THE INFLUENCE OF BIOCENOSIS ON THE FORMATION OF THE FAUNA OF ARGALI-MERINO SHEEP PARASITES IN THE NORTHERN TIEN SHAN

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Abstract
In the Karkara-Kegen valley of the Almaty region of Kazakhstan, when breeding a new breed of sheep with the participation of different animal species, their fauna of parasites was formed from parasites present in this biocenosis or natural focus. In this region there were 75 species of parasites belonging to 5 types, 10 suborders, 21 families and 34 genera. During the formation of the breed for more than 20 years, argali-merino sheep had 28 species of parasites: one species of trematodes (*Dicrocoelium lanceatum*), 4 species of cestodes (*Taenia hydatigena* larvae; *Echinococcus granulosus* larvae; *Moniezia expansa*; *M. benedeni*) and 23 species of nematodes (*Skrjabinema ovis*, *Chabertia ovina*, *Trichostrongylus axei*, *Trichostrongylus colubriformis*, *Ostertagiella circumcincta*, *O. occidentalis*, *O. trifida*, *O. trifurcata*, *Marshallagia marshalli*, *Nematodirus arvari*, *N. dogielii*, *N. filicollis*, *N. oiratianus*, *N. spathiger*, *Nematodirella longissimespiculata*, *Dictyocaulus filaria*, *Protostrongylus davtiani*, *P. hobmaieri*, *P. raillietii*, *P. skrjabini*, *Cystocaulus nigrescens*, *Bicaulus schulzi*, *Trichocephalus skrjabini*). In the next 60 years, hybrids acquired another 35 species. Thus, a new breed of animals is included in the cycle of invasion in the biocenosis. Some parasites (not previously noted in this biocenosis) that are in the body of argali-merino sheep, getting into the external environment with feces, form new foci, involving other species of animals living in this biocenosis in the circulation.

**Keywords:** cestode; nematode; gadfly; fauna of parasites; Karkara-Kegen; valley; biocenosis.

Introduction
It is known that the formation of biocenoses, in addition to climatic changes and anthropogenic factors, is significantly influenced by the patterns of dynamics of a complex of biological components, among which parasites play an important role, participating, along with predators, in the regulation of the number of wild animals. In nature, the relationship between parasites and hosts is not always clearly traced, therefore, the study of such interactions, for example, the influence of helminths on the dynamics of wild ungulate populations, becomes not only a scientific, but also a practical task.

The fauna of eimeria of wild ungulates in the Northern Tien Shan was studied in 1958 by S.K.Svanbayev [1,2]. For the first time, he discovered two species of eimeria in wild boar (*Sus scrofa*): *Eimeria ibragimovae*, *E. almataensis* and one species of isospores – *Isospora suis*, in roe deer (*Capreolus pygargus*) – four species: *Eimeria capreoli*, *E. ponderosa*, *E. rotunda* and one species of isospores – *Isospora capreoli*, in maral (*Cervus elaphus*) – three species of eimeria: *Eimeria cervi*, *E. gallivalerioi*, *E. robusta*, argali (*Ovis ammon*) has four species: *Eimeria ammonis*, *E. surkovae*, *E. zeijnjevi*, *E. rachmatullinae*, mountain
goat (Capra hircus) has four species: Eimeria capra, E. babaevi, E. randilovi, E.nazijrovi.

The helminth fauna of wild boar (Sus scrofa) in the Northern Tien Shan was studied in 1953-1954 by Y.N.Zakhryalov [3]. He registered the following helminths in the boar: E.granulosus larvae; Taenia hydatigena, larvae; Ascarops strongylina; Physocephalus sexalatus; Metastrongylus elongatus; M. pudendotectus. In this region, the helminth fauna of wild boars was studied by V.A.Shol in 1961 [4]. He discovered seven types of helminths: D.lanceatum, Alveococcus multilocularis, E.granulosus, T.hydatigena, Metastrongylus elongatus, M. pudendotectus, Trichocephalus suis.

According to helminthological studies by N.V.Badanin [5], the following types of helminths are parasitized in roe deer (Capreolus pygargus) from the Northern Tien Shan: D.lanceatum, T.hydatigena (larvae), M.expana, Trichostrongylus colubriformis, T.probolurus, T.vitrinus, Ostertagia circumcincta (=Ostertagiella circumcincta),Ostertagia trifurcata (=Ostertagiella trifurcata), Ostertagia marshalli (=Marshallagia marshalli), Ostertagia occidentalis (=Ostertagiella occidentalis), Nematodirus spathiger, Haemonchus contortus, Ch.ovina, Dictyocaulus hadweni (=D.eckerti), Parabronema skrjabini u Trichocephalus skrjabini.

The helminth fauna of the maral (Cervus elaphus) from the Northern Tien Shan, according to S.N.Boev [6], I.B.Sokolova [7] and M.P.Lyubimov [8], are represented by 8 species: D.lanceatum, M.benedeni, Dictyocaulus eckerti, Elaphostrongylus panticola, Oesophagostomum venulosum, Parabronema skrjabini, Setaria altaica.

According to S.N.Boev, I.B.Sokolova and V.Ya.Panin, 28 species of helminths were identified in argali (Ovis ammon) in the Northern Tien Shan [9]: Dicrocoelium lanceatum, Cysticercus tenuicollis, Moniezia alba, M.benedeni, S.ovis, Trichocephalus skrjabini, Chabertia ovina, Trichostrongylus colubriformis, T.probolurus, Marshallaggia marshalli, M.mongolica, Ostertagiella circumcincta, O.occidentalis, O.orloffi, Ostertagia ostertagi, O.trifurcata, Nematodirus oiratanus, N.dogieli, N. archari, N.spathiger, Parabronema skrjabini, Dictyocaulus filaria, Protostrongylus davtaii, P.hobmaieri, P.skrjabini, P.raillieti, Systoocaulus nigrescens, Spiculocaulus leuckarti.

The helminth fauna of native sheep, goats and cattle in the Northern Tien Shan in 1960-1962 was studied by O.S.Karamendin and N.A.Gubaidulin [10]. They found the following helminths in this region: D.lanceatum1,2, E.granulosus1,2, Cysticercus bovis1, C.tenuicollis2, Coenurus cerebralis2, M.benedeni1,2, Thysaniezia giardia1,2, Protostrongylus davtian2, P.hobmaieri2, P.raillieti2, P.skrjabini2, Cystocaulus ocreatus2, Dictyocaulus filaria2, D.viviparus1, Haemonchus contortus1,2, T.axei1,2, T.capricola2, T.colubriformis1,2, T.skrjabini2, Ostertagia ostertagi1, Ostertagiella circumcincta2,


One of the main branches of agriculture in Kazakhstan is traditional nomadic animal husbandry, which involves the use of common pastures with representatives of wild ungulate mammals. This technology has been developed for centuries. If the migration routes coincide, domestic and wild animals act as food competitors, while a mutual flow of invasion of various etiologies is possible in sufficiently large territories. In the natural conditions of the Northern Tien Shan, argali, wild boars, siberian roe deer and siberian mountain goats live on the grazing paths of farm animals. Therefore, when using common pasture lands and watering holes,
there is a wide interchange of parasites of domestic and wild animals, in which two kinds of phenomena are observed: flows of invasion between these groups of animals and the transfer of invasion in space.

The purpose of the research. The purpose of this study is to study 

**Material and methods**

The material was collected in 1986-1987 and 2021-2022 from 1330 argali-merino sheep in the Karkara-Kegen valley of the Almaty region.

The material was collected by the method of complete and incomplete helminthological autopsies and intravital studies (Fulleborn and Berkinbay methods).

Intravital parasitological studies of sheep were carried out according to the method of O.Berkinbay [12].

A study on sarcocysts in sheep was performed by muscle biopsy using a Popov needle.

**Results**

The Kazakh argali is the first breed in the world history of sheep breeding, obtained by crossing (hybridization) of fine-fleeced sheep (Novokavkaz merino) with wild argali sheep living in the Tien Shan Mountains and other high-altitude areas. Hybrids here were kept on pastures without fertilizing throughout the year. At the same time, in accordance with the purpose of the animals of the degenerated breed, pastures located at an altitude of 2.0-3.5 thousand meters above sea level were used for them.

Below is a list of parasites compiled according to their own and literary data (Table).

Table shows that the argali-merino sheep appeared in a new biocenosis for them when there were already marals, roe deer, argali, wild boars, native rough-haired sheep, goats, cattle, in which protozoa, trematodes, cestodes, nematodes were registered. That is, a certain focus of a number of parasites already existed.

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<tr>
<td>2</td>
<td>3. E. almatensis Musajev, 1970</td>
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<td>3</td>
<td>5. E. cervi Galli-Valerio, 1927</td>
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<td>7. E. faurei (Moussu, Marotel, 1902) Martin, 1909</td>
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<td>5</td>
<td>8. E. gallivalerioi Rastegaieff, 1930</td>
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<td>6</td>
<td>9. E. granulosus Christensen, 1938</td>
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<td>7</td>
<td>10. E. ibragimovae Musajev, 1970</td>
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<td>8</td>
<td>11. E. intricata Spiegl, 1925</td>
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<td>9</td>
<td>12. E. ovina Levine, Ivens, 1970</td>
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<td>10</td>
<td>13. E. ovinoidalis Levine, 1961</td>
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<td>11</td>
<td>14. E. parva Kotlan, Mocsy, Vaida, 1929</td>
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<td>12</td>
<td>15. E. ponderosa Wetzel, 1942</td>
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<td>13</td>
<td>16. E. robusta Supperer, Kutzer, 1961</td>
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<td>14</td>
<td>17. E. rotunda Pellerdy, 1955</td>
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<td>18. E. wassilewskyi Rastegaieff, 1930</td>
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<td>16</td>
<td>19. I. capreoli Svanbaev, 1958</td>
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<td>17</td>
<td>20. I. suis Biester, Murray,</td>
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<tr>
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| Classis Cestoidea Rudolphi, 1808 |
| Subclassis Cestoda Gegenbauer, 1859 |
| Ordo Cyclophyllidae Braun, 1900 |
| Subordo Taeniata Skrjabin, Schulz, 1937 |
| Familia Taeniidae Ludwig, 1886 |
| Subfamilia Taeniinae Abuladze, 1960 |
| Genus Taenia Linnaeus, 1758 |

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<th>29.T.hydatigena (Pallas, 1766), larvae</th>
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<td>31. M. multiceps (Leske, 1780), larvae</td>
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| 32. E. granulosus (Batsch, 1786), larvae | Ld - - Ld - Ld Ld Od |

Subordo Anoplocephalata Skrjabin, 1933
Superfamilia Anoplocephaloidea Spassky, 1949
Familia Anoplocephalidae Cholodkowsky, 1902
Subfamilia Moniezinae Spassky, 1951
Genus Moniezia Blanchard, 1891

| 33. M. expansa (Rudolphi, 1810) Blanchard, 1891 | - - Ld - - Ld Ld Ld Od |
| 34. M. benedeni (Moniez, 1879) Blanchard, 1891 | - - Ld - - Ld Ld Ld Od |

Familia Avitellinidae Spassky, 1951
Subfamilia Thysanieziinae Skrjabin, Schulz, 1937
Genus Thysaniezia Skrjabin, 1926

| 35. T. giardi (Moniez, 1879) | - - - - - Ld Ld Od |

Phylum Nemathelminthes Schneider, 1873
Classis Nematoda Rudolfi, 1808
Subclassis Plasmidia Chitwood, Chitwood, 1933
Subordo Spirurata Railliet, 1914
Familia Histiocephalidae Skrjabin, 1941
Genus Parabronema Baylis, 1921

| 36. P. skrjabini Rassowska, 1924 | - - Ld Ld - - Ld Od |

Subordo Oxyurata Skrjabin, 1923
Familia Syphaccidae Skrjabin, Schikhobalova, 1951
Genus Skrjabinema Werestschagin, 1926

| 37. S. ovis (Skrjabin, 1915) Werestschagin, 1926 | - - - Ld - Ld Ld Ld Od |

Subordo Strongylata Railliet, Henry, 1913
Superfamilia Strongyloidea Wainland, 1858
Familia Strongylidae Baird, 1853
Subfamilia Chabertinae Popova, 1952
Genus Chabertia Railliet, Henry, 1909

| 38. Ch. ovina (Pabricine, 1788) | Ld Ld Ld Ld Ld Ld Ld Od |

Familia Ancylostomatidae Looss, 1905
Genus Bunostomum Railliet, 1902

| 39. B. trigonocephalum (Rudolphi, 1802) | - - - - - - Ld Od |

Superfamilia Trichostrongylidea Cram, 1927
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<td>Nematodirus</td>
<td>N.andreevi</td>
<td>Satubaldin, 1954</td>
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<tr>
<td>55.<strong>N. archari</strong> Sokolova, 1948</td>
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<td>56.<strong>N. dogieli</strong> Sokolova, 1948</td>
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<tr>
<td>57.<strong>N. filicollis</strong> (Rudolphi, 1802) Ransom, 1907</td>
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<td>58.<strong>N. helvetianus</strong> May, 1920</td>
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<tr>
<td>59.<strong>N. oiratianus</strong> Rajewskaja, 1929</td>
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<tr>
<td>60.<strong>N. schulzi</strong> Satubaldin, 1954</td>
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<td>Ld</td>
<td>Ld</td>
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<tr>
<td>61.<strong>N. spathiger</strong> (Railliet, 1896) Railliet, Henry, 1909</td>
<td>Ld</td>
<td>Ld</td>
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**Genus Nematodirella Yorke, Maplestone, 1926**

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<tr>
<td>62.<strong>N. longissimespiculata</strong> (Romanovitsch, 1915) Skrjabin, Schikholoalova, 1952</td>
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**Familia Dictyocaulidae Skrjabin, 1941**

**Genus Dictyocaulus Railliet, Henry, 1907**

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<tr>
<td>63.<strong>D. filaria</strong> (Rudolphi, 1809) Railliet, Henry, 1907</td>
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**Familia Protostrongylidae Leiper, 1926**

**Genus Protostrongylus Kamensky, 1905**

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<tr>
<td>64.<strong>P. davtiani</strong> (Savina, 1940) Davtian, 1949</td>
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<tr>
<td>65.<strong>P. hobmaieri</strong> (Schulz, Orlow, Kutass, 1933) Cameron, 1934</td>
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<tr>
<td>66.<strong>P. kochi</strong> (Schulz, Orlow, Kutass, 1933) Chitwood, Chitwood, 1938</td>
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<tr>
<td>67.<strong>P. raillietti</strong> (Schulz, Orlow, Kutass, 1933) Cameron, 1934</td>
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<tr>
<td>68.<strong>P. skrjabini</strong> (Boev, 1936) Dikmans, 1945</td>
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**Genus Cystocaulus Schulz, Orlow, Kutass, 1933**

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<tr>
<td>69.<strong>C. nigrescens</strong> (Jerke, 1911) Schulz, Orlow, Kutass, 1933</td>
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**Genus Bicaulus Schulz, Boev, 1940**

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<tr>
<td>70.<strong>B. schulzi</strong> (Boev, Wolf, 1938) Schulz, 1933</td>
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<tr>
<td>Suborda Rhabditata Chitwood, 1933</td>
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<tr>
<td>Familia Strongyloididae Chitwood, 1934</td>
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<td>Genus Strongyloides Grassi, 1879</td>
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<tr>
<td>71. S. papillosus (Wedl., 1856)</td>
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| Suborda Trichocephalata Skrjabin, Schulz, 1928 |
| Familia Trichocephalidae Baird, 1853 |
| Genus Trichocephalus Schrank, 1788 |
| 72. T. ovis Abildgaard, 1795 |
| - | - | - | Ld | - | - | - | Ld |
| 73. T. skrjabini (Backakow, 1924) |
| - | Ld | Ld | Ld | Ld | Ld | Ld | Ld | Ld, Od |

Familia Capillariidae Neveu-Lemaire, 1936
Genus Capillaria Zeder, 1800
| 74. Capillaria sp. |
| - | Ld | Ld | Ld | Ld | - | - | Od |

Phylum Arthropoda Siebold, Stannius, 1848
Classis Linnaeus, 1758
Ordo Diptera Linnaeus, 1758
Superfamilia Oestroidea Leach, 1815
Familia Oestridae Leach, 1815
Subfamilia Oestrinae Leach, 1815
Genus Oestrus Linnaeus, 1758
| 75. Oestrus ovis L., 1758 |
| - | - | - | - | - | - | - | - | Od |

Note. Od-own data, Ld-literary data, Am-argali-merino sheep, Fo-local rough-haired sheep, Bt- cattle, Ss-wild boars, Ch-goat, Cs-roe deer, Ce-maral, Op-argali.

**Discussion**

Thus, when breeding a new breed of sheep with the participation of different animal species, their fauna of parasites is formed from parasites present in this biocenosis or natural focus. Thus, a new breed of animals is included in the cycle of invasion in the biocenosis.

It is likely that in the following years a number of new species of parasites will be registered in the argali-merino sheep, the owners of which are currently roe deer (Spilocaulus austriacus, Trichostrongylus vitrinus), maral (Oesophagostomum venulosum, Setaria altaica, Capillaria bovis), argali (Marshallagia schumakovitschi, Nematodirus abnormalis, Ostertagia ostertagi, Spiculocaulus leucarti), cattle (Cooperia oncophora, Oesophagostomum spp.), goats (Nematodirus andreevi).

The process of formation of fauna of parasites in animals or the formation of animals as hosts of parasites is complex and lengthy, during which mutual morphobiochemical adaptation of parasites and the host occurs [12, 23]. However, in modern conditions, under the influence of human activity, this process can accelerate [12]. Thus, when creating new breeds of animals
obtained by crossing closely related species, the process of formation of parasitofauna accelerates. During the formation of the breed for more than 20 years, argali-merino sheep had 28 species of parasites [11]. Noting such a relatively small number of them, the author [11] believed that hybrids have increased resistance to helminths. This opinion turned out to be erroneous, since currently 63 species of parasites have already been registered in argali-merino sheep. That is, in sixty years, the argali-merino sheep have become the owners of another 35 species.

Conclusions
Thus, the analysis of the literature and our own research have shown that 75 species of parasites belonging to 5 types, 5 classes, 3 subclasses, 3 orders, 10 suborders, 4 superfamilies, 21 families, 11 subfamilies, 1 trive and 34 genus are parasitized in wild and domestic ungulates living in the Karkara-Kegen valley of the Almaty region.

During the formation of the breed for more than 20 years, argali-merino sheep had 28 species of parasites. Currently, 63 species of parasites have already been registered in argali-merino sheep. That is, in sixty years, the argali-merino sheep have become the owners of another 35 species.

The formation of argali-merino sheep as hosts of 63 species of parasites in a short time became possible thanks to genetic information obtained from the ancestors of argali and sheep.

Acknowledgements
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Түйін
Қазакстанның Алматы облысының Каркара-Кеген алыстың ар түрлі жануарлардың катьсуымен қойылардың жаңа тұқымын өсіру кезінде олардың паразиттерінің түрлі курамы осы биоценозда және де табиғи ошақта кездескен паразиттерден қалыптасты. Бұл аймақта паразиттердің 5 типке, 10 отрядтарына, 21 тұрындағы, 34 түсқа жататын 75 түрі анықталған. 20 жылдан астам уақыт ішінде будандар паразиттердің 28 түріне не болды: третатодалардың бір түрі (Dicrocoelium lanceatum), цестодалардың 4 түрі (Taenia hydatigena, larvae; Echinococcus granulosus larvae; Moniezia expansa; M. benedeni) және нематодалардың 23 түрі (Skrabinema ovis, Chabertia ovina, Trichostrongylus axei, Trichostrongylus colubriformis, Ostertagiella circumcincta, O. occidentalis, O. trifida, O. trifurcata, Marshallagia marshalli, Nematodirus archari, N.dogieli, N.filicollis, N.oiratianus, Nspathiger, Nematodirella longissimespiculata, Dictyocaulus filaria, Protostrongylus davtiani, P. hobmaieri,
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Аннотация
В Каркара-Кегенской долине Алматинской области Казахстана при выведении новой породы овец с участием разных видов животных фауна паразитов формировалась из паразитов, имеющихся в данном биоценозе или природном очаге. Данном регионе имелись 75 видов паразитов, принадлежащих 5 типам, 10 подотрядам, 21 семействам, и 34 родам. В период формирования породы в течение более 20 лет у архаромериносов насчитывалось 28 видов паразитов: один вид трематод (Dicrocoelium lanceatum), 4 вида цестод (Taenia hydatigena, larvae; Echinococcus granulosus larvae; Moniezia expansa; M. benedeni) и 23 вида нематод (Skrjabinem ovis, Chabertia ovina, Trichostrongylus axei, Trichostrongylus colubriformis, Ostertagiella circumcincta, O.occidentalis, O. trifida, O. trifurcata, Marshallagia marshalli, Nematodirus archari, N. dogieli, N. filicollis, N. oiratianus, N. spathiger, Nematodirella longissimespiculata, Dictyocaulus filaria, Protostrongylus davtian, P. hobmaieri, P.raillieti, P. skrjabini, Cystocaulus nigrescens, Bicaulus schulzi, Trichocephalus skrjabini). В последующие 60 лет гибриды дополнительно приобрели еще 35 видов. Тем самым, новая порода животных включается в циркуляцию инвазионных элементов в биоценозе. Некоторые паразиты (ранее не отмеченные в этом биоценозе), находящиеся в организме архаромериносов, попадая во внешнюю среду с фекалиями, образуют новые очаги, вовлекая в циркуляцию других видов животных, обитающих в этом биоценозе.

Ключевые слова: цестода; нематода; овод; фауна паразитов; Каркара-Кегень; долина; биоценоз.