REPUBLIC OF AZERBAIJAN

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ABSTRACT

of the dıssertation for the degreeof Doctorof Science

BIOECOLOGICAL CHARACTERISTICS AND MODERN CONTROL MEASURES AGAINST OF MAIN PARASITIC PATHOGENS OF CATTLE (BOS TAURUS) AND PIGS (SUS SCROFA DOMESTICA) İN AZERBAIJAN

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INTRODUCTION

Relevance and degree development of the topic. It is known that humans must constantly exchange food and energy with the environment in order to continue biological activity and perform vital functions. The sources of the latter are mainly plants and animals. It is true that microorganisms also have a certain share in this matter, but so far the role of plants and animals in this matter is greater. In this regard, livestock farming is of particular importance among the energy and food sources of the world's population, as the role of this sector in meeting the demand for meat and meat products, milk and dairy products, etc., which are stable elements of people's diet, is still irreplaceable. Thus, livestock products produced worldwide “account for 40% of agricultural products”[1]. For this reason, various state programs are being implemented around the world, including in the Republic of Azerbaijan, aimed at the development of the agricultural sector, including livestock breeding, where reliable food supply for people directly depends on food security. Despite all this, today, almost everywhere in the world, planned production does not always achieve the planned or predicted results, and there are a number of reasons for this. Among these, diseases caused by organisms belonging to different taxonomic groups are of great importance. Thus, the negative impact of invasive, including helminthic, diseases on the development of livestock has been confirmed in various studies, “repeatedly found all over the world ”[2,3]. Currently,

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[1] Salmon, G.R., M. et al. Exploring the landscape of livestock ‘Facts’. Glob. Food Sec., 2020, 25:100329. doi: 10.1016/j.gfs.2019.100329

[2] Кабардиев С.Ш., Мусаев З.Г., Карпущенко К.А., Шапиев Б.И. Мониторинг гельминтофауны крупного рогатого скота при отгонно-пастбищной системе ведения животноводства в условиях Северного Кавказа. Ветеринария сегодня. 2024;13(2):143-148.

[3] Hamid, L. Et al. , Alsayari, A., Tak, H., Mir, S. A., Almoyad, M. A. A., Wahab, S., & Bader, G. N. (2023). An Insight into the Global Problem of Gastrointestinal Helminth Infections amongst Livestock: Does Nanotechnology Provide an Alternative? *Agriculture*, *13*(7), 1359. https://doi.org/10.3390/agriculture13071359

these diseases are considered one of the main factors that slow down the development of agriculture, significantly affect the production of food products, and cause serious economic losses. Pathogens continue their life activities inside and outside animals, negatively affecting the health of their owners and the quantitative and qualitative indicators of the products produced, as well as the birth of healthy individuals. As a result, livestock producers, mainly farmers, "lose billions of dollars every year"[4]. In this regard, it is worth remembering that in 18 countries around the world, "1.8 billion euros are spent annually on the prevention of diseases caused by gastrointestinal nematodes, helminths such as *Fasciola hepatica* and *Dictyocaulus viviparus*, 81% of which is formed by crop losses and 19% by the funds spent on its treatment"[5]. Therefore, the fact that the prevention and treatment of the aforementioned diseases are the most important steps is a reality that everyone accepts today.

As a part of the world, the Republic of Azerbaijan is no exception in this regard. Thus, cattle breeding plays an important role in the economy of the Republic of Azerbaijan, and millions of tons of animal products are produced every year. For example, according to the data of the State Statistics Committee of Azerbaijan for 2024, "386.3 thousand tons of meat (cut into pieces), 2,298.5 thousand tons of milk, 2,300.8 million eggs and other animal products were produced in the country per year"[6]. This is not the end of animal products produced in the Republic of Azerbaijan. Because "parasitic diseases are also widespread in the Republic of Azerbaijan"[7] and their impact causes a decrease in

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[4] Strydom T, Lavan RP, Torres S, Heaney K. The Economic Impact of Parasitism from Nematodes, Trematodes and Ticks on Beef Cattle Production. Animals (Basel). 2023 May 10;13(10):1599. doi: 10.3390/ani13101599.

[5] Charlier J. Anthelmintic resistance in ruminants: challenges and solutions / J. Charlier, D.J. Bartley, S. Sotiraki [et al.] // Advances in Parasitology,-2022, v.115, -p.171–227. DOI: 10.1016/bs.apar.2021.12.002.

[6] https://www.stat.gov.az/source/agriculture/

[7] Мамедова Р.А. Возбудители и переносчики кровепаразитарных болезней крупного рогатого скота Центрально-Аранского экономического района (Азербайджан) // Бюллетень науки и практики. 2023. Т. 9. №3. С. 147-151

both quantity and quality of products produced every year. One of the dangerous aspects of this is that these types of diseases are observed more intensively in young animals. The relatively weak immune system of young animals allows them to be easily infected with invasive pathogens, including helminths. Natural-climatic conditions play an important role in the spread of invasions, and the presence of ponds around pastures is also a factor that positively affects the development of intermediate hosts. Such favorable conditions lead to an increase in the prevalence of invasive diseases and an increase in the intensity of infection of animals with parasites. Although treatment and preventive measures against parasitic diseases have been developed and applied in farms by researchers from both foreign countries and our republic, helminthiasis continues to spread among animals and "continue to exert its harmful effects today"[8]. For this reason, it is of great scientific and practical importance to further develop animal husbandry, especially cattle breeding, to obtain ecologically clean and high-quality products, and to protect against infectious and invasive diseases, especially helminthiasis. It should be noted that "the natural-climatic conditions of the area also play an important role in the expansion of the distribution area of helminths, significantly influencing the formation of the parasitic fauna of animals and leading to the widespread spread of mixed (associative) invasions."[9,10] Taking into account the above, developing treatment and preventive measures against helminthiasis with new generation drugs and applying them to

[8] Bricarello PA, Longo C, da Rocha RA, Hötzel MJ. Understanding Animal-Plant-Parasite Interactions to Improve the Management of Gastrointestinal Nematodes in Grazing Ruminants. Pathogens. 2023 Mar 29;12(4):531. doi: 10.3390/pathogens12040531.

[9] Полаз С. В. Гельминты диких копытных, обитающих в разных районах Беларуси // Российский паразитологический журнал. 2022. Т. 16. № 1. С. 33–49. https://doi.org/10.31016/1998-8435-2022-16-1-33-49

[10] Bautista-Garfias, C. R. et al. A Review of the Impact of Climate Change on the Epidemiology of Gastrointestinal Nematode Infections in Small Ruminants and Wildlife in Tropical Conditions//Pathogens, 2022, *11*(2), 148. https://doi.org/10.3390/pathogens11020148

farms is considered one of the important tasks of the modern era.

The aims and tasks. The purpose of the presented work was to determine the prevalence rates of helminthiasis and mixed blood parasites in cattle and pigs in private farms located in various economic regions of the Republic of Azerbaijan, the factors affecting them, and to develop preventive control measures to prevent them.

In order to achieve the set goal, it was considered appropriate to carry out the following **tasks** during the research:

- Determination of the species composition and infection rate of the main helminths prevalent in cattle and pig farms in various economic regions of the country;
- Determination of the species composition and infection rate of mixed blood parasites in cattle and pig farming;
- Determination of the influence of seasonal factors on the spread of helminthiasis among cattle and pigs;
- Clarification of the dynamics of the spread of helminthiasis depending on the age of animals;
- Identification of the main parameters of conditions limiting the spread of helminthiasis in animals and development of preventive control measures

Research methods. Since the issues clarified during the research were mainly of a biological nature, the methods used in the work were chosen accordingly. Thus, during taking samples, conducting monitoring observations, preparing the samples for laboratory research, and conducting appropriate analyses were used known methods and approaches currently widely used in biology, as well as in the field of parasitology. During the completion of the dissertation, all experimental experiments were repeated 4-6 times, the results obtained were statistically processed, and the results that met the formula S/M 0.05 (where S is the standard deviation, M is the average value of the repetitions) were considered valid and included in the dissertation. At the same time, the purity of the reagents and reactants used in the work, as well as the accuracy of the instruments and equipment used in completing the dissertation, were at a level that made it possible to obtain reliable data.

The main provisions of the dissertation submitted for defense.

- The natural soil-climate and flora of the studied economic regions of the Republic of Azerbaijan are favorable for the spread of helminthiasis of cattle and pigs, as well as mixed blood parasites.
- The prevalence of helminthiasis and blood parasites in cattle in all the studied economic regions was characterized by different quantitative indicators, the factors causing this difference include the seasons of the year, the age of the animals, the natural soil-climatic and relief characteristics of the area, as well as the biological characteristics of the pathogens.
- Although helminth infections recorded in the studied cattle farms were found in all age groups of animals with different invasion extensiveness, helminth infection of older individuals was observed to be weaker than that of younger individuals.
- The observation of a decrease in the amount of hemoglobin and an increase in the erythrocyte sedimentation rate in cattle indicates their infection with mono and associative invasions, which leads to the observation of conditions such as reduced mobility, weakened digestion, increased water demand, etc. in carriers of the invasion compared to healthy animals.
- The concentration and exposure time of dezinvasion indicators allows for the complete destruction of pathogens in cattle.
- The relatively low quantitative indicators of helminthic invasion in pigs, the relatively high prevalence of the disease in older generations, the observation of maximum indicators in different seasons, as well as the increase in reproductive activity with the help of antioxidant and organic selenium-containing preparations are the main indicators that distinguish them from cattle.

Scientific novelty of the research. The prevalence rates of helminthiasis and mixed blood parasites in cattle and pigs raised on private farms located in the economic regions of the Republic of Azerbaijan, such as Ganja-Dashkasan, Shaki-Zagatala, Shirvan-Salyan and Guba-Khachmaz, and the factors affecting them, also have been determined development cycle and epizootological characteristics of the registered pathogens and preventive measures have been proposed to prevent diseases.

It became clear that in all the studied economic regions, diseases such as trichocephalosis, strongyloidosis, nematodirosis, fascioliasis, dictyocaulosis, paramphistomatosis, and others are found in cattle, the prevalence of which is characterized by different quantitative indicators. Factors that cause this difference include the seasons of the year, the age of the animals, the natural soil-climatic and relief characteristics of the area, as well as the biological characteristics of the pathogens.

It was determined that cattle are infected with helminths throughout the year, and the extensiveness of the invasion is 17.7-43.6% in the Sheki-Zagatala economic region, 10.6-27.3% in the Ganja-Dashkan economic region, 17.0-27.4% in the Shirvan-Salyan economic region, and 9.0-36.0% in the Guba-Khachmaz economic region, so that a certain specificity was observed in the maximum and minimum extensiveness of the pathogens in individual economic regions. It has been established that cattle are infected with helminths throughout the year, and the extensiveness of the invasion in the Sheki-Zagatala economic region is 17.7-43.6%, in the Ganja-Dashkasan economic region - 10.6-27.3%, in the Shirvan-Salyan economic region - 17.0-27.4%, and in the Guba-Khachmaz economic region - 9.0-36.0%, so that a certain specificity was observed in the maximum and minimum extensiveness of the pathogens in individual economic regions.

It was determined that infection with helminths recorded in cattle farms where the helminth fauna of the Republic of Azerbaijan was studied occurs in all age groups of animals with different invasion extensiveness, but infection of older individuals with helminthosis is observed less frequently than in younger individuals, and this fact has been confirmed to one degree or another in all economic regions studied. Thus, the prevalence of helminth infections in 3-6 month old and older individuals is 9.1-28.6% and 7.9-20.0% in the Sheki-Zagatala economic region, 0-21.7% and 9.5-42.9% in the Ganja-Dashkasan economic region, 12.0-66.7% and 3.8-50.0% in the Shirvan-Salyan economic region, and 13.8-31.8% and 8.0-19.0% in the Guba-Khachmaz economic region, respectively.

Helminths such as *Dictykocaulus viviparus, Trichocephalus skrjabini, Nematodirus oiratianus, Strongyloides papillosus, Fasciola* *hepatica, Paramphistomum* sp., were found in the intestines of animals at slaughterhouses in the studied economic regions, and their numbers in the localization sites varied between 2-36 exem. It was determined that the recorded pathogens were characterized by a wide variety in terms of morphological images, development cycles, epizootological characteristics and extensiveness of distribution.

During a comparative study of blood samples of healthy, mono- and associatively infected cattle, it was determined that the hemoglobin content in the blood of healthy animals varied between 10.0 and 12.0 g/%, while in the blood of animals infected with mono-invasion nematodirosis it varied between 9.2 and 9.8 g/%, in the blood of animals infected with associative invasions nematodirosis and paraphistomatosis the hemoglobin content in the blood varied between 8.0 and 9.0 g/%, and in cattle infected with nematodirosis, paraphistomatosis and trichocephalosis it varied between 7.0 and 8.0 g/%, i.e., the invasions caused a decrease in the amount of hemoglobin in the blood. Unlike hemoglobin, infection with invasions is observed with an increase in the erythrocyte sedimentation rate, that is, higher than the physiological norm, which leads to the observation of unfavorable changes in invasion carriers.

Studies conducted to clarify the effect of disinfestants on pathogens in cattle have shown that, depending on the concentration of the substances studied (deltatrine and citrine) and the exposure time, it is possible to achieve up to 100% destruction of helminth eggs. Thus, the use of a 3% solution of deltathrin is both 1.6 times more effective than phenol and is economically efficient at 94.0 manat per animal.

During the study of helminthic infections in pigs in private farms in the territories of the Ganja-Dashkasan, Shaki-Zagatala and Guba-Khachmaz economic regions of the Republic of Azerbaijan, it became clear that they are prone to diseases such as ascariasis, esophagosomiasis, eymeriosis, trichocephalosis and others, and among the factors affecting the extensiveness of their invasion are the season, age and relief indicators in cattle. Compared to cattle, there are also certain differences in the invasion extensiveness of helminths in pigs, which are characterized by relatively low quantitative indicators of invasion extensiveness of helminths in pigs, relatively high prevalence of the disease in older generations, maximum indicators observed in different seasons, etc. Thus, the invasion extensiveness of helminths in animals and pigs varies between 0-66.7% and 0-54.4%, respectively, with the highest infection of pigs with ascariasis, esophagostomiasis and trichocephalosis occurring in the spring, and low infection in the winter. The addition of organic selenium-containing preparations "DAFS-25" and "Selenolin", as well as "Fosprenil" and "Gamovit" to the feed ration of breeding pigs enhances their reproductive activity, and the highest productivity was observed in spring (74.2%), and the lowest in summer (65.8%), which was higher than similar indicators in animals of the control group (7.8% and 6.0%).

Theoretical and practical significance of research. The results obtained in the conducted studies are factual material useful for expanding the understanding of the spread of pathogens in cattle and pigs in the Republic of Azerbaijan, their developmental biology, invasion extensiveness, and other issues, and for developing animal husbandry in the country in accordance with modern requirements.

Based on the obtained results, a recommendation “On the prevention of nematodirosis in cattle” was developed and published.

Publication, approval and application of dissertation. 26 works have been published on the topic of the dissertation, 16 of which are scientific articles. The materials of the dissertation were presented at the international scientific conference on “The problem of improving livestock products and ways to solve it” (Russia F., Dubrovisa, 2008), at the international scientific-practical conference on “Modern problems of veterinary provision of animal reproductive health” (Russia F., Voronezh, 2009), at the international scientific-practical conference on “Actual problems of society, economy and law in the context of global challenges” (Moscow, 2022), at the “I International Livestock” conference (Lankaran, 2023), at the 3rd International scientific conference on “Progress in science” (Belgium, Brussels, 2023), at the International Symposium on “Eurasian biodiversity” (Baku, 2023), at the International Scientific Research Conference of the Azerbaijan Science Center (Baku, 2023).

The organization where the dissertation was carried out. The dissertation work was carried out at the Parasitology Department of the

Veterinary Research Institute of the Ministry of Agriculture of the Republic of Azerbaijan.

The structure and volume of the dissertation. The dissertation consists of 7 chapters in total. The first chapter is a literature review, the second chapter is devoted to the materials and methods of the study, and chapters 3-7 are devoted to the presentation and interpretation of the results obtained by the author in his personal research. The dissertation concludes with a final analysis of the research, main conclusions, references, and lists of abbreviations. All of this amounts to a total of 412500 characters.

CHAPTER I
GENERAL CHARACTERISTICS OF THE CAUSATIVE AGENTS OF THE MAIN PARASITIC DISEASES OF ANIMALS AND MEASURES TO COMBAT THEM

In the section 1.1 of the dissertation discusses the main parasitic diseases in animals and their causative agents, in section 1.2 discusses the study and epizootological situation of parasitic diseases in animals in Azerbaijani conditions, and in section 1.3 analyzes the results of research conducted on measures to combat parasitic diseases in animals and their effectiveness in accordance with the goals and objectives of the work, also assesses the current situation in this area, identifies the tasks that need to be solved in this area, and makes recommendations on ways to solve them.

CHAPTER II
RESEARCH MATERİALS AND METHODS

2.1. Research areas and their general characteristics

The studies were conducted in various farms of the Republic of Azerbaijan, which were located in 4 economic regions of the country: Ganja-Dashkasan(40°41′09″N and 46°22′00″E), Shaki-Zagatala(40°06′ – 41°33′ N and 46°20′ – 48°10′E), Shirvan-Salyan(39°10′ – 40°35′ N and 48°00′ – 49°35′ E), and Guba-Khachmaz(41°–42° N and 48°–49°E). In selecting these economic regions, the relative specificity of their natural soil-climate, flora and fauna, and reliefs was also taken into account, which was related to ensuring the relative universality of the control measures resulting from the results to be obtained.

Since pig breeding is not a widely developed sector in the Republic of Azerbaijan, research on them was mainly carried out on farms engaged in pig breeding located in the Ganja-Dashkasan, Shaki-Zagatala and Guba-Khachmaz economic regions.

2.2. General characteristics of the methods used in the analysis of samples taken in the studies

During the research, cattle and pigs belonging to 5 age groups from farms in each economic region were used, with 20-25 cattle and pigs in each group. Fecal samples were taken from them every season and analyzed for helminthiasis based on "known methods and approaches"[11,12,13,14,15,16].

Blood samples were taken from the jugular vein of the cattle in the morning on an empty stomach for examination and the blood was diluted with sodium citrate solution (1:9 ratio) to prevent clotting. During the experiment, blood was taken from healthy and infected animals with mono and associative helminthiasis, 10 animals in each group, and analyzed using "known methods"[17,18,19] for a number of indicators

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[11] Профилактика паразитарных болезней на территории РФ (СанПиН 3.2.3215-14). - М., 2014, -42 с.

[12]Арисов М.В. и др. Классические копрологические методы диагностики паразитозов животных: учебно-методическое пособие. М.: ВНИИП – филиал ФГБНУ ФНЦ ВИЭВ РАН, 2022. 36 с.

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[14]Foreyt W. J. Veterinary parasitology reference manual. 5th ed., John Wiley & Sons, 2013; 256.

[15] Zajac A. M., Conboy G. A., Little S. E., Reichard M. V. Veterinary clinical parasitology. 9rd edn. WileyBlackwell, Chichester, 2021; 432.

[16] Аубакиров М.Ж, Еренко Е.Н. Диагностика гельминтозов и меры борьбы с ними. - Костанай, 2020, 81с.

[17] Васильева С. В., Конопатов Ю. В. Клиническая биохимия крупного рогатого скота: Учебное пособие. — 2-е изд., испр. — СПб.: Из-во «Лань», 2017. — 188 с

(hemoglobin content, erythrocyte and leukocyte counts, erythrocyte sedimentation rate).

During the research, experiments that served to obtain quantitative results were performed in at least 4 replicates and the results were processed "statistically"[20].

CHAPTER III
SPECIES COMPOSITION AND INFECTION RATE OF CATTLE HELMINTHIASİS IN THE STUDY AREAS, INVASION EXTENSIVENESS

3.1. Helminthiasis of cattle and their prevalence rates in the Guba-Khachmaz economic region

In order to determine the prevalence of helminthiasis in cattle in individual farms located in the territory of the Guba-Khachmaz economic region depending on the seasons of the year, during the analysis of fecal samples brought from farms located in the Khachmaz and Shabran regions, it became clear that the most common diseases in livestock farms of the Khachmaz region are trichocephalosis, strongyloidiasis, nematodirosis and fascioliasis, the overall prevalence of which in the region can vary depending on both age groups and the seasonal factor, but although a certain relationship is observed between the prevalence of this or that helminthiasis and the age group, the situation is somewhat different depending on the seasonal factor. Thus, as age increases, the prevalence of all diseases decreases, but in terms of seasonality, the maximum prevalence of all helminthiasis occurs in different seasons (Fig. 3.1). As can be seen, if the quantitative indicator of the infection rate for trichocephalosis is according to the sequence of

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[18] Грачева О.А., Пахомов Г.А., Елдашев А.В. Методы взятия крови у разных видов животных, птиц и рыб. –Казань, 2008, -34с.

[19] Смолин, С.Г. Физиология системы крови: метод. указания / С.Г. Смолин, Краснояр. гос. аграр. ун-т. – Красноярск, 2014. – 50 с.

[20] Welham, S.J. Gezan, S.A., Clark, S.J., & Mead, A. Statistical Methods in Biology: Design and Analysis of Experiments and Regression (1st ed.). Chapman and Hall/CRC., 2014 https://doi.org/10.1201/b17336

autumn, spring, summer and winter, then the analogous sequence for strongyloidiasis, nematodirosis and fascioliasis is autumn, spring, summer and winter; autumn, summer, spring and winter, respectively. In all cases, winter is the season when helminthiasis is least prevalent. A similar situation was observed in studies conducted in the Shabran region.

As a result of the helminthological examination of the intestines of animals slaughtered in the slaughterhouses of the Khachmaz region in the Guba-Khachmaz economic region, 14-35 exem. of *Trichocephalus skrjabini*, 11-24 exem. of Nematodirus oiratianus, 11-25 exem. of *Strongyloides papillosus*, and 12-35 exem. of *Fasciola hepatica* were collected, also from the intestines of animals slaughtered in the Shabran region, 12-22 exem. of *Trichocephalus skrjabini*, 10-18 exem. of Nematodirus oiratianus, 8-19 exem. of *Strongyloides papillosus*, and 7-21 exem. of *Fasciola hepatica* were collected from the liver.

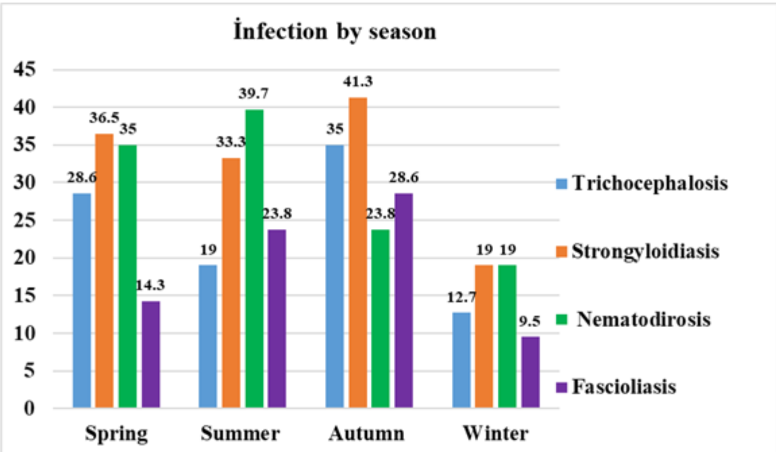

Figure 3.1. Helminth infection rate (%) in Khachmaz region.

3.2. Helminthiasis of cattle and their prevalence rates in the Shaki-Zagatala economic region

During the determination of the prevalence of helminthiasis among cattle in livestock farms located in Shaki, Zagatala, Balaken and Gakh districts of the Shaki-Zagatala economic region, depending on age, it became clear that cattle were infected with trichocephalosis and strongyloidosis from gastrointestinal nematodes, and dictyocauloidosis, a nematode that parasitizes the lungs. İn individual livestock farms of Shaki region were detected infections : trichocephalosis in 3-5 month old animals 31.6%, 6-9 month old animals 30.4%, 10-12 month old animals 23.8%, old animals 13.6%, strongyloidosis in 3-5 month old animals 36.8%, 6-9 month old animals 34.8%, 10-12 month old animals 33.3%, old animals 18.2%, dictyocaulosis in 3-5 month old animals 52.6%, 6-9 month old animals 39.1%, 10-12 month old animals 28.6%, old animals 22.7%. Similar studies were conducted in livestock farms of Balakan, Zagatala and Gakh regions and the situation was repeated with some quantitative differences. This has also manifested itself in different age groups.

3.3. Helminthiasis of cattle and their prevalence rates in the Ganja-Dashkasan economic region

In the studies conducted in the livestock farms located in the Lowland, Foothills, Mountainous zone of the Goranboy and Goygol regions of Ganja-Dashkasan economic regionwas studied the dependence of infection with *Paramphistomum* sp, the causative agent of paraphistomatosis parasitic in the gastrointestinal system, *Dictyocaulus viviparus*, the causative agent of dictyocaulosis parasitic in the lungs (bronchi), and *Trichocephalus skrjabini*, the causative agent of trichocephalosis parasitic in the cecum and large intestine, on bio-ecological characteristics. It has become clear that helminthiasis is found in farms located in the economic region, and their prevalence is characterized by different quantitative indicators depending on both age and season. When summarizing the results of the studies conducted in the Ganja-Dashkasan economic region, it was determined that: in the spring, 18.0% with trichocephalosis from nematodes, 23.0% with strongyloidosis, 23.5% with nematodirosis, and 7.0% with fasciolosis from trematodes; in the summer, 10.0% with trichocephalosis, 26.5% with strongyloidosis, 28.0% with nematodirosis, and 14.0% with fasciolosis; in autumn 21.5% with trichocephalosis, 30.5% with strongyloidosis, 17.5% with nematodirosis, and 18.5% with fasciolosis; in winter, 7.0% with trichocephalosis, 14.0% with strongyloidiasis, 11.5% with nematodirosis, and 5.5% with fascioliasis (Table 3.1).

In addition to coprological examination, helminthological examination of feces was also conducted in the Ganja-Dashkasan economic region. In the intestines of animals slaughtered in the slaughterhouses of the Goranboy region of the Ganja-Dashkasan economic region, the following helminths were identified: 12-29 exem. *Paramphistomum* sp., 9-22 exem. Dictyocaulus viviparus, 10-20 exem.*Trichocephalus skrjabini*, and in the intestines of animals slaughtered in the Goygol region were identified: 9-21 exem. *Paramphistomum* sp., 8-19 exem. *Dictyocaulus viviparus*, 7-15 exem. *Trichocephalus skrjabini* (Table 3.2).

In livestock farms, the highest infection rates by age group were found in animals aged 10-12 months, while the lowest infection rates were found in older animals. This is explained by the fact that older animals are carriers of parasites. As a result of repeated infection in animals, develops immunity against invasions.

3.4. Helminthiasis of cattle and their prevalence rates in the Shirvan-Salyan economic region

The prevalence rates of helminthiasis in individual farms (livestock) located in the Shirvan-Salyan economic region were also studied depending on the seasons of the year, and for this purpose, samples taken from livestock farms located in Bilasuvar, Hajigabul and Salyan regions were analyzed, and the dynamics of helminthiasis infection by season was determined (Table 3.2). As can be seen, the results obtained from the conducted on farms in all three regions are generally replicated with some quantitative differences.

The presence of favorable conditions (ecological factors) for infection with helminths in the Shirvan-Salyan economic region was determined during the conducted studies. However, it has been observed that the prevalence of extensiveness reaches its peak in the spring, summer and autumn seasons. The lowest infection with helminths was observed in the winter season, which is due to external environmental factors - low air temperature. This is

Table 3.1
The extensiveness of the invasion (EI) with helminths in cattle in livestock farms of the Ganja-Dashkan economic region by seasons

Examined	Infected							
	Trichocephalosis		Strongyloidosis		Nematodirosis		Fasciolosis	
	Amount	EI (%)	Amount	EI (%)	Amount	EI (%)	Amount	EI (%)
Spring season								
200	36	18,0	46	23,0	47	23,5	14	7,0
Summer season								
200	20	10,0	53	26,5	56	28,0	28	14,0
Autumn season								
200	43	21,5	61	30,5	35	17,5	37	18,5
Winter season								
200	14	7,0	28	14,0	23	11,5	11	5,5

Table 3.2

The extensiveness of the invasion (EI) of helminth in animals of different ages by season in livestock farms of Bilasuvar region

Age	Examined	Infected							
		Trichocephalosis		Strongyloidosis		Nematodirosis		Fasciolosis	
		Amount	EI (%)	Amount	EI (%)	Amount	EI (%)	Amount	EI (%)
1	2	3	4	5	6	7	8	9	10
Spring season									
6-9 months	21	10	47,6	11	52,4	12	57,1	6	28,6
10-12 months	23	8	34,8	10	43,5	9	39,1	5	21,7
Elderly	22	7	31,8	8	36,4	6	27,3	4	18,2
Total	66	25	37,9	29	44,0	27	41,0	15	22,7
Summer season									
6-9 months	21	7	33,3	12	57,1	14	66,7	8	38,1
10-12 months	23	6	26,1	11	47,8	12	52,2	6	26,1
Elderly	22	4	18,2	9	41,0	8	36,4	6	27,3
Total	66	17	25,8	32	48,5	34	51,5	20	30,3

Table 3.2 continued

1	2	3	4	5	6	7	8	9	10
Autumn season									
6-9 months	21	11	52,4	13	62,0	8	38,1	10	47,6
10-12 months	23	10	43,5	12	52,2	6	26,1	9	39,1
Elderly	22	9	41,0	8	36,4	5	22,7	7	31,8
Total	66	30	45,5	33	50,0	19	28,8	26	39,4
Winter season									
6-9 months	21	6	28,6	8	38,1	7	33,3	5	23,8
10-12 months	23	4	17,4	5	21,7	5	21,7	3	13,0
Elderly	22	3	13,6	4	18,2	3	13,6	2	9,1
Total	66	13	19,7	17	25,8	15	22,7	10	15,2

explained by the fact that helminth eggs develop faster when the weather is warm. The temperature necessary for the development of eggs in spring, summer, and autumn has a positive effect on their development. In winter, the ambient temperature drops, the development of helminths slows down, and the likelihood of infection decreases.

CHAPTER IV
BIOECOLOGICAL CHARACTERISTICS OF HELMINTHIC PATHOGENS IN CATTLE

4.1. General characteristics of helminthiasis observed in cattle

Studies conducted in various economic regions of the Republic of Azerbaijan have shown that helminthiasis is found everywhere and differs from each other in its main characteristics. This is also confirmed by the research data we have obtained on the characteristics of the helminthiasis mentioned below.

Fascioliasis - is an acute or chronic ancient disease of domestic and wild animals, as well as humans, characterized by damage to the liver and spleen.

Two species of fasciola from the Fasciolidae family are found in the Republic of Azerbaijan: the common fasciola (*Fasciola hepatica*, 1758), whose bodies are covered with spines, and the giant fasciola (*Fasciola gigantica*, 1885). This has also been confirmed in our research.

The common fasciola has a leaf-shaped body that is 2-3 cm long and up to 1 cm wide, the giant fasciola is found in animals in the southern regions and differs from the common fasciola in size.

Fassiola belongs to biohelminths, to intermediate hosts includes various freshwater mollusks, also *Lymnaea truncatula*, *L. auricularia* and others. People are facultative owners.

Fassiola eggs develop into embryos (miracidia) in 12-18 days under favorable conditions in freshwater at an air temperature of 20-30°C. The embryo hatches from the egg, actively swims in the water with the help of cilia, and penetrates the body of the freshwater mollusk. In the liver of the intermediate host, the miracidium transforms into a sporocyst, within which rediae are formed by asexual reproduction, and within these cercariae. The latter leave the mollusk and after a few hours turn into adolescens, which contain infective trematode larvae.

Fasciolosis is transmitted to animals through feed, pasture grass, and water. The development periods of the different stages of Fasciola are as follows: miracides – 2-3 weeks, in mollusks – 2-3 months and young Fasciola (marita) – 3-4 months.

Paramphistomosis-is an acute or chronic disease of ruminants caused by organisms that parasitize at the entrance of stomach and duodenum. They are trematodes from the suborder *Paramphistomata*, which includes 10 orders and more than 60 helminth species. The most common pathogens are *Paramphistomum ichikawai*, *P. cervi* and *Liorchis scotiae*. They are light pink, conical in shape, and up to 20 mm long.

Paraphistoma parasites are biohelminths, and their main hosts are cattle, buffalo, zebu, sheep, goats, deer, and other wild ruminants, where the trematodes lay large numbers of eggs. These eggs develop into miracidiums in warm water after 11-22 days. In the external environment, mirasidium penetrates the body of an intermediate host freshwater mollusk. In the liver of the mollusk, the mirasidium develops into a sporocyst, which, through asexual reproduction, produces several redia, within which daughter redia develop, and within these daughter redia, cercariae develop. The latter leave the body of the mollusk in groups and form adolescaria - infective larvae in the external environment. Animals become infected with trematodes while grazing or drinking water from unorganized sources (pits, ditches, or ponds).

The development period of trematodes is as follows: in eggs, miracidium is formed within 9-19 days; in mollusks, larvae develop within 45-90 days and reach sexual maturity within 90-120 days. The lifespan of *Paramphistoma* is about 6-7 years.

Trichocephalosis is a disease caused by nematodes in animals, as well as humans, and its causative agents have unique morphological and biological characteristics. The anterior end of the body is slender and the posterior end is considerably broader. The mouth is simple, with poorly defined lips. The esophagus is long, lined with paraesophageal glands that form a single or double row of cells that cover almost the entire length of the esophagus. Males have a single, thin, long spike or none at all. Females are oviparous or viviparous. They are geohelminths and biohelminths.

The development cycle of trichocephalosis occurs without the participation of intermediate hosts. Adult female parasites lay eggs, which have not yet completed embryonic development, in the intestinal cavity of the host. These eggs are shed into the environment with feces and, under optimal conditions (temperature 25-30°C, high humidity, access to oxygen), become infectious within 3-4 weeks. In the intestine, the larvae hatch from the eggs, penetrate the mucous membrane, molt, and then re-enter the intestinal cavity, reaching sexual maturity within 30-60 days. The lifespan of nematodes in animals can be up to 8 months.

Strongyloidiasis is a disease that occurs in the digestive system of ruminant animals**.** Different species of disease-causing nematodes are localized in different parts of the digestive system, such as the stomach (those belonging to the genus *Haemonchus*), the small intestine (genus *Nematodirus*), or the large intestine (genus *Oesophagostomum*). Although the causative agents of this disease differ morphologically, they are similar in their developmental biology.

After the ingested larvae enter the stomach and intestines of the animal, they penetrate the submucosal layer of the intestine or stomach and return to the organ cavity after 20-26 days. They reach sexual maturity within 20-60 days.

Nematodirosis is a disease caused by species of small parasitic roundworms (nematodes) in ruminant animals. They are found in the small intestine, ranging in length from 10 mm to 30 mm. The anterior end has been noticeably thinner and they are highly resistant to the environment.

Characterized by a poorly developed oral capsule. Males have a large cuticular enlargement on their posterior end used for mating, their eggs are very large, oval-shaped, thin-shelled, and light-colored. The eggs are excreted into the environment with feces. Inside the egg, the larva goes through two developmental stages (before the invasive stage) and can hatch or remain inside the shell, even overwintering in severe frosts. Animals (most often sheep, goats, and cattle) become infected through food, ingesting the invasive larvae with grass or water.

Dictyocaulosis is a disease caused by the parasitism of specific nematodes belonging to the *Dictyocaulidae* family in animals. The pathogen is mainly found in the medium and large bronchi, and less often in the trachea.

Dictyocaulus filariae has a thread-like body, light gray, milky, or slightly straw-yellow in color. The tip of the tail of males is equipped with a genital organ supported by ribs.

Dictyocaulus helminths are geohelminths. They lay eggs in the bronchi of ruminant animals, which are then transferred to the animal's oral cavity via bronchial mucus and swallowed.

D. filaria larvae reach infectivity within 5-8 days at optimal temperatures (16-28°C), while *D. viviparus l*arvae complete their development within 3-5 days.

4.2. The influence of climate on the development of helminthic pathogens in cattle

When determining the dynamics of the dependence of the incidence of paraphystomatosis in cattle farms in the Zagatala and Sheki districts of the Sheki-Zagatala economic region on climatic zones, it became clear that in the livestock farms of the Zagatala district, 30.3% of cases of paraphystomatosis were recorded in the Aran zone, 20.9% in the Foothill zone, and 6.3% in the Mountain zone (Fig. 4.1).

In the livestock farms of the Sheki region, 24.2% of paraphistomatosis infections were detected in the Aran zone, 13.4% in the Foothill zone, and 4.8% in the Highland zone, as a result of coprological examinations (Fig.4.2).

In addition to the coprological examination, an incomplete helminthological autopsy was also performed during the studies. In the Sheki-Zagatala economic region, 18-37 exem of *Paramphistomum* sp. helminths were collected from the intestines of animals slaughtered at

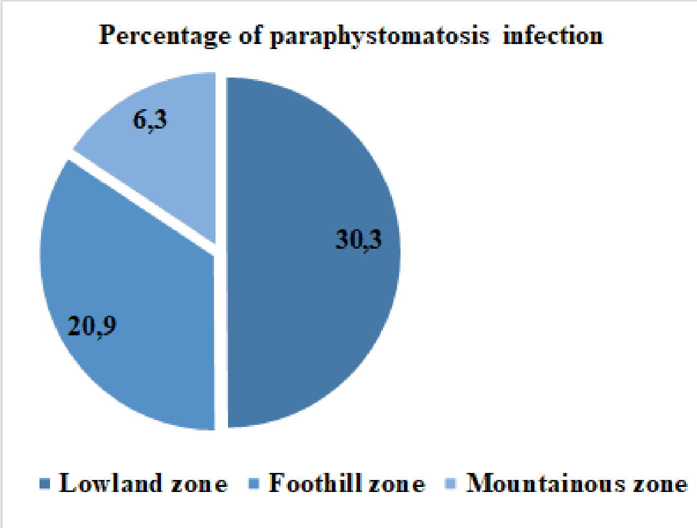

Figure 4.1. Paraphystomatosis infection of cattle in Zagatala region

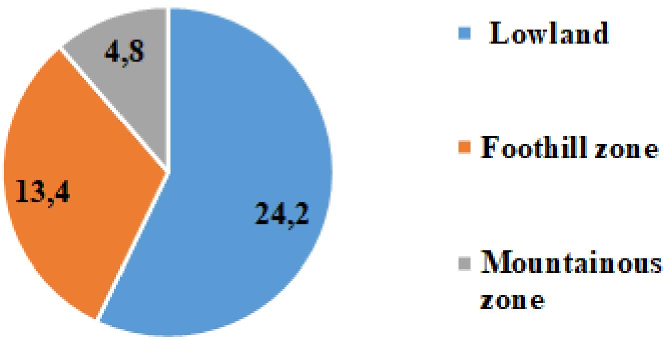

Figure 4.2. Paraphistomatosis infection(%) of cattle in Sheki region

slaughterhouses in the Zagatala region, and 11-19 exem from the intestines of animals slaughtered in the Sheki region, and the intensity of infection with paramphistomatosis was studied.

Fecal samples from livestock farms located in Bilasuvar in the

Shirvan-Salyan economic region, Gabala in the Sheki-Zagatala economic region, Guba in the Guba-Khachmaz economic region, and Goranboy in the Ganja-Dashkan economic region were studied, and the dynamics of dicroceliosis infection by age and season were also determined. During the conducted studies, dicroceliosis infection was detected in cattle kept in individual livestock farms of Bilasuvar district: in the spring, 31.6% in 6-9 month old animals, 44.4% in 10-12 month old animals, and 45.0% in older animals; in the summer, 11.8% in 6-9 month old animals, 10.5% in 10-12 month old animals, and 22.2% in older animals; in the fall, 33.3% in 6-9 month old animals, 41.2% in 10-12 month old animals, and 40.0% in older animals; in winter 6.3% in 6-9 month old animals, 10.5% in 10-12 month old animals, 17.6% in old animals. İn cattle kept in private livestock farms of Gabala region: in spring 26.3% in 6-9 month old animals, 33.3% in 10-12 month old animals, 35.0% in old animals; in summer was not detected infection with dicroceliosis in 6-9 month old animals, 10.5% in 10-12 month old animals, 16.7% in old animals; in autumn 27.8% in 6-9 month old animals, 23.5% in 10-12 month old animals, 30.0% in old animals; in winter was not detected infection with dicroceliosis in 6-9 month old animals, 5.3% in 10-12 month old animals, 11.8% in old animals.

4.2. The influence of age factors on the development of helminthic pathogens in cattle

As a result of examinations conducted in livestock farms in Khachmaz and Shabran of the Guba-Khachmaz economic region, and Bilasuvar and Hajigabul districts of the Shirvan-Salyan economic region, the causative agents of eymeriosis were also detected in calves. Thus, in the Khachmaz district of the Guba-Khachmaz economic region was determined infection with eymeriosis as a result of coprological examinations: 33.3% of calves aged 10-30 days, 45.5% of calves aged 1-3 months, and 23.1% of calves aged 4-6 months; in the Shabran district, 25.0% of calves aged 10-30 days, 36.4% of calves aged 1-3 months, and 15.4% of calves aged 4-6 months.

Infection with eymeriosis was detected in the Bilasuvar district of the Shirvan-Salyan economic region: 20.0% in calves aged 10-30 days, 18.2% in calves aged 1-3 months, 10.0% in calves aged 4-6 months; in the Hajigabul district, 20.0% in calves aged 10-30 days, 27.3% in calves aged 1-3 months, 20.0% in calves aged 4-6 months. Summarizing the results of examinations conducted depending on age, infection with eymeriosis was detected (Fig. 4.3): 33.3% in Khachmaz district, 25.0% in Shabran district, 15.2% in Bilasuvar district, 21.2% in Hajigabul district, and it was determined that their pathogens were not morphologically different from each other (Fig. 4.4). The

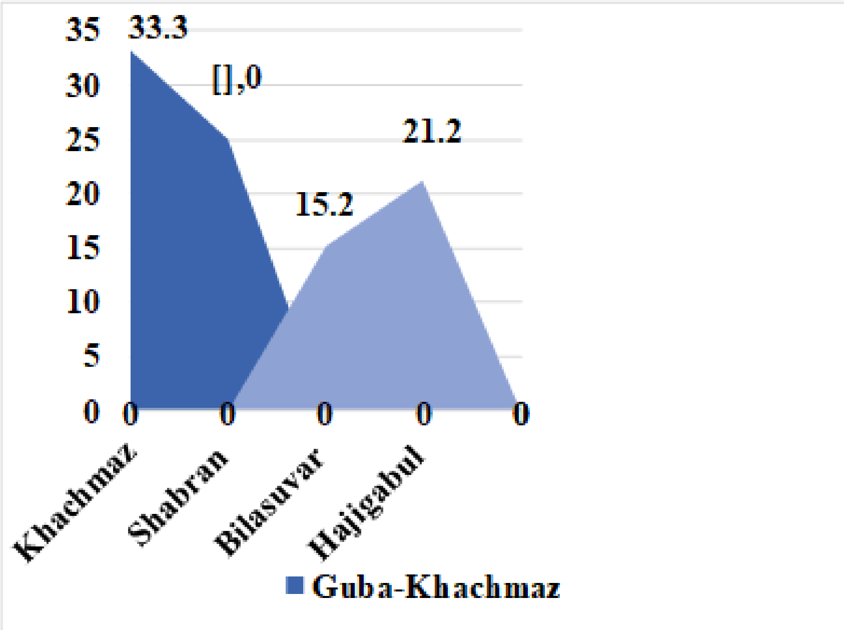

Figure 4.3. Infection of calveswith eymeriosis (%)

seasonal dependence of eymeriosis infection in calves kept in individual livestock farms of the Khachmaz and Shabran districts of the Guba-Khachmaz economic region was also studied during coprological examinations.

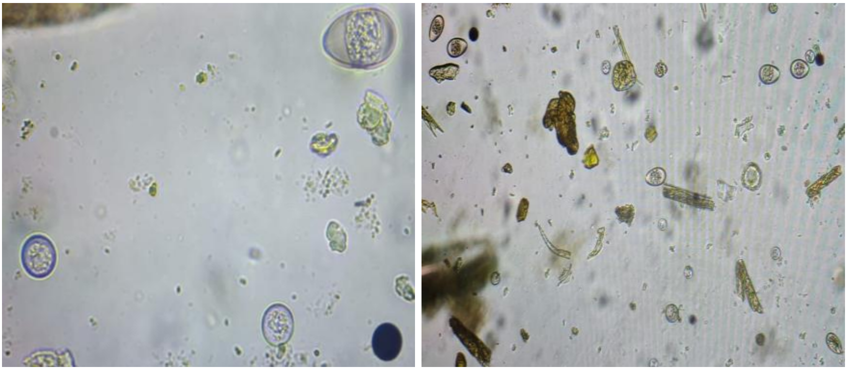

Figure 4.4. Causative agents of eymeriosis in calves

Infection was detected in farms in the Khachmaz region: in the spring, 42.9% of calves aged 10-30 days, 50.0% of calves aged 1-3 months, and 25.0% of calves aged 4-6 months; in the summer, no infection in calves aged 10-30 days, 16.7% of calves aged 1-3 months, and 12.5% of calves aged 4-6 months; in the autumn, 28.6% of calves aged 10-30 days, 33.3% of calves aged 1-3 months, and 25.0% of calves aged 4-6 months; in the winter, 14.3% of calves aged 10-30 days, 33.3% of calves aged 1-3 months, and none infection in calves aged 4-6 months. İn the farms of Shabran region infection was detected: in spring, 33.3% in 10-30-days calves, 40.0% in 1-3-month-old calves, and 14.3% in 4-6-months calves; in the summer, no infection in calves in 10-30 days, 20.0% in 1-3 months calves, and no infection in 4-6 months calves ; in the autumn, 16.7% in 10-30 days calves, 20.0% in 1-3 months calves, and 14.3% in 4-6 months calves; in the winter, 16.7% of 10-30 days calves, 20.0% in 1-3 months calves, and no infection was detected in 4-6 months calves.

Analogy results, with some quantitative differences, were also obtained in studies conducted in livestock farms of Bilasuvar and Hajigabul region of the Shirvan-Salyan economic region (Fig. 4.5). In general, it should be noted that the infection of calves with eymeriosis depends on both their age and the season of the year. In spring and autumn, the presence of factors necessary for the development of eimeria oocysts (temperature, humidity, oxygen) has a positive effect, whereas in winter a decrease in air temperature has a negative effect on the development of eimeria oocysts.

4.3. The influence of seasonal factors on the development of helminthic pathogens in cattle

Research conducted in all economic regions has shown that seasonal factors are among the factors that seriously affect the development of helminthiasis. In the summer, were infected with trichocephalosis 20.0% in 6-9 months, 16.7% in 10-12 months, in adults 11.5%, infection with in strongyloidosis 36.0% in 6-9 months, 33.3% in 10-12 months, in adults 23.1%, with

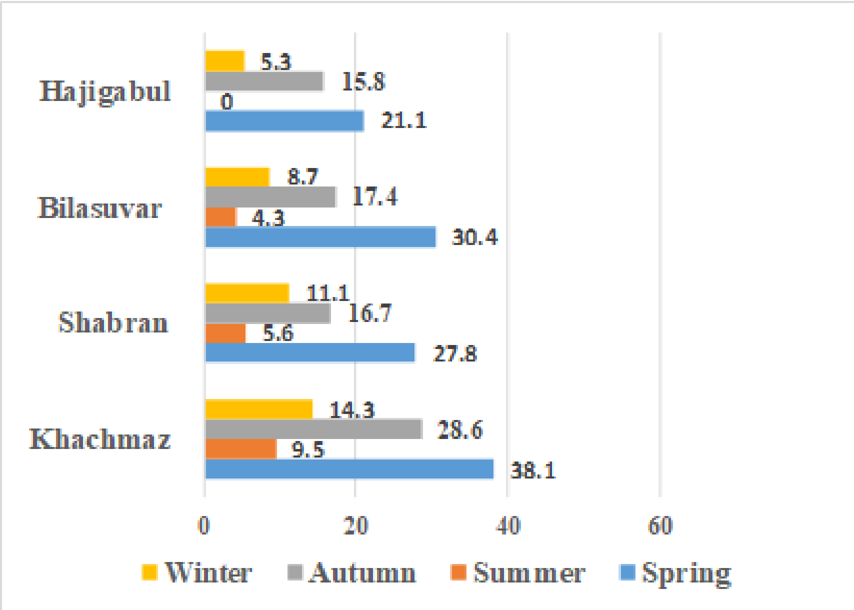

Figure 4.5. Calves infected with eymeriosis by season (%)

nematodirosis 48.0%in 6-9 months, 37.5% 10-12 months, in adults 15.4%, with fasciolosis 24.0% in 6-9 months, 20.8% in 10-12 months, in adults 19.2%; in autumn, with trichocephalosis 36.0% in 6-9 months, 25.0% in 10-12 months, in adults 19.2%, with strongyloidosis 48.0% in 6-9 months, 41,7% in 10-12 months, in adults 23,1%, with nematodirosis 36.0% in 6-9 months, 20.8% in

10-12 months, 11.5% in the elderly, with fasciolosis 28.0% in 6-9 months, 25.0% in 10-12 months, 19.2% in the elderly; in winter, with trichocephalosis 16.0% in 6-9 months, 12.5% in 10-12 months, 7.7% in the elderly, with strongyloidosis 24.0% in 6-9 months, 20.8% in 10-12 months, 11.5% in the elderly, with nematodirosis 20.0% in 6-9 months, 16.7% in 10-12 months, 7.7% in the elderly, with fasciolosis 12.0% in 6-9 months, 8.3% in 10-12 month, 3.8% in the adults.

In general, it has been determined during the conducted studies that there are favorable conditions (ecological factors) for infection with helminths in farms in all economic regions. The lowest infection with helminths was observed in the winter season, which is due to external environmental factors - low air temperature.

4.4. The influence of relief on the development of helminthic pathogens in cattle

In order to determine the dynamics of the dependence of cattle infection with helminths on climatic zones in livestock farms in the Goranboy and Goygol region of the Ganja-Dashkasan economic region, fecal samples brought from livestock farms were coprologically examined, helminth eggs were detected, and the extensiveness of infection was studied. The results obtained for the livestock farms of Goranboy region showed that the infection rate were: in lowland 23.7% with paraphistomatosis, 13.6% with dictyocaulosis, and 15.3% with trichocephalosis; in foothill, 27.4% with paraphistomatosis, 17.7% with dictyocaulosis, 21.0% with trichocephalosis; in mountainous farms 8.3% with paraphistomatosis, 3.3% with dictyocaulosis, and 6.7% with trichocephalosis. A analogical situation has been recorded in studies conducted in both this economic region and other economic regions. More precisely, as a result of the conducted coprological examinations, it was found that helminth infection is high in individual livestock farms located in the lowland zone, and relatively low in the foothill zone. A weaker infection rate was observed in individual livestock farms located in the mountainous zone.

CHAPTER V
CATTLE INFECTION WITH BLOOD PARASITES

5.1. Spread of blood parasites in the study areas

Due to the transition of livestock breeding to individual and farmer farms in our republic, certain difficulties have arisen in studying the epizootological situation of blood parasites (piroplasmosis) in cattle. For this purpose, in order to study the epizootological situation of piroplasmosis in various regions of the republic, sick and parasite-carrying cattle were examined in individual and livestock farms. The climate, humidity, relief, and vegetation of the Sheki-Zagatala economic region of the republic create favorable conditions for the development and spread of pasture ticks, which transmit blood parasitic diseasesIn order to determine the prevalence of blood parasitic diseases among animals on livestock farms in the Gakh region during 2022-2023, blood smears were taken from both sick and clinically healthy animals and examined microscopically (Fig. 5.1). As a result of studies conducted by us and other researchers, the causative agent of francaisilleosis, a blood parasitic disease, has been found: pear-shaped, round and oval forms of *Fr. Colchica.* During the examination of piroplasmosis in cattle, fever (40-41^{0}C) and the first clinical signs such as the appearance of yellow mucus layers and bloody urine were observed. Depending on the fact that the ticks that transmit the causative agent of piroplasmosis reproduce three times a year, the disease occurs in the spring, summer, and autumn seasons. The highest incidence of piroplasmosis in cattle occurred in the spring and summer months. Microscopic examination of the pathogen P. bigeminum showed that its cytoplasm was blue and the nucleus was purple, while in the erythrocytes the parasites were predominantly pear-shaped, elongated-oval and arranged in pairs.

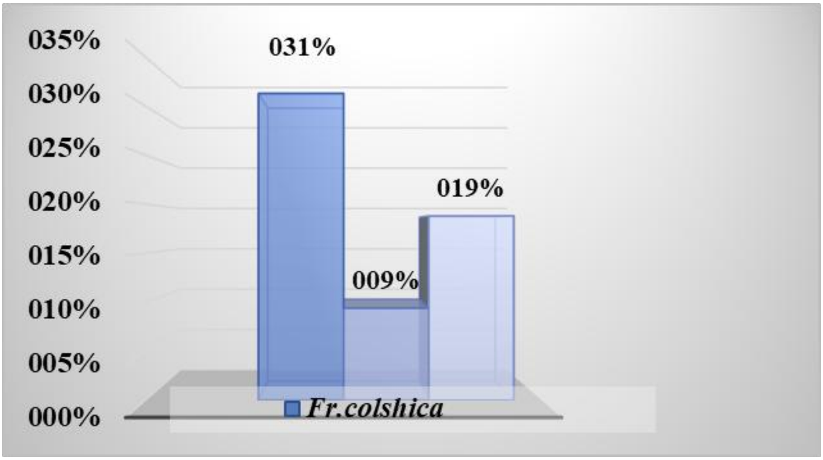

Figure 5.1. Spread of blood parasites in the Gakh region

The causative agent of anaplasmosis in cattle is transmitted by ticks belonging to the genera Boophilus and Hyalomma. During examination, the temperature of the sick animals rose to 40-41°C, and the mucus layers appeared yellow. When examined microscopically, A. marginale was black, dark red in color and was located along the edge of erythrocytes in the amount of 1-4 pieces. The animal has an abnormal gait, rapid breathing and heartbeat.

5.2. Comparative study of blood parameters of healthy, mono- and associatively infected cattle

Since the study of changes in the blood composition of large horned animals (cattle) during infection with helminths is of interest from both scientific and practical points of view, these issues have also been clarified in the course of research. During the examinations, the hemoglobin content in the blood of healthy animals ranged from 10.0 to 12.0 g/%, in the blood of animals infected with mono-invasion nematodirosis, it ranged from 9.2 to 9.8 g/%, in the blood of animals infected with associative invasions nematodirosis and paraphistomatosis, it ranged from 8.0 to 9.0 g/%, and in cattle infected with nematodirosis, paraphistomatosis and trichocephalosis, it ranged from 7.0 to 8.0 g/%. The amount of hemoglobin in animals infected with mono and associative invasions was reduced compared to that in the blood of healthy animals.

As a result of our research, it was determined that the amount of erythrocytes in the blood of sick animals was reduced, while in healthy animals it was within the norm. Thus, the amount of erythrocytes in the blood of healthy animals was 6.5-7.2 mm3/min, and in cattle infected with nematodirosis it was 5.5-6.2 mm3/min. The amount of erythrocytes in the blood of animals infected with nematodirosis and paraphistomatosis was 4.4-5.4 mm3/min, and in cattle infected with nematodirosis, paraphistomatosis and trichocephalosis it was 4.0-5.0 mm3/min. The number of erythrocytes was significantly reduced in infected animals compared to that in the blood of animals in the healthy group.

The amount of leukocytes in the animals in the experimental group exceeded the physiological norm. Thus, the amount of leukocytes in the blood of healthy animals was 7.2-9.0 mm3/min, and in animals infected with nematodirosis it was 7.8-9.5 mm3/min. The number of leukocytes in the blood of animals infected with nematodirosis and paraphistomatosis was 9.2-10.4 mm3/min, and in cattle infected with nematodirosis, paraphistomatosis and trichocephalosis it was 9.7-10.9 mm3/min. The number of leukocytes in the blood of infected animals was higher than that of animals in the healthy group. These indicators are related to changes in the blood of animals.

During the studies, the erythrocyte sedimentation rate was determined in blood taken from healthy animals, as well as animals infected with mono and associative invasions. This indicator fluctuated in the blood of healthy, uninfected animals: 0.1-0.2 mm/min for 15 minutes, 0.2-0.3 mm/min for 30 minutes, 0.5-0.6 mm/min for 45 minutes, 0.6-0.7 mm/min for 60 minutes, and in animals infected with mono-invasion - nematodirosis - 0.1-0.2 mm/min for 15 minutes, 0.2-0.4 mm/min for 30 minutes, 0.5-0.7 mm/min for 45 minutes, and 0.6-0.8 mm/min for 60 minutes.

In animals infected with nematodirosis and paramphistomatosis, it was 0.2-0.3 mm/min for 15 minutes, 0.3-0.5 mm/min for 30 minutes, 0.6-0.8 mm/min for 45 minutes, and 0.7-0.9 mm/min for 60 minutes; in cattle infected with nematodirosis, paramphistomatosis, and trichocephalosis, it was 0.2-0.3 mm/min for 15 minutes, 0.4-0.6 mm/min for 30 minutes, 0.7-0.8 mm/min for 45 minutes, and 0.9 - 1.1 mm/min for 60 minutes. The amount of ESR was increased in the blood of infected animals compared to that of animals in the healthy group.

In general, the erythrocyte sedimentation rate (ESR) was increased in the blood of infected animals. This is explained by the fact that when the amount of proteins in the blood plasma of infected animals increases, and globulins increase, cargo transport weakens, and finally, depending on this, erythrocyte sedimentation rate increases.

As a result of the conducted studies the average amount of hemoglobin in the blood in healthy animals was 10.82 g/% and 9.64 g/% in animals infected with nematodirosis. It was 8.48 g/% in the blood of animals infected with nematodirosis and paraphistomatosis, and 7.52 g/% in cattle infected with nematodirosis, paraphistomatosis and trichocephalosis. During the examinations, the average erythrocyte count was 6.82 mm3/min in healthy animals, 5.93 mm^3/min in animals infected with nematodirosis, 4.85 mm^3/min in the blood of animals infected with nematodirosis and paraphistomatosis, and 4.53 mm^3/min in cattle infected with nematodirosis, paraphistomatosis, and trichocephalosis. The average leukocyte count in healthy animals was 8.28 mm^3/min, in animals infected with nematodirosis 8.71 mm^3/min, in the blood of animals infected with nematodirosis and paraphistomatosis it was 9.84 mm^3/min, and in cattle infected with nematodirosis, paraphistomatosis and trichocephalosis 10.2 mm^3/min.

The average ESR in the blood of healthy animals was 0.13 mm/min at 15 minutes, 0.26 mm/min at 30 minutes, 0.50 mm/min at 45 minutes, and 0.64 mm/min at 60 minutes. In animals infected with nematodirosis, the average speed was 0.16 mm/min at 15 minutes, 0.31 mm/min at 30 minutes, 0.60 mm/min at 45 minutes, and 0.70 mm/min at 60 minutes. In the blood of animals infected with nematodirosis and paramphistomatosis, the average rate was 0.22 mm/min at 15 minutes, 0.43 mm/min at 30 minutes, 0.70 mm/min at 45 minutes, and 0.82 mm/min at 60 minutes. In cattle infected with nematodirosis, paramphistomatosis, and trichocephalosis, the average rate of ESR was

0.27 mm/min at 15 minutes, 0.51 mm/min at 30 minutes, 0.75 mm/min at 45 minutes, and 0.98 mm/min at 60 minutes.

When studies compared infected experimental animals with healthy control animals, the infected ones were less active, slept most of the day, and had reduced rumination. Sick animals showed signs of diarrhea, refused food and drank a lot of water.

CHAPTER VI

HELMINTHIC INFESTATION OF PIGS IN AZERBAIJAN AND SPECIES COMPOSITION OF MAIN PATHOGENS

6.1. Infection of pigs with helminths in the Sheki-Zagatala economic region

During the study of the dynamics of esophagostomiasis and ascariasis in pigs in Azerbaijan depending on the age of the animals and the seasons, it became clear that in the samples of feces brought from individual pig farms in the Sheki-Zagatala economic region, no infection with esophagostomiasis was detected in 2-6 month old pigs in the spring, but was detected 20.0% in 7-12 month old pigs, 33.3% in old animals; with ascariasis 2-6 month old pigs 27.3%, 10.0% in 7-12 month old pigs, 8.3% in old animals; in the summer with esophagostomiasis 18.2% in 2-6 month old pigs, 30.0% in 7-12 month old pigs, 50.0% in old animals; with ascariasis 45.5% in 2-6 month old pigs, 20.0% in 7-12 month old pigs, 16.7% in old animals; In the autumn season, esophagostomiasis was detected in 9.1% of animals in 2-6 months, 20.0% in animals in 7-12 months, and 41.7% in older animals; ascariasis was detected in 18.2% of animals in 2-6 months, 30.0% in animals aged 7-12 months, and 16.7% in older animals; in the winter season, esophagostomiasis and ascariasis were not detected in animals in 2-6 months, 20.0% in animals in 7-12 months, and 25.0% in older animals; ascariasis was detected in 30.0% of animals aged 7-12 months, and 8.3% in older animals. Pigs are infected with esophagostomiasis and ascariasis in all seasons and age groups. Only during the studies in 2-6 month old animal was not detected infection with esophagostomiasis and ascariasis in winter and esophagostomiasis in spring. Studies have shown that the prevalence of infection is highest in the summer and early autumn seasons. Depending on age, high extensiveness of invasion was noted in the elderly with esophagostomiasis and in 2-6 month olds with ascariasis. Therefore, the seasons of the year and the age groups of the pigs examined affect the extensiveness of esophagostomiasis and ascariasis.

When summarizing the results obtained, it was found that among pigs, the incidence of esophagostomiasis was 18.2% in spring, 33.3% in summer, 24.2% in autumn, and 15.2% in winter, and the incidence of ascariasis was 15.2% in spring, 27.3% in summer, 21.2% in autumn, and 12.1% in winter (Fig. 6.1).

During the studies were performed both coprological examination and incomplete helminthological autopsy. During autopsy, 1-8 exem of *Ascaris suum* (Fig. 6.2A) and 3-12 exem of

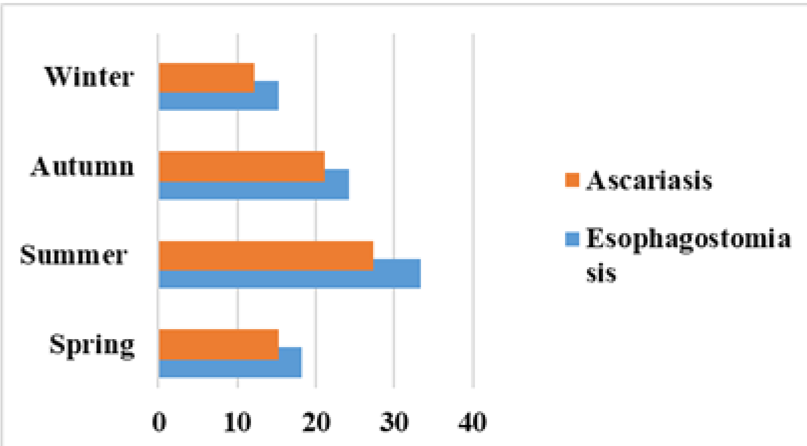

Figure 6.1. Infection of pigs with esophagostomiasis and ascariasis (in %)

Oesophagostomum dentatum (Fig. 6.2B) were collected from the intestines of animals slaughtered and the intensity of infection was studied.

A **B**

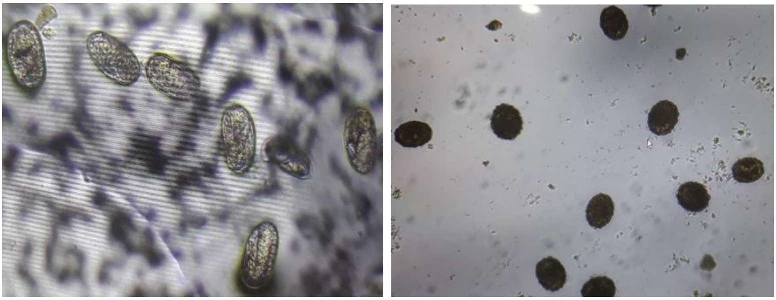

Figure 6.2. Microscopic view of eggs of *Ascaris suum(A)* və *Oesophagostomum dentatumin* (B)

6.2. Infection of pigs with helminths in the Guba-Khachmaz economic region

Fecal samples collected from pig farms in the Khachmaz region were examined by coprological examination to determine the dynamics of infection with Eimeria by age of animals and season of the year. It was clear that infection with eimeria was detected: in the spring season 41.7% in 2-6 month old animals, 33.3% in 7-12 month old, 15.4% in old animals; in the summer season 9.1% in 2-6 month old, 7.7% in 7-12 month old, no infection was detected in old animals; in the autumn season 33.3% in 2-6 month old, 21.4% in 7-12 month old, 12.5% in old animals; in the winter season 15.4% in 2-6 month old animals, 8.3% in 7-12 month old animals, 7.1% in old animals. Based on these results, it can be noted that as the age of pigs increases, a decrease in the extensiveness of the invasion is observed. Thus, eymeriosis is more severe in young animals (mainly pigs) than in older animals, while older animals have a chronic form of the disease and are mainly carriers of the disease. This also depends on the relatively strong immune status of older animals.

In the corpological examinations conducted in the Guba-Khachmaz economic region, 30.0% of infections with eymeriosis were detected in spring, 5.3% in summer, 21.4% in autumn, and 10.3% in winter (Fig. 6.4). The low incidence of infection in the summer is due to high air temperatures and low humidity. This causes the majority of oocysts to be destroyed in the summer. In spring and autumn, the air temperature, which positively affects the development of oocysts, as well as humidity, are within normal limits, which positively affects their development (sporulation) in the external environment. In winter, the ambient temperature is low, which weakens the development of Eimeria oocysts, negatively affecting infection.

During the study, the incidence of *Isospora suis* infection in pigs was also examined by age group. During the coprological examinations, infection with *Isospora suis* was detected 33.3% in 2-6 month old, 25.0% in 7-12 month old, and 20.0% in old animals. A total of 26.0% of infections were investigated on the farm (Table 6.3).

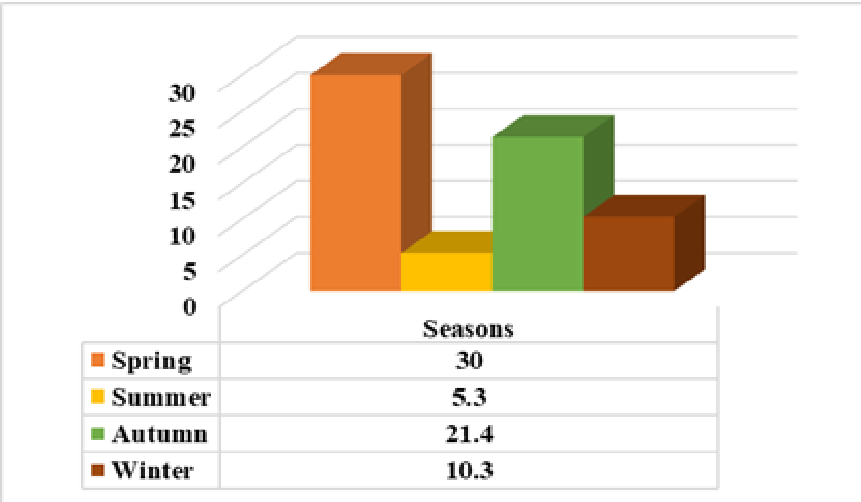

Figure 6.4. Seasonal dynamics of Eimeria infection

Table 6.3

Infection percent of Isospora suis infection in pigs (in %)

Age	Examined	Infection with *Isospora suis*	
		Infected	II (%)
2-6 months	9	3	33,3
7-12 months	8	2	25,0
Elderly	10	2	20,0
Total	27	7	26,0

When analyzing the results of the examinations conducted, it becomes clear that Eimeria infections occur in pig farms throughout the year. However, it should be noted that the highest infection with Eimeria was observed in the spring and autumn (mainly in spring). This also depends on the conditions (temperature, humidity, oxygen) necessary for eimeria oocysts to develop in the external environment.

When examining the incidence of *Isospora suis* infection in pigs by age group, it was found that piglets were infected at a higher rate than older animals. The main reason is that older animals have a higher immune status.

6.3. Infection of pigs with helminths in the Ganja-Dashkasan economic region

Helminths also parasitize pigs, negatively affecting their development and causing a decrease in productivity. One of the most common intestinal nematodes in them is ascariasis. *Ascaris suum* (Goeze, 1782) is the causative agent of ascariasis, and these helminths parasitize in the small intestine and sometimes in the stomach of pigs. Both ends of the helminth are thinned and white in color. The parasite does not require an intermediate host to develop, and piglets between 2-4 months are most commonly infected. The source of the disease is older pigs infected with ascaris.

The causative agent of macracanthorhynchosis is a spiny-headed helminth called *Macracanthorhynchus hirudinaceus (Pallas, 1781)*. The helminth develops in the presence of an intermediate host. Pigs become infected when they eat insects, their intermediate hosts. Pigs are most susceptible to the disease after 10 months of age, and infection is higher in animals aged 1-2 years. The source of invasion is old domestic pigs.

The aim was to study the dynamics of the spread of macrocanthoriniasis and ascariasis in pigs in Azerbaijan depending on age and season.

During the examinations conducted, it was determined: in the spring, no infection was detected in pigs in 2-6 months with macrocanthorhynchosis, and 8.3% with ascariasis, in 7-12 months 16.7% with macrocanthorhynchosis and 25.0% with ascariasis; in older animals 25.0% with macrocanthorhynchosis and 16.7% with ascariasis; in the summer, 8.3% with macrocanthorhynchosis in 2-6 months and 25.0% with ascariasis; in 7-12 months with acrocanthorhynchosis 33.3% and with ascariasis 41.7%; in older animals with macrocanthorhynchosis 33.3%, with ascariasis 16.7% infection.

Infection during the coprological examination was detected: in the autumn season, in pigs in 2-6 months, no infection with macrocanthorhynchosis, but 8.3% with ascariasis, in 7-12 months- 16.7% with macrocanthorhynchosis, 33.3% with ascariasis, in older animals-33.3% with macrocanthorhynchosis, 16.7% with ascariasis; in winter, in pigs in 2-6 months, no infection with both helminthiasis, in 7-12 months 8.3% with macrocanthorhynchosis, 16.7% with ascariasis, in older animals - 8.3% with macrocanthorhynchosis and ascariasis. Studies have shown that the incidence of macracanthorhynchosis in pigs increases with age. During the coprological examinations conducted, the highest number of infections was observed in older animals (33.3%). This is because pigs become infected when they eat dung beetles, which act as intermediate hosts in pasture conditions. The ingested insects are digested in the pig's gastrointestinal system, and the released larvae attach their heads to the intestinal wall, where they develop and reach the sexually mature stage. As pigs get older, the incidence of ascariasis decreases. During coprological examinations, the highest infection rate was observed in 7-12 month old (41.7%).

As a result of the conducted studies, infection in pigs was found: with macracanthorhynchosis 13.9% in spring, 25.0% in summer, 16.7% in autumn, and 5.6% in winter, with ascariasis 16.7% in spring, 27.8% in summer, 19.4% in autumn, and 8.3% in winter (Fig. 6.5).

Studying the spread of invasive diseases, including helminthiasis, in pig farms is of practical importance. If the disease is detected in time, it is possible to raise healthy animals and increase the profitability of the farm.

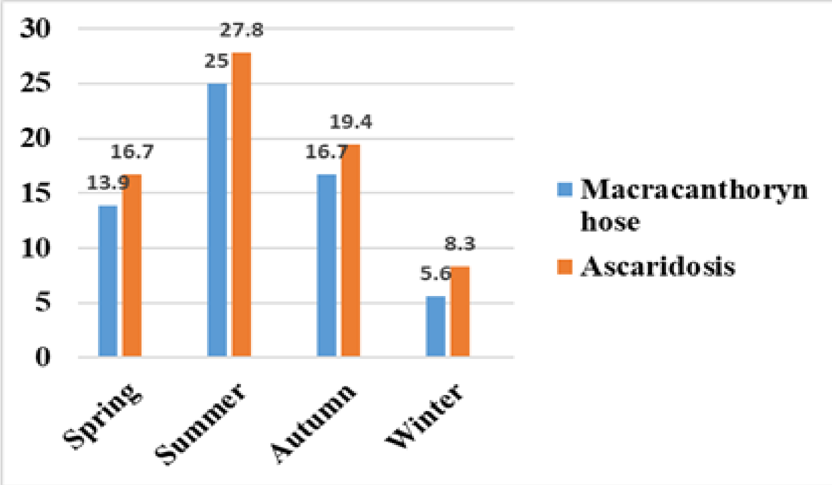

Figure 6.5. Infection of pigs with helminths by season (in %)

6.4. Blood parasites in pigs

Blood-parasitic diseases, including piroplasmosis, also occur in pigs. In pigs, piroplasmas first multiply in the internal organs, then affect erythrocytes in the peripheral blood.

They reproduce by simple division in erythrocytes. Piroplasmas also multiply in the body of ticks. Transmission of piroplasms by ticks occurs transovarially. The source of infection is sick animals and carriers of piroplasma, as well as ixodid ticks. The carrier of the parasite is the *Rhipicephalus turanicus* tick. The pathogens are transmitted from a sick animal to a healthy one through ixodid (pasture) ticks. The causative agents of piroplasmosis localize in the internal organs of the sick animal and break down or destroy the tissues of these organs. During our research, we recorded piroplasmosis in pigs, the causative agent of which is *P. trautmanni* (Fig. 6.6). Flavacridine and piroplasmin give positive results in the treatment of piroplasmosis. As a preventive measure, animals should be bathed with acaracid solutions.

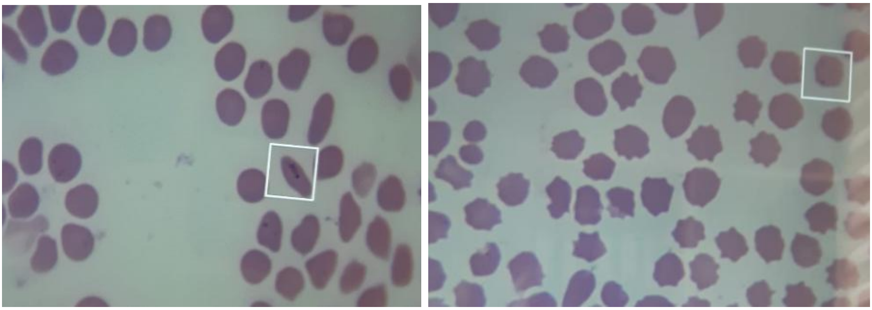

Figure 6.6. Piroplasmas in the peripheral blood of pigs

The number of parasites in the peripheral blood of the animals was 15-25 copies (in 100 fields of view of the microscope). The number of piroplasmas in erythrocytes was 1-2 copies. Parasites have been observed to be mainly uninucleate and in some cases binucleate. The nuclei were clearly visible under the microscope, where they were localized predominantly on the blunt side of the parasite edge (Fig. 6.7). Piroplasmas multiply in the internal organs of pigs (liver, lungs, heart).

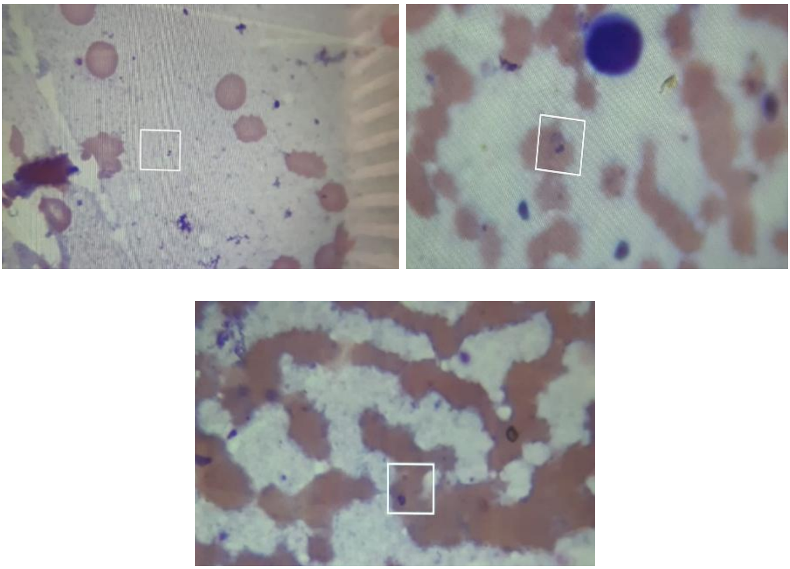

Figure 6.7. Piroplasmas in the internal organs of pigs

Morphological differences (shapes, sizes) of parasites both in the blood and in the internal organs of the animals studied were determined using a microscope. Have been studied pear-shaped, amoeba-shaped, circular, and oval shapes forms of parasites. The size of parasites in the peripheral blood of pigs is larger than the size of parasites in their internal organs. Thus, as a result of microscopy, it was determined that; the sizes of pear-shaped parasites in peripheral blood were 2.4-2.9x1.3-1.7 µm, and in internal organs - 0.9-1.6x0.8-1.2 µm; amoebic parasites were not detected in peripheral blood, but in internal organs - 0.9-1.6x0.8-1.2 µm; the sizes of round-shaped parasites in peripheral blood were 0.8-1.2x2.3-2.7 µm, and in internal organs - 0.6-0.7x1.7-1.9 µm; the sizes of oval-shaped parasites in peripheral blood vary between 1.1-2.8x0.6-1.9 µm, and in internal organs - 0.8-2.3x1.0-1.3 µm.

It should be noted that in blood smears the nuclei of piroplasms were small, and the volume of parasites was covered with protoplasm. It has been confirmed that the nuclei of piroplasms in internal organs are large. Therefore, in piroplasms, the main volume of the parasite is made up of the nucleus, and a small part ifrom protoplasm.

6.5. Infection of pigs with associative invasions

As a result of the research, fecal samples collected from a pig farm located in the Gabala region were subjected to coprological examination in order to determine the dynamics of infection with helminths and eymeriosis by age of the animals and season of the year. As a result of the examination, infection with helminths and eymeriosis was detected. Thus, as a result of the conducted coprological examinations, was determined: in the spring, metastrongylosis in 2-6 month old animals was 36.4%, in 7-12 month old animals 38.5%, and 25.0% in older animals; with strongyloidosis in 2-6 month old animals 27.3%, in 7-12 month old animals 30.8%, and 16.7% in older animals; with eymeriosis, a disease caused by primary intestinal parasites, 54.5% in 2-6 month old animals, in 7-12 month old animals 38.5%, and 25.0% in older animals; in summer, with metastrongylosis in 2-6 month old animals 30.0%, in 7-12 month old animals 33.3%, and 27.3% in older animals; with strongyloidosis in 2-6 month old animals 20.0%, in 7-12 month old animals 25.0%, and 18.2% in older animals; 20.0% in 2-6 month old animals were infected with eymeriosis, and 8.3% in 7-12 month old animals, while no infection was detected during examination in older animals. Summarizing the results obtained, it was found that the incidence of infection was: with metastrongylosis, 33.3% in spring, 30.3% in summer, 42.9% in autumn, and 20.6% in winter; with strongyloidosis, 25.0% in spring, 21.2% in summer, 31.4% in autumn, and 11.8% in winter; with eymeriosis, 38.9% in spring, 9.1% in summer, 37.1% in autumn, and 17.6% in winter (Fig. 6.8).

During the research, samples of feces brought from individual pig farms in the Goygol region of the Ganja-Dashkasan economic region were examined and infection was determined: for the spring season, in pigs 2-6 months with macrocanthorhynchosis no infection was detected, with ascariasis 8.3%, in 7-12 months old with macrocanthorhynchosis 16.7%, with ascariasis 25.0%, in old animals with macrocanthorhynchosis 25.0%, with ascariasis 16.7%; in the summer season, in 2-6 months old with macrocanthorhynchosis 8.3%, with ascariasis 25.0%, in 7-12 months old with macrocanthorhynchosis 33.3%, with ascariasis 41.7%, in old animals with macrocanthorhynchosis 33.3% , with ascariasis 16.7%. In the autumn, infection was detected during coprological examination: in pigs aged 2-6 months no infection with macrocanthorhynchosis, 8.3% with ascariasis, in pigs in 7-12 months 16.7% with macrocanthorhynchosis, 33.3% with ascariasis, in older animals 33.3% with macrocanthorhynchosis, 16.7% with ascariasis; in the winter, infection with both helminthiasis was not detected in pigs in 2-6 months old, in 7-12 months old 8.3% with macrocanthorhynchosis and 16.7% with ascariasis, in older animals with macrocanthorhynchosis and ascariasis 8.3% As pigs get older, the percentage of ascariasis infection decreases. During coprological examinations, the highest infection rate was observed in 7-12 month olds (41.7%). The reason of that animals are more susceptible to infection with ascariasis and have a weaker immune system. As a result of repeated infections, immunity gradually develops in the body, and as pigs gets older, their tolerance to parasites increases.

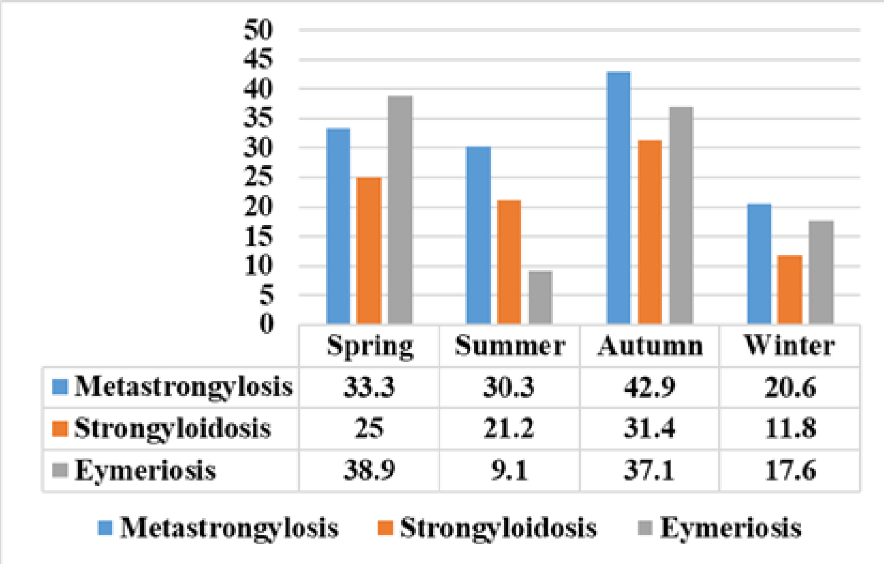

Figure 6.8. Seasonal infection of pigs

6.6. The effect of preparations containing organic selenium and having antioxidant activity on the reproductive functions and sperm quality of breeding pigs

The use of antioxidants, as well as immunomodulators, to improve reproductive function in breeding pigs has been of interest for some time in terms of obtaining highly productive pigs, and this trend continues today. Taking this into account, this issue has also been clarified in studies, which began in the Russian Federation in 2008 and were then completed in the Republic of Azerbaijan. As a result of the studies conducted during this period, was observed that adding organic selenium-containing preparations "DAFS-25" and "Selenolin", as well as "Fosprenil" and "Gamovit" from natural sources, to the feed ration of breeding pigs increased sperm concentration by 19.85% and dehydrogenase activity by 26.4%, also was observed decrease in the microbial count in the preputial spaces by 63.2%, the coli index by 1.38 times, and the coli titer by

1.27 times compared to the preputial spaces of control boars. It was determined that the level of microbial contamination of sperm varies seasonally. The highest discharge amounts were obtained in spring (57.1%) and autumn (51.2%), while the lowest were obtained in winter (15.5%) and summer (26.1%). The sperm fertilization ability of breeding boars in the experimental group was 5.05% higher.

CHAPTER VII
OVICIDAL EFFECT OF DISINFESTATION AGENTS AGAINST EGGS OF NEMATODIROSIS PATHOGENS AND THEIR ECONOMIC SIGNIFİCANCE

7.1. Measures to combat pathogens in animals

During the studies, to determine their disinvasive properties, from the chemical substances were taken deltathrin, citrine preparations and phenol and their various percentage solutions were studied for their ovicidal effect on both invasive and non-invasive nematode eggs *in vitro*. The results showed that the mechanism of action of deltathrin and citrine solutions on nematode eggs is different. Thus, when exposed to deltatrin and citrine during the experiment, the color of helminth eggs became pale, the eggs were deformed, some became curled, the egg shell melted on one or both sides, and the internal structure of the egg spilled out into the surrounding area. When viewed under a microscope, its structure was visible around the deformed eggs.

The effects of different percentages of chemicals on non-invasive nematode eggs are shown in Table 7.1. When the solution of Deltathrin affects the eggs, it begins to destroy them: with a 0.5% solution after an exposure time of 30 minutes, with a 1.0% solution after 20 minutes, with a 3.0% solution after 10 minutes, with a 5.0% solution after 5 minutes of exposure. The citrin solution begins to have an ovicidal effect after exposure time: 0.5% solution after 30 minutes of exposure, 1.0% solution after 20 minutes, 3.0% solution after 20 minutes of exposure, and 5.0% solution after 10 minutes. A 4.0% solution of phenol used for comparison had an effect on nematode eggs after 20 minutes.

The effects of different percentages of chemicals on invasive nematode eggs are shown in Table 7.2. The solution of Deltathrin begins to kill eggs after 40 minutes of exposure to 0.5% solution, 30 minutes of exposure to 1.0% solution, 20 minutes of exposure to 3.0% solution, and 10 minutes of exposure to 5.0% solution. The ovicidal effect of the Citrine preparation begins: 0.5% solution after 40 minutes of exposure, 1.0% solution after 30 minutes, 3.0% solution after 30 minutes of exposure, and 5.0% solution after 20 minutes of exposure. A 4.0% solution of phenol used for comparison had an effect on nematode eggs after 20 minutes.

Invasive nematode eggs were destroyed during the ovicidal effect of various percentages of disinfestation agents: 0.5% solution of deltathrin killed 72.2% of helminth eggs, 1.0% solution 77.8%, 3.0% solution 94.4%, and 5.0% solution 100%; 0.5% solution of citrine 61.1% of helminth eggs, 1.0% solution 66.7%, 3.0% solution 72.2%, and 5.0% solution 77.8% of helminth eggs. For comparison, a 4.0% solution of phenol killed 66.7% of the eggs.

For non-invasive nematode eggs, a 0.5% solution of deltathrin killed 75.0% of helminth eggs, a 1.0% solution killed 85.0%, and 3.0% and 5.0% solutions killed 100%; a 0.5% solution of citrine killed 65.0% of helminth eggs, a 1.0% solution killed 70.0%, a 3.0% solution killed 75.0%, and a 5.0% solution killed 80.0%. For comparison, a 4.0% solution of phenol killed 75.0% of the eggs. Helminth eggs were not destroyed in ordinary water used for control purposes. In subsequent experiments, a 3.0% solution of deltathrin was tested on wood and concrete as the experimental object. In a concrete test object, 100% of helminth eggs (1200 eggs) were destroyed by 3.0% deltathrin after 3 hours of exposure, 63.6% by 3.0% citrine (800 eggs), and 58.3% by 4.0% phenol (700 eggs). In the wooden test object, 100% of helminth eggs (1200 eggs) were destroyed after 3 hours of exposure by 3.0% deltathrin, 58.3% by 3.0% citrine (700 eggs), and 63.6% by 4.0% phenol solutions (600 eggs). As a control, plain water was added to the helminth eggs and no decrease in their number was detected.

Table 7.1

Exposure time of ovicidal effect of disinfestants on non-invasive nematode eggs

№	Name of the substance	Concentration of the solution (%)	Exposure time (minutes)					
			5'	10'	20 '	30'	40'	60'
1.	Deltatrine	0,5	+ + +	+ + +	+ + +	+ + -	+ + -	+ + -
2.	Deltatrine	1,0	+ + +	+ + +	+ + -	+ + -	+ + -	+ - -
3.	Deltatrine	3,0	+ + +	+ + +	+ - -	+ - -	- - -	- - -
4.	Deltatrine	5,0	+ + -	+ - -	+ - -	- - -	- - -	- - -
5.	Citrine	0,5	+ + +	+ + +	+ + +	+ + +	+ + -	+ + -
6.	Citrine	1,0	+ + +	+ + +	+ + -	+ + -	+ + -	+ + -
7.	Citrine	3,0	+ + +	+ + +	+ + -	+ - -	+ - -	+ - -
8.	Citrine	5,0	+ + +	+ + -	+ + -	+ - -	+ - -	+ - -
9.	Phenol (Comparison)	4,0	+ + +	+ + +	+ + -	+ + -	+ + -	+ + -
10.	Ordinary water (control)	-	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +

Table 7.2

Exposure time of ovicidal effect of disinfestants on invasive nematode eggs

№	Name of the substance	Concentration (%)	Exposure time (minutes)					
			5'	10'	20'	30'	40'	60'
1.	Deltatrine	0,5	+ + +	+ + +	+ + +	+ + +	+ + -	+ + -
2.	Deltatrine	1,0	+ + +	+ + +	+ + +	+ + -	+ + -	+ - -
3.	Deltatrine	3,0	+ + +	+ + +	+ + -	+ - -	+ - -	- - -
4.	Deltatrine	5,0	+ + +	+ + -	+ - -	- - -	- - -	- - -
5.	Citrine	0,5	+ + +	+ + +	+ + +	+ + +	+ + -	+ + -
6.	Citrine	1,0	+ + +	+ + +	+ + +	+ + -	+ + -	+ + -
7.	Citrine	3,0	+ + +	+ + +	+ + +	+ + -	+ - -	+ - -
8.	Citrine	5,0	+ + +	+ + +	+ + -	+ + -	+ - -	+ - -
9.	Phenol (Comparison)	4,0	+ + +	+ + +	+ + -	+ + -	+ + -	+ + -
10.	Ordinary water (control)	-	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +

During the experiments conducted under in vitro conditions, 4 areas, each 1 m^2, were isolated from the other areas. Area 1 was sprayed with 3.0% solutions of deltathrin, area 2 with 3.0% solutions of citrine, area 3 with 4.0% solution of phenol, area 4 was sprayed with plain water for control purposes. After 3 hours of exposure, 15 samples were taken from different locations in each area and examined. For experimental purposes, 93.3% of eggs were destroyed in the area sprayed with a 3.0% solution of deltathrin, 66.7% of eggs were destroyed in the area sprayed with a 3.0% solution of citrine, and 60.0% of eggs were destroyed in the area sprayed with a 4.0% solution of phenol. In the area sprayed with plain water for control purposes, helminth eggs were not destroyed.

7.2. Testing of disinfestants against nematodirosis pathogens in cattle under farm conditions and studying their economic efficiency

Research work on testing disinfestation preparations against nematodirosis pathogens in livestock farms under farm conditions and calculating the economic benefits obtained was carried out in accordance with the rules adopted in veterinary. Thus, for experimental purposes, 3.0% solutions of deltathrin were used against the eggs of nematodirosis pathogens of cattle, 4.0% solutions of phenol were used for comparison, and plain water was used for control. In the livestock farm, 3 areas, each 50 m^2, were isolated from other areas and experiments were continuedUsing a mobile spraying device NQP-05, disinfestation agents were sprayed at the rate of 1.0 liters per 1 m2 of area, and after a 3-hour exposure period, 25 samples were taken from different parts of each designated area and coprological examination was performed. In the first area, where a 3.0% solution of deltathrin was sprayed for experimental purposes, the effectiveness of the preparation was 92.0%, and in the second area (arranged for comparison), the effectiveness of the 4.0% solution of phenol was 56.0%. To the area 3 (organized for control purposes) was sprayed plain water, fecal samples were collected, and coprological examinations were performed. Since no medication was applied to area 3, infection was determined to be (66.7%).

Based on the results obtained from the studies carried out in farm conditions, the economic damage and economic benefits obtained during the implementation of disinfestation measures against nematodirosis pathogens in cattle were calculated.

As a result of our research, the use of deltathrin against nematodiasis pathogens in large horned animals was used for disinfestation purposes.

The damage caused by one cattle is calculated using the following formula:

$$\mathbf{N_d = D_{aw} \times D_{pw}}$$

N_d - damage from nematodirosis
D_{aw} – decreased amount of live weight
D_{pw} - the price of 1 kg of live weight

While the live weight of an animal is 350 kg, it loses 4.3% or 15 kg of live weight during the disease.

If the price of 1 kg of live weight of cattle is 4.00 manat, the cost of the lost live weight is

$$D_{pw} = 4 \text{ man.}$$

$$D_{aw}=15 \text{ kq.}$$

$$X= 15{,}0 \text{ kg} \times 4{,}00 \text{ man.} = 60 \text{ man.}$$

A healthy cow infected with nematodirosis produces 12 liters of milk per day and loses 30% of its milk during the disease.

$$\mathbf{N_{d2} = M_a \times M_p}$$

Here: **N_{d2}** – damage from milk during the disease, **M_a** – decreased amount of milk and **M_p** – the price of 1 liter of milk

12 litrers x 30% = 360 :100 = 3,6 litrers

S_m=3.6 liters of milk lost in a day

3.6 liters x 20 days = 72 liters (milk)

So, during the illness, 72 liters of milk are lost.

If the price of 1 liter of milk is 0,60 man

72 x 0,60 = 43,2 man

So, milk loss

$$M_a = 43{,}2 \text{ man}$$

According to calculations, the economic loss from the decrease in live weight of a large horned animal infected with nematodirosis is 60.0 manat, and the economic loss from the decrease in milk production is 43 manat and 0,50 man. In general, the damage caused by nematodirosis to the productivity of 1 head of cattle is calculated using the following formula:

$$\mathbf{N_{dc}=(D_d \times M_l)}$$

$$N_{dc}=60,0+43,20 = 103,2 \text{ man.}$$

D_d – economic damage per live weight

M_l – economic damage from the loss of milk productivity

The price of the drug Deltathrin, used against nematodirosis, was calculated as follows.

In our research, the following indicators were used to determine economic efficiency:

-The price of 1.0 liter of Deltatrin is 24.0 manats.

-3.0% deltathrin used per 1m^2 area - 1.0 liters

-The price of 1 liter of 3.0% of the deltatrine preparation – 0,72 man

Therefore, the cost of the preparation spent on disinvasion for one head of cattle is 0,72 man. The cost of labor spent on each 1m2 of the field during disinvasion is 0,30 man.

The economic effect obtained during the disinvasive measures is calculated using the following formula

$$\mathbf{E_e = N_d - (P_p + S_{cl})}$$

Ee – the economic efficiency of the measure carried out, N_d – damage caused by nematodirosis – 103,2 man, P_p – the price of preparation – 0,72 man, S_{cl} – the cost of labor spent – 0,30 man. E_e = 103,2 man.– (0,72 man + 0,30 man) = 102,18 man. Damage in the amount of 102,18 man per 1 head of animalwas prevented from the disinvasive measures carried out against nematodirosis in cattle. The applied 3.0% deltatrine preparation showed the effectiveness of disinvasion 92.0% in farm conditions: 102,2 man. x 92,0% = 94 manats Thus, in case of bovine nematodirosis, 3.0% of the deltatrine preparation at the rate of per 1 head of animal, an economic effect of 94 manats is obtained.

FINAL ANALYSIS OF THE RESULTS OBTAINED IN THE STUDIES

Livestock farms are located in all regions of the Republic of Azerbaijan, and there are cases of disease outbreaks and reduced productivity. However, it is not common to completely prevent diseases observed in animals, as well as cases of reduced productivity due to diseases. In general, crop losses in livestock farming due to diseases continue to occur. The cases of foot-and-mouth disease in the country over the past year clearly prove this. Similar thoughts can be said about pig farming in the country. It is true that pig farming is a poorly developed sector in the Republic of Azerbaijan compared to animal husbandry (cattle and sheep farming), and at the same time, research on pigs related to diseases in the country is also weak compared to other sectors.

Taking into account the above, in accordance with the goal set in the presented work, were determined the prevalence rates of helminthiasis or other parasites in cattle and pigs raised on private farms in some economic regions of the Republic of Azerbaijan, the factors affecting them, the development cycle of the registered pathogens, and epizootological characteristics, and preventive measures for the prevention of diseases were developed. The information obtained is expressed in the following 10 final conclusions and practical recommendations.

RESULTS

1. The prevalence rates of helminthiasis and mixed blood parasites in cattle, the factors affecting them, the development cycle of the registered pathogens, and epizootological characteristic have been determineds, also developed preventive control measures to prevent diseases in cattle raised on private farms located in the territories of the Ganja-Dashkasan, Shaki-Zagatala, Shirvan-Salyan and Guba-Khachmaz Economic Regions of the Republic of Azerbaijan[8, 9, 18-20, 26].
2. It became clear that diseases such as trichocephalosis, strongyloidosis, nematodirosis, fascioliasis, dictyocaulosis, paramphistomatosis, etc. are found in the territories of all the studied economic regions, the prevalence of which is characterized by different quantitative indicators. Factors that cause this difference include the seasons of the year, the age of the animals, the natural soil-climatic and relief characteristics of the area, as well as the biological characteristics of the

pathogens[4, 6-7, 9-10, 12, 14, 26].

3. It has been shown that cattle are infected with helminths throughout the year and the extensiveness of the invasion were 17.7-43.6% in the Shaki-Zagatala economic region, 10.6-27.3% in the Ganja-Dashkasan economic region, 17.0-27.4% in the Shirvan-Salyan economic region and 9.0-36.0% in the Guba-Khachmaz economic region, which is characterized by a certain specificity in terms of the maximum and minimum invasion extensiveness of pathogens in individual economic regions. Thus, the minimum and maximum indicators are respectively: for Sheki-Zagatala, trichocephalosis 17.7-24.7% and dictyocaulosis 29.1-43.6%; for Ganja-Dashkasan, trichocephalosis 1.6-15.3% and paraphistomatosis 8.3-27.4%,; for Shirvan-Salyan, trichocephalosis 12-45.5% and strongyloidosis 18.7-48.5%; and for Guba-Khachmaz, fascioliasis 6.3-23.8% and strongyloidosis 14.1-41.3%[8-10, 16, 18-19].
4. It was determined that infection with helminths recorded in cattle farms where the helminth fauna of the Republic of Azerbaijan was studied occurs in all age groups of animals with different invasion extensiveness but, the incidence of helminth infections in older individuals is lower than in younger individuals, and this is confirmed to one or another degree in all studied economic regions. Thus, helminth infection occurs in 3-6 month old and older individuals, respectively: 9.1-28.6% and 7.9-20.0% for Sheki-Zagatala, 0-21.7% and 9.5-42.9% for Ganja-Dashkasan, 12.0-66.7% and 3.8-50.0% for Shirvan-Salyan, and 13.8-31.8% and 8.0-19.0% for Guba-Khachmaz[8-9, 14, 18-19].
5. It was determined that helminths such as *Dictykocaulus viviparus, Trichocephalus skrjabini, Nematodirus oiratianus, Strongyloides papillosus, Fasciola hepatica, Paramphistomum* sp. were found in the intestines of animals slaughtered at slaughterhouses in the studied economic regions, the number of which in the places of localization varied between 2-36 specimens. The recorded pathogens are characterized by a wide

diversity in their morphological appearance, development cycles, epizootological characteristics, and extensiveness of distribution[10, 12, 16].

6. It has become clear that the factors affecting the extensiveness of helminth invasion in cattle include the seasons and the relief. Thus, relatively high air temperatures have a positive effect on the development of helminthiasis. For this reason, the highest infection rate of invasions (66.7%) was recorded in the Shirvan-Salyan economic region in the summer which the average annual temperature of this region is higher than that of other economic regions. A similar situation was observed in studies conducted in different reliefs (plains, foothills, and mountains), and it was determined that the extensiveness of infasias in plain areas was up to 4.8 times higher than in mountainous areas [7, 18].
7. A comparative study of blood parameters of healthy cattle, infected with mono and associative invasions revealed that: the hemoglobin content were in the blood of healthy animals between 10.0 - 12.0 g/%, in the blood of animals infected with mono-invasion nematodirosis - 9.2 - 9.8 g/%, in the blood of animals infected with associative invasions nematodirosis and paraphistomatosis - 8.0-9.0 g/%, and in cattle infected with nematodirosis, paraphistomatosis and trichocephalosis - 7.0 - 8.0 g/%, taht is the invasions cause a decrease in the amount of hemoglobin in the blood. Unlike hemoglobin, it is observed that during invasions the erythrocyte sedimentation rate increases, that is, it exceeds the physiological norm. This causes the invasion carriers to experience reduced mobility, decreased digestion, increased water requirements, and other symptoms[12, 17, 21].
8. Studies conducted to clarify the effect of disinfestants on pathogens in cattle have shown that, depending on the concentration of the substances studied (deltathrin and citrine) and the exposure time, it is possible to achieve up to 100% destruction of helminth eggs. Thus, the use of a 3% solution of deltathrin is 1.6 times more effective than phenols and is

economically efficient at 94 manats per animal[22-24].

9. The infection of pigs with helminths in private farms in the territories of the Ganja-Dashkasan, Shaki-Zagatala and Guba-Khachmaz economic regions of the Republic of Azerbaijan was studied and it was determined that ascariasis, esophagosomiasis, eymeriosis, trichocephalosis and other diseases are found in pigs and the factors affecting their invasion extensiveness include season, age and relief indicators[3, 5, 11, 13, 15, 25].
10. Compared to cattle, there are certain differences in the invasion extensiveness of helminths in pigs, which are characterized by relatively low quantitative indicators of invasion extensiveness of helminths in pigs, a relatively high spread of the disease in older generations, maximum indicators observed in different seasons, etc. Thus, the invasion extensiveness of helminths in cattle and pigs varies between 0-66.7% and 0-54.4%, respectively, the highest infection of ascariasis, esophagostomiasis, and trichocephalosis in pigs occurs in the spring, lower infection in the winter. Adding organic selenium-containing preparations such as "DAFS-25" and "Selenolin", as well as antioxidant preparations such as "Fosprenil" and "Gamovit" to the feed ration of breeding pigs enhances their reproductive activity. At this time, the highest productivity is observed in the spring (74.2%), and the lowest in the summer (65.8%), which is 6.0-7.8% higher than the result obtained in the control group pigs [1-2, 11, 13, 15, 25].

PRACTICAL RECOMMENDATIONS

1. When a 3.0% solution of deltathrin is used as a disinfectant against nematodirosis of cattle, gets 92.0% effective, and an economic benefit of 94 manats is obtained.
2. It is considered more appropriate to apply the 3.0% solution of Deltatrin in large farms, taking into account that it is practically convenient, has a high disinfestation effect, and is economically profitable against nematodirosis pathogens in cattle.

3. It is possible to stimulate the reproductive activity of pigs by adjusting their feed ration, and for this purpose it is appropriate to use preparations containing organic selenium and having antioxidant activity. Using sperm from feeding pigs fed this way in artificial insemination may allow for higher results.

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