+		+		+		+	+	+	+						
	Deer		+	+	+	+	+	+	+	+	+	+	+						
	Chamois		+	+					+	+	+	+	+	+					
	Mountain goat						+	+		+	+	+	+	+			+	+	+

Thus, the main helminths found in sheep are common with certain helminth species found in domestic and wild animals. Table 6 presents the number of common helminths. In domestic animals: Goat-18, Cattle-12, Buffalo-11, Zebu-8, Camel-10, Domestic pig-6, Domestic cat-3, Dog-4 Horse-3 Rabbit-3; In wild mammals: Brown hare-3, Coypu-2, Jackal-3, Wolf-4, Fox-4, Lynx-1, Brown bear-2, Wildcat-2, Jungle cat-2, Boar-5, Roe deer-12, Gazelle-11, Daghestan tur-14, Deer-11, Chamois-8, Mountain goat -10[12].

[12] Ağayeva, A.N. Abşeron bölgəsində aşkar edilmiş başlıca helmintoz törədicilərinin epidemiolji və epizootoloji rolu // -Bakı: Gənc tədqiqatçı, - 2020. VI cild, № 1, - s. 95-101.

CHAPTER V. EXAMINATION OF BLOOD PARAMETERS OF HELMINTH-INFECTED AND HEALTHY LAMBS

According to the research, blood was taken from the carotid artery of sick and healthy sheep, the amount of hemoglobin, the number of erythrocytes, leukocytes, and ESR were examined according to the generally accepted methodology. In the experiment, 2 groups (healthy and infected) were created with 15 sheep each[13].

During the experiment, the amount of hemoglobin in the group of healthy sheep was 10.8-12.1 g/l, the amount of hemoglobin in the blood of sheep infected with *H.contortus* and *D.filaria* helminths decreased to 7.6-9.1 g/l. The number of erythrocytes in healthy animals was 8.3-10.1 million, whereas in the infected animals it decreased to 5.7-7.5 million, the number of leukocytes in healthy animals was 7.5-10.3 thousand, and in sick animals increased to 11.8-13.9 thousand (Table 7).

Table 7

Hemoglobin amount and the number of erythrocytes and leukocytes in the blood of healthy and sick sheep (M±m, n=15)

No	Hemoglobin amount		The number of erythrocytes		The number of leukocytes	
	Infected	Healthy	Infected	Healthy	Infected	Healthy
1	11.6	8.2	8.5	6.5	8.2	13.9
2	11.5	8.6	8.9	6.8	7.8	11.8
3	10.9	8.8	8.4	7.1	8.7	12.5
4	11.0	9.1	10.0	7.5	9.6	13.6
5	12.0	7.6	9.1	6.9	9.1	13.5
6	12,1	8,3	8.3	6.8	9.3	12.6
7	11,5	9,0	10.2	7.1	10.0	13.0
8	11,9	8,3	9.6	6.1	9.0	13.1
9	12.0	8.4	10.1	6.0	9.1	12.1
10	11.0	8.0	8.9	5.7	8.9	13.2
11	11.7	8.5	9.3	6.7	10.3	12.8
12	11.6	7.8	9.3	6.2	7.8	13.0
13	12.0	8.0	8.9	7.0	8.0	13.1
14	11.8	7.6	10.1	6.1	7.5	12.9
15	11.4	8.3	9.4	5.9	9.1	13.2
Average	11.6±0.11	8.3 ±0.12	9.3±0.17	6.6±0.17	8.8±0.17	13.3±0.17

[13] Ağayeva, A.N. *Dictyocaulus filaria* və *Haemonchus contortus* ilə yoluxmuş qoyunların qan göstəricilərinin dinamikası // Baytarlıq elmi XXI əsrdə - gələcəyə doğru innovasiyalar, - Bakı: Müəllim, - 25-26 noyabr, - 2021, - s. 116-119.

In healthy sheep, the ESR was 0.8 mm in 60 minutes, and in sick sheep, it increased to 1.1 mm in 60 minutes (Table 8).

Table 8

ESR in infected and healthy sheep (mm) (M±m, n=15)

No	Healthy sheep				Infected sheep			
	15 min.	30 min.	45 min.	60 min.	15 min.	30 min.	45 min.	60 min.
1	0.2	0.3	0.5	0.9	0.4	0.6	1.0	1.2
2	0.2	0.4	0.6	0.8	0.3	0.5	0.9	1.1
3	0.3	0.4	0.7	0.7	0.3	0.6	0.7	0.9
4	0.2	0.3	0.5	0.8	0.3	0.7	0.9	1.1
5	0.1	0.5	0.6	0.9	0.3	0.6	0.7	1.0
6	0.2	0.4	0.5	0.7	0.4	0.6	0.7	0.9
7	0.1	0.5	0.6	0.8	0.3	0.5	0.8	1.0
8	0.2	0.3	0.6	0.7	0.3	0.6	1.0	1.2
9	0.1	0.3	0.7	0.8	0.3	0.5	0.8	0.9
10	0.2	0.4	0.7	0.9	0.4	0.6	0.8	1.0
11	0.2	0.4	0.6	0.8	0.4	0.7	0.9	1.1
12	0.2	0.5	0.7	0.8	0.3	0.7	0.8	1.2
13	0.3	0.3	0.6	0.8	0.4	0.6	0.7	1.0
14	0.2	0.5	0.4	0.7	0.3	0.7	0.8	1.0
15	0.3	0.4	0.7	0.9	0.3	0.6	1.0	1.2
Average	0.2± 0.02	0.4± 0.02	0.6± 0.02	0.8± 0.02	0.3± 0.02	0.6± 0.02	0.8± 0.03	1.1± 0.04

CHAPTER VI. PREVENTIVE MEASURES AND ECONOMIC EFFICIENCY

Given the serious economic damage that helminthiasis can cause to the development of such a lucrative field as sheep breeding, we consider it important to implement a number of preventive measures to limit their spread areal.

6.1. Study of the effect of desinvasion substances on the eggs of *Haemonchus contortus* and *Dictyocaulus filaria* in the laboratory. Laboratory and farm testing of desinvasion substances against helminthiasis of sheep (*H. contortus* and *D. filaria* eggs) was performed using 2.0; 4.0; 6.0 and 8.0% sodium hydroxide, 2.0; 4.0; 6.0 and 8.0% formaldehyde, 5.0% phenol for comparison, and tap water as control.

Laboratory tests showed that the ovicidal effect of a 6.0% solution of sodium hydroxide on the eggs of *H. contortus* and *D. filaria* was faster and manifests itself in 5 minutes (Table 9), its efficiency was higher, and amounted to 100% (Table 10).

Table 9

Exposure time of desinvasion substances to *H. contortus* and *D. filaria* eggs

No	Substances	Concentration (%)	Exposure time						
			5 min.	10 min.	15 min.	20 min.	30 min.	50 min.	60 min.
H.contortus									
1.	NaOH	2.0	+++	+++	+++	+++	++-	++-	++-
2.	NaOH	4.0	+++	+++	++-	++-	++-	++-	+--
3.	NaOH	**6.0**	++-	++-	+--	+--	---	---	**---**
4.	NaOH	8.0	++-	++-	+--	+--	---	---	---
5.	Formalin	2.0	+++	+++	+++	+++	++-	++-	++-
6.	Formalin	4.0	+++	+++	+++	+++	++-	++-	++-
7.	Formalin	6.0	+++	+++	+++	++-	+--	+--	+--
8.	Formalin	8.0	+++	+++	++-	+--	+--	+--	+--
9.	Phenol (Comparison)	5.0	+++	+++	++-	++-	++-	+--	+--
10.	Tap water (Control)	-	+++	+++	+++	+++	+++	+++	+++
D.filaria									
1.	NaOH	2.0	+++	+++	+++	+++	++-	++-	++-
2.	NaOH	4.0	+++	+++	++-	++-	+--	+--	+--
3.	NaOH	**6.0**	++-	++-	+--	++-	---	---	**---**
4.	NaOH	8.0	++-	++-	+--	++-	---	---	---
5.	Formalin	2.0	+++	+++	+++	+++	++-	++-	++-
6.	Formalin	4.0	+++	+++	+++	+++	++-	++-	++-
7.	Formalin	6.0	+++	+++	+++	++-	+--	+--	+--
8.	Formalin	8.0	+++	++-	++-	+--	+--	+--	+--
9.	Phenol (Comparison)	5.0	+++	+++	+++	++-	++-	++-	+--
10.	Tap water (Control)	-	+++	+++	+++	+++	+++	+++	+++

Under the influence of a 6% solution of sodium hydroxide, the eggs become deformed, their color whitens and becomes transparent, some lose their shape, and finally, the shell of the egg melts, and the inner structure of the egg appears in a transparent-granular shape when viewed under a microscope. The shell of some eggs is pierced on one or both sides, from which the internal structure of the egg is poured around. The structure of eggs, which lost their form, i.e. deformed eggs appear in a granular form.

In subsequent experiments, the ovicidal effect of 6.0% sodium hydroxide and formalin solutions on helminth eggs spread on wood, brick, and concrete was determined. Thus, a 3-hour exposure to 6.0% sodium hydroxide and formalin solutions resulted in 100% and 73.3% destruction of *H. contortus* eggs, respectively. The same concentration of the invasion substances destroyed, respectively, 100%

and 70.7% of *D.filaria* eggs.

Table 10

Ovicidal effect of solutions of desinvasion substances of various concentrations on *H.contortus* and *D.filaria* eggs (M±m, n=3)

№	Substances	Concentrations (%)	The number of eggs		Invasion		Without invasion	
			Invasion	Without invasion	The number of destroyed eggs	Effectiveness of the substance (%)	The number of destroyed eggs	Effectiveness of the substance (%)
H. contortus								
1.	NaOH	2.0	1300 ± 31	1300 ±29	1020 ±15	78.4	1090 ±15	83.8
2.	NaOH	4.0	1300 ±12	1300 ±31	1110 ±15	85.3	1180 ±15	90.7
3.	NaOH	**6.0**	1300 ±18	1300 ±6	1240 ±21	95.3	1300 ±0	**100.0**
4.	NaOH	8.0	1300 ±16	1300 ±10	1270 ±10	97.6	1300 ±0	100.0
5.	Formalin	2.0	1300 ±29	1300 ±21	900 ±12	69.2	950 ±12	73.0
6.	Formalin	4.0	1300 ±10	1300 ±26	960 ±10	73.0	1010 ±15	77.6
7.	Formalin	6.0	1300 ±16	1300 ±15	1000 ±15	76.9	1150 ±17	88.4
8.	Formalin	8.0	1300 ±29	1300 ±21	1080 ±12	83.0	1160 ±12	89.2
9.	Phenol (Comparison)	5.0	1300 ±26	1300 ±27	820 ±6	63.0	920 ±10	70.7
10	Control	Tap water	1300 ±20	1300 ±15	–	–	–	–
D. filaria								
1.	NaOH	2.0	1400±21	1400 ±18	1110 ±10	79.2	1250 ±10	89.2
2.	NaOH	4.0	1400 ±10	1400 ±15	1240 ±15	88.5	1320 ±15	94.2
3.	NaOH	**6.0**	1400 ±12	1400 ±18	1310 ±12	93.5	1400 ±0	**100.0**
4.	NaOH	8.0	1400 ±15	1400 ±10	1360 ±10	97.1	1400± 0	100.0
5.	Formalin	2.0	1400 ±15	1400 ±18	1010 ±10	72.1	1070 ±15	76.4
6.	Formalin	4.0	1400 ±15	1400 ±15	1130 ±18	80.7	1190 ±12	85.0
7.	Formalin	6.0	1400 ±10	1400 ±12	1200 ±21	85.7	1250 ±10	89.2
8.	Formalin	8.0	1400 ±12	1400 ±10	1230 ±15	87.8	1300 ±15	92.8
9.	Phenol (Comparison)	5.0	1400 ±12	1400 ±10	900 ±15	64.2	1090 ±10	77.8
10	Control	Tap water	1400 ±15	1400 ±18	–	–	–	–

Then, 4 plots of 1m^2 were isolated from other plots. 93.3% of eggs in the area sprayed with 6.0% solution of sodium hydroxide, 72.0% in the area sprayed with 6.0% solution of formalin, 60.0% in the area sprayed with 5.0% solution of phenol was destroyed. Helminth eggs were not destroyed in the area sprayed with tap water as control. All these experiments make necessary the use of 6% sodium hydroxide solution on the farm.

7. On-farm testing of sodium hydroxide and phenol solutions.

The desinvasion effect of 6.0% sodium hydroxide solution was tested in infected individual sheep farms for haemonchosis and dictyo-

caulosis in the Yeni Yashma settlement of the Khizi region.

Studies have shown that when using a 6.0% solution of sodium hydroxide against the eggs of dictyocaulosis and haemonchosis causative agents, the efficiency was 91.4% (68.5% efficiency with the 5.0% phenol we used for comparison). Due to its high desinvasion effect, and considering that it is practical, convenient, and economically profitable, it is expedient to apply it in large farms[14].

6.3 Economic efficiency. During helminthiasis (dictyocaulosis and haemonchosis), due to the loss of live weight and wool of sick sheep, livestock and farms suffer significant damage. Studies confirm that each animal infected with helminths lost an average of 3 kg of live weight and 0.3 kg of wool.

Our research shows that when a 6.0% solution of sodium hydroxyl was used as a desinvasion substance against dictyocaulosis and haemonchosis in sheep, the economic efficiency was 13.60 manats per sheep, and in the case of phenol, this parameter was 9.65 manats. It can be concluded that since sodium hydroxide is more cost-effective compared to phenol as a desinvasion substance, its use is advisable[15].

CONCLUSIONS

1) The major helminth fauna in sheep in the private and farmer farms of the Absheron region was found to consist of 18 helminth species (4 of them are geohelminths and 14 are biohelminths), with 4 species belonging to trematodes, 6 species – cestodes, and 8 species – nematodes. Trematodes: *Fasciola hepatica, F.gigantica, Dicrocoelium lanceatum, Paramphistomum cervi*; Cestodes: *Moniezia expansa, M.benedeni, Taeni hydatigena, T.ovis, Multiceps multiceps, Echinococcus granulosus;* Nematodes: *Protostrongylus hobmaieri, P.kochi, P.railleti,*

[14] Ağayeva, A.N. Natrium qələvisi və fenol məhlullarının qoyunçuluq təsərrüfatı şəraitində sınaqdan keçirilməsi // Kimyanın müasir problemləri Respublika elmi konfransı, - Sumqayıt: SDU, - 15-16 aprel, - 2021, - s. 306-308.

[15] Ağayeva, A.N. Qoyunların hemonxoz və diktiokaulyozuna qarşı mübarizə tədbirləri / A.N.Ağayeva. – Bakı: Təknur, - 2021. – 12 s.

Mullerius capillaris, geohelminths - T*richocephalus ovis, Chabertia ovina, Haemoinchus contortus, Dictyocaulus filaria.*

2) Higher invasion levels were identified for *Tr.ovis* (43.2%, 1-53 samples), *E. granulosus* (39.2%, 1-18 samples), *H. contortus (*35.0%, 2-56 samples), and they were considered the dominant helminth species of the region.

3) High invasion level with main helminths in the Absheron peninsula was found in Gobu (22.7%, 1-35 samples), Guzdek (22.7%, 1-23 samples), and Jeyranbatan (28.0%, 1-63 samples); In the Khizi region, it was observed in Gizilgazma (36.1%, 1-83 samples), Altiaghaj (36.3%, 1-54 samples), and Tudar (38.0%, 1-68 samples) villages.

4) The extensiveness and intensity of the invasion were found to be higher in the Khizi region than in the Absheron peninsula. According to coprological examinations, IE was 19.4% in the Absheron peninsula, 31.4% in the Khizi region. Based on the complete helminthological dissection, in the Absheron peninsula, IE was 17.7% and II was 1-64 samples, and in the Khizi region, IE was 29.0% and II was 1-83 samples.

5) The infection in the Absheron peninsula was caused by trematodes in 11.7% of the cases, by cestodes-14.3%, and by nematodes-23.3%, and in the Khizi region, respectively, 20.4%, 24.5%, and 36.2%. This confirms once again that there is a higher infection rate in the Khizi region for all three classes. The highest infection rate in the region was manifested by the class *Nematoda*. These results will help to determine which areas and against which helminths to carry out deinvasion and dehelminthation measures in the first place.

6) High extensiveness and intensity for all main helminths in the region were recorded in the low mountainous belt. The average infection rate for main helminths was 15.1% (1-51 samples) in the plains, 19.2% (1-64 samples) in the foothills, and 37.1% (1-83 samples) in low mountainous areas. The main helminths in domestic and wild animals were investigated, and it was found that 10 species of domestic animals and 16 species of wild mammals were involved in the development cycle and distribution of helminths to various degrees.

7) The average hemoglobin content in the blood of healthy sheep was 11.6 g / l, and in the blood of helminth-infected sheep decreased to 8.0 g/l. Average values of ESR in the blood of healthy and infected sheep were 0.8 mm in 60 minutes and 1.1 mm in 60 minutes, respectively. The number of erythrocytes in 1 mm^3 of the healthy sheep blood averaged 9. 3×10^6, and in infected sheep decreased to 6.6 $\times10^6$. The number of leukocytes in 1 mm^3 of the healthy sheep blood ranged from 7.5×10^3 to 10.3×10^3, and in infected animals, it was in the range of 11.8×10^3-13.9×10^3.

8) It was found that a 6.0% solution of sodium hydroxide had a higher desinvasion effect against the eggs of dictyocaulosis and haemonchosis pathogens and was highly effective in destroying 91.4% of helminth eggs *(H.contortus* and *D.filaria*). The application of this solution in the farm resulted in the economic efficiency of 13 manats 60 kopecks per one sheep, which makes it expedient to use 6.0% NaCl. This substance has a high deinvation effect and is practically convenient and profitable.

PRACTICAL RECOMMENDATIONS

1. Taking into account the widespread of the main helminthiasis pathogens and the serious economic damage they can cause to sheep farms (meat, wool, milk loss), it is expedient to carry out preventive control measures in sheep farms in the Khizi region, where the infection is higher.
2. Farmers and veterinarians should take into account the dominant species identified in the region *(E. granulosus* from cestodes, *Tr.ovis* and *H. contortus* species from nematodes) and take appropriate control measures when carrying out treatment and preventive measures in sheep farms.
3. When using a 6.0% solution of sodium hydroxide as a deinvation substance, economic efficiency of 13.60 manats per 1 sheep was obtained. Production tests have shown that the substance has a high deinvation effect, is practical and economically profitable. Therefore, it is expedient to apply this substance in larger sheep farms.

THE LIST OF PUBLISHED SCIENTIFIC WORKS ON THE TOPIC OF THE DISSERTATION

1. Ağayeva, A.N. Trematododozların *(Dicrocoelium lanceatum, Fasciola hepatica)* hündürlük qurşaqları üzrə yayılması // Müasir təbiət və İqtisadiyyat elmlərinin aktual problemləri, -Gəncə: Gəncə Dövlət Universitetinin nəşriyyatı, -3-4 may, - 2019, - s. 197-199.
2. Ağayeva, A.N. Azərbaycan Respublikasının Abşeron yarımadası və Xızı rayonu ərazilərində xabertioz törədicisinin *(Chabertia ovina)* zonalar üzrə yayılması // -Bakı: Gənc Tədqiqatçı Elmi-praktik jurnal, - 2019. Cild V, № 1, - s. 118-122.
3. Ağayeva, A.N. Abşeron bölgəsində qoyunlar arasında trixosefalyozun yayılması // Baytarlıq elminin inkişaf istiqamətində innovasiyaların tətbiqi, -Bakı: Müəllim, -25-27 noyabr, - 2019, - s. 185-187
4. Ağayeva, A.N. Abşeron bölgəsinin fərdi qoyunçuluq təsərrüfatlarında protostrongilyoz törədicilərinin (*Protostrongylus hombaieri, P.kochi, P.railleti)* ekstensivlik və intensivliyinin müxtəlif məntəqələr, hündürlük qurşaqları üzrə tədqiqi // -Gəncə: Azərbaycan Texnologiyalar Universitetinin Elmi xəbərlər məcmuəsi, - 2019. № 3, - s. 56-63.
5. Ağayeva, A.N. Qoyunların helmintlərinin bioekoloji xüsusiyyətlərinin öyrənilməsi // Ekologiya və həyat fəaliyyətinin mühafizəsi: nailiyyətlər, problemlər. Respublika elmi konfransının materialları, - Sumqayıt: SDU, - 12-13 mart, - 2020, - c.108-111.
6. Ağayeva, A.N., Ələkbərli, G.Y. Qoyunlarda parazitlik edən başlıca helmintlər və onlara qarşı aparıla biləcək bəzi profilaktik mübarizə tədbirləri // Təbiət elmlərinin əsasları mövzusunda I Respublika elmi konfransı, - Bakı: Zəngəzurda, - 24 iyul, - 2020, - s. 104-106.
7. Ağayeva, A.N. Abşeron bölgəsində aşkar edilmiş başlıca helmintoz törədicilərinin epidemiolji və epizootoloji rolu // -Bakı: Gənc tədqiqatçı, - 2020. VI cild, № 1, - s. 95-101.
8. Ağayeva, A.N. Abşeron bölgəsində *M.benedeni* və *M.expansa* növlərinin hendürlük qurşaqları üzrə yayılması // Pontokaspi və Qafqaz bölgəsi: ekosistemlərin birləşməsi və izolyasiyası şəraitində dəyişikliklər, canlıların filogenezi, geologiya, ekologiya və coğrafiyası. Multidistiplinar beynəlxalq (online) konfransın mate-

rialları, - Bakı: - 27-28 noyabr, - 2020, - s. 124-128.
9. Ağayeva, A.N. Qoyunlarda sestodoz törədiciləri (*Cysticercus tenuicollis, Cysticercus ovis, Coenurus cerebralis)* // - Bakı: Odlar Yurdu Universitetinin Elmi və Peraqoji Xəbərləri, -2020. № 56, - s. 288-295.
10. Ağayeva, A.N. Qoyunların hemonxoz və diktiokaulyozuna qarşı mübarizə tədbirləri / A.N.Ağayeva. – Bakı: Təknur, - 2021. – 12 s.
11. Ağayeva, A.N. Natrium qələvisi və fenol məhlullarının qoyunçuluq təsərrüfatı şəraitində sınaqdan keçirilməsi // Kimyanın müasir problemləri Respublika elmi konfransı, - Sumqayıt: SDU, - 15-16 aprel, - 2021, - s. 306-308.
12. Məhərrəmov, S.H., Ağayeva, A.N. Qoyunlarda bəzi nematodoz törədiclərinin *(Dictyocaulus filaria, Mullerius capillaris)* Abşeron bölgəsi üzrə yayılması // - Naxçıvan: AMEA Naxçıvan bölməsi Elmi əsərlər, təbiət və texniki elmlər seriyası, - 2021. C.17, №2, - s. 151-155.
13. Ağayeva, A.N. Abşeron yarımadası və Xızı rayonu qoyunçuluq təsərrüfatlarında başlıca helmintlər // - Gəncə: Azərbaycan Texnologiya Univeristeti Elmi xəbərlər, - 2021. №2, - s. 52-58.
14. Aghayeva, A.N. Azerbaycan Cumhuriyeti Abşeron bölgesindeki koyunlarda *Dicrocoelium lanceatum* dağılımının araştırılması // IV İNSAC, -Kayseri, Türkiyə: - 11-13 ekim, -2019, - s. 10-13.
15. Агаева, А.Н. Распространение возбудителя фасциолеза *(Fasciola hepatica* l.*)* по зонам на территориях Апшеронского полуострова Хызинского района Азербайджанской республики. Бюллетень науки и практики // - Нижневартовск: Bulletin of Science and Practice, - 2019. Т.5, № 3, - с. 188-193.
16. Агаева, А.Н. Распространение возбудителя эхинококкоза овец (*Echinococcus granulosus*) на территориях Апшеронского полуострова и Хызынского района Азербайджанской республики // - Москва: Аграрная наука, - 2020. №1, - с.43-45.
17. Агаева, А.Н. Протостронгилез овец Апшеронского полуострова и Хызынского района Азербайджанской республики // -Саратов: Аграрный научный журнал, - 2020. № 3, - с. 36-40.
18. Агаева, А.Н., Алиев, Ф.Т Распространение возбудителей мониезиоза по временам года на территории Апшерона Азер-

байджанской Республики // Сборник научных трудов международной научно-практической конференции “Современные тенденции и успехи в борьбе с зооантропонозами сельскохозяйственных животных и птиц”, - Махачкала: - 3-4 декабря, - 2020, - с. 14-18.
19. Ağayeva, A.N. *Dictyocaulus filaria* və *Haemonchus contortus* ilə yoluxmuş qoyunların qan göstəricilərinin dinamikası // Baytarlıq elmi XXI əsrdə - gələcəyə doğru innovasiyalar, - Bakı: Müəllim, - 25-26 noyabr, - 2021, - s. 116-119.

The defense of the dissertation will be held on 28 december 2021, at 14[00] at the meeting of the Dissertation council FD 1.09 operating under the Institute of Zoology of the Azerbaijan National Academy of Sciences

Address: AZE 1004, Baku, A.Abbaszadə, Passage 1128, block 504.

The dissertation is available at the library of the Institute of Zoology of the Azerbaijan National Academy of Sciences

The electronic versions of the dissertation and abstract have been uploaded on the official website of the Institute of Zoology of the Azerbaijan National Academy of Sciences

The abstract was sent to the required addresses on
27 november 2021.

Signed for print: 27.11.2021

Paper format: 60x84$^{1/16}$

Volume: 37 661

Number of hard copies: 20