Journal of Life Sciences & Biomedicine, vol. 4(77), No 1, p. 84-89 (2022)

The seasonal dynamics of helminth invasion of domestic carnivores in Azerbaijan

Ibrahimova Reyhan Shohlat

Institute of Zoology, Azerbaijan National Academy of Sciences, Abbszade Str., Passage 1128, Block 504, Baku AZ1073, Azerbaijan
For correspondence: *ibrahimova_reyhan@bk.ru*

Received: March 31, 2022; Received in revised form: May 25, 2022; Accepted: June 08, 2022

The article is devoted to studying the seasonal variability in the degree of infection of domestic carnivores with helminths. The following results were obtained during the study: animals are infected by helminths to a greater extent in spring, summer, and autumn and to a considerably lesser extent in winter. Infection by trematodes is characterized by a 2-peak curve with peaks in spring and autumn. Cestodes infected domestic carnivores in spring, summer, and autumn with one peak in autumn, while nematodes were observed in animals in all seasons of the year. Investigation of seasonal dynamics of the degree of helminthic infection of domestic carnivores will allow making predictions about the extent, season, and the most dangerous period of infection of animals by helminths.

Keywords: *domestic carnivores (stray dogs, domestic cats), trematodes, cestodes, nematodes, season*

INTRODUCTION

Some authors studied the species composition and intermediate hosts of helminths of domestic carnivores (stray dogs, domestic cats) in different regions of Azerbaijan as well as some ecological factors that affect the degree of infection of these animals by helminths (Sadigov et al., 2003; Sadigov et al., 2001).

However, almost no scientific work has been done on studying the seasonal dynamics of infection of domestic carnivores by helminths in the Republic. The only paper concerning this problem is by M.Yolchiyev and R.Ibrahimova (2012) who studied the seasonal variation of helminthic infection in wild and domestic carnivores in the Shirvan region.

Study the seasonal dynamics of animal infection with helminths enables to specify some biological and ecological peculiarities of helminths on the one hand and on the other hand to identify the most dangerous periods i.e. the time of the highest degree of infection of animals by helminths. Thus, the study the effect of seasonal changes in the rate of infection of animals by helminths is practically important.

Taking into account the above mentioned, I conducted the investigation of seasonal dynamics of infection of domestic carnivores by helminths in Azerbaijan.

MATERIALS AND METHODS

The investigation was conducted in the territory of Azerbaijan in 2001- 2014 years. 349 stray dogs (105 in spring, 112 in summer, 73 in autumn, 59 in winter) and 323 domestic cats (105 in spring, 98 in summer, 63 in autumn and 57 in winter) were captured and treated through the widely accepted helminthological methods of body examination to study the effect of seasonal changes on infection of carnivores by common groups of helminths in various habitats: in the periaquatic areas, in the rural areas, in the urban areas and in the vicinity of the slaughterhouse. The animals were dead (they died due to unknown reasons or got hit by a car) (Skryabin, 1928).

The collected trematodes and cestodes were preserved in 70% ethanol, whereas nematodes were fixed in a 4% formalin solution. To identify the species belonging of trematodes and cestodes alum car-

10.5281/zenodo.7239809
Available online 30 June 2022

mine stained slides were prepared. Nematode species were treated in a solution of lactic acid and glycerol in a ratio of 1:1.

For the identification of trichinella, the various muscles of animals (diaphragm, ribs, thigh muscles) have been studied by the compressor method (Visotskaya, Daniel, 1973). The samples of muscles carded and made thinner, after adding lactic acid they tightened between slides. After 1 day until it becomes transparent, it was observed by trichinelloscope. The trichinella larvae are clearly visible under the microscope.

All helminth species were identified using MBS-6 and Olympus (Olympus SZ2=ST, *Olympus corporation*, Japan) stereomicroscopes.

The discovered helminths were identified according to DP Kozlov's (1977) reference book.

The prevalence was calculated with the following formula:

$$\boldsymbol{P} = \frac{\mathbf{X\,inf.}}{\mathbf{X\,anim.}} \boldsymbol{x}\ \mathbf{100}\%$$

RESULTS AND DISCUSSION

As the result of the investigation it was found that the rate of infection of animals by helminths varied among the different seasons. The percentage of infected animals was 30.3% in spring, 37.1% in summer, 20.7% in autumn and 16.4% in winter Table.

As a result of research, were found 36 species of helminths in domestic carnivores. Of these, 32 species in stray dogs, and 23 species in domestic cats.

It is seen from the Table that the studied animals were infected by 17 species of helminths in winter, 35 species in autumn, 34 species in spring and 24 species in summer. This fact is apparently related to the difference in population densities of intermediate hosts of helminths of domestic carnivores, which are most numerous in spring and autumn.

Fourteen species of 14 helminths (*Dipylidium caninum*, *Taenia hydatigena*, *T. pisiformis*, *Hydatigera taeniaeformis*, *Mesocestoides lineatus*, *Thominx aerophilus*, *Uncinaria stenocephala*, *Ancylostoma caninum*, *Toxoascaris leonina*, *T. canis*, *T. mystax*, *Molineus patens*, *Spirura rytipleurites*, *Physaloptera praeputiale*) were recorded in all seasons of the year.

The revealed helminths were present to a higher extent in spring, summer and autumn and to a considerably lesser extent in winter. Infection of domestic carnivores by trematodes was observed in spring and summer, by cestodes in spring, summer and autumn, and by nematodes throughout the whole year (Yolchuyev, Ibrahimova, 2012).

The infection of domestic carnivores by some trematode species Alaria *alata*, *Plagiorchis elegans*, *Cryptocotyle lingua,* which have freshwater snails as intermediate hosts, was observed only in spring and autumn.

The dynamics of infection of domestic carnivores by trematodes according to seasons is characterized by a two-peak curve. The first peak was observed in spring (May - 13.3%). At the beginning of summer (June), the level of infection considerably decreased (7.5%). The second peak was recorded in autumn (21.3%), while the lowest level of infection was observed in December - 3.5%.

The infection caused by a widespread trematode of the domestic carnivores, *A. alata* was highest in autumn -13.5%, spring-6.6%, and summer-7.5%. The highest infection of *P.cordatum* was observed in spring-15.3% and in autumn-4.5%; The highest incidence of *P.elegans* species was observed in autumn-9.1%.

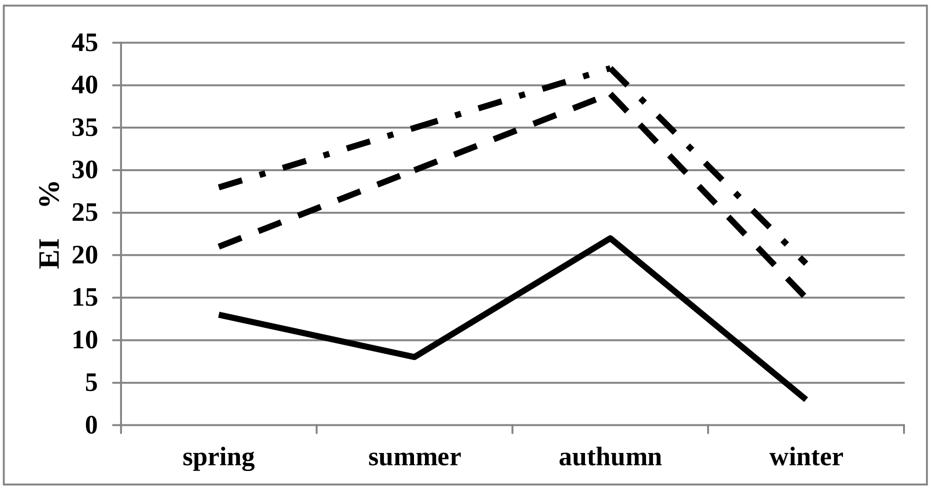
The observed picture is due to the differences in the abundance of freshwater snails which are intermediate hosts of parasites and which populations exhibit considerably reduced activity in summer and winter because of high and low ambient temperatures respectively Fig.

The degree of infection of domestic carnivores with cestodes was characterized by a single-peak curve. Infection reached a peak in summer starting from 20.8% in spring, then sharply raised to 40.1% and decreased at the beginning of autumn in September, and the lowest level of infection 15.2% was registered in winter – December and January. Rodents, reptiles, cat and dog fleas, which are the intermediate hosts of cestodes are more active in the spring, summer and autumn months of the year, which causes infection of domestic carnivores by helminths in these seasons of the year (Ibragimova, 2017; Rzayev, 2006).

Table. Helminth species and their parameters of invasion of domestic carnivores in separate seasons

Families Species of helminths	Season of the year				Domestic carnivores	
	Spring	Summer	Autumn	Winter	Stray dog	Domestic ca
Trematoda						
Alaria alata Goeze, 1782	$\frac{6,6}{2-4}$	$\frac{7,5}{1-3}$	$\frac{13,5}{4-8}$	$\frac{3,5}{1-3}$	+	+
Plagiorchis elegans Rudolphi,1802	$\frac{3,3}{6}$	-	$\frac{9,1}{5-9}$	-	+	-
Echinochasmus perfoliatus Ratz,1908	$\frac{3,3}{8}$	-	$\frac{4,5}{11}$	-	+	-
Cryptocotyle lingua Creplin,1825	$\frac{2,9}{9}$	-	$\frac{3,1}{2-3}$	-	+	-
Pharhyngostomum cordatum Diesing,1850	$\frac{13,3}{2-17}$	-	$\frac{4,5}{15}$	-	+	+
Cestoda						
Spirometra erinacei-europei Rudolphi,1819	$\frac{19,2}{1-11}$	-	$\frac{1,2}{1-7}$	$\frac{1,1}{2-6}$	+	+
Dipylidium caninum Lühe, 1758	$\frac{31,2}{2-16}$	$\frac{37,9}{5-32}$	$\frac{48,8}{1-20}$	$\frac{15,9}{3-12}$	+	+
Diplopylidium nolleri Skrjabin, 1924	$\frac{6,6}{3-7}$	$\frac{11,6}{1-6}$	$\frac{3,6}{4-9}$	$\frac{3,1}{1-4}$	+	+
D. skrjabini Popov, 1935	-	-	$\frac{9,1}{3-5}$	-	-	+
J.rossicum Skrjabin, 1923	$\frac{23,8}{3-14}$	$\frac{11,4}{1-12}$	$\frac{25,1}{5-16}$	-	-	+
Taenia hydatigena Pallas, 1766	$\frac{16,6}{2-14}$	$\frac{8,5}{1-7}$	$\frac{24,7}{1-14}$	$\frac{10,4}{3-6}$	+	+
T. crassiceps Zeder, 1880	$\frac{13,2}{2-7}$	$\frac{17,2}{3-14}$	$\frac{9,3}{2-5}$	-	-	+
T.laticollis Rudolphi, 1819	$\frac{6,5}{2-9}$	$\frac{7,9}{3-7}$	$\frac{4,5}{2-5}$	-	-	+
T.pisiformis Bloch, 1780	$\frac{15,9}{1-9}$	$\frac{22,5}{3-15}$	$\frac{18,1}{2-13}$	$\frac{15,9}{1-10}$	+	+
Hydatigera taeniaeformis Batsch,1786	$\frac{30,2}{1-10}$	$\frac{41,2}{1-21}$	$\frac{49,9}{3-27}$	$\frac{14,2}{2-6}$	+	-
Mesocestoides lineatus Goeze, 1782	$\frac{16,5}{2-20}$	$\frac{35,9}{8-27}$	$\frac{41,2}{5-12}$	$\frac{14,7}{6-14}$	+	+
Nematoda						
Capillaria plica Rudolphi, 1819	$\frac{10}{4-8}$	$\frac{6,8}{2-7}$	$\frac{9,1}{5-10}$	-	+	+
Thominx aerophilus Creplin, 1839	$\frac{5,8}{1-4}$	$\frac{12,5}{1-9}$	$\frac{4,6}{1-3}$	$\frac{3,9}{2-4}$	+	+
Trichocephalus georgicus Rodonaya,1950	$\frac{19,7}{1-8}$	-	$\frac{13,5}{1-6}$	-	+	-
Tr. vulpis Froelich, 1789	$\frac{23,8}{6-18}$	$\frac{9,7}{4-6}$	$\frac{13,5}{8-13}$	-	+	-
Trichinella spiralis Owen, 1825	-	-	$\frac{4,5}{23}$	$\frac{9,7}{14-29}$	+	-
Strongyloides vulpis Petrow, 1941	$\frac{18,7}{3-9}$	-	$\frac{14,8}{2-6}$	-	+	-
Ancylostoma caninum Ercolani, 1859	$\frac{23,3}{8-19}$	$\frac{36,1}{17-35}$	$\frac{47,8}{10-29}$	$\frac{16,8}{8-19}$	+	+
Uncinaria stenocephala Railliet, 1854	$\frac{28,5}{12-23}$	$\frac{37,2}{17-42}$	$\frac{49,6}{9-32}$	$\frac{17,4}{10-21}$	+	+
Molineus patens Dujardin, 1945	$\frac{17,6}{3-9}$	$\frac{19,7}{2-8}$	$\frac{12,1}{1-6}$	$\frac{9,7}{1-5}$	+	+
Toxascaris leonina Linstow, 1902	$\frac{24,8}{3-6}$	$\frac{39,1}{2-14}$	$\frac{50,3}{1-14}$	$\frac{18,3}{2-8}$	+	+
Toxocara canis Werner, 1782	$\frac{23,8}{1-14}$	$\frac{17,2}{3-15}$	$\frac{22,8}{2-11}$	$\frac{15,4}{2-7}$	+	-
T. mystax Zeder, 1800	$\frac{14,9}{3-16}$	$\frac{17,4}{2-11}$	$\frac{31,7}{1-14}$	$\frac{11,4}{1-7}$	+	+
Spirura rytipleurites Deslongchamps,1824	$\frac{9,1}{4-9}$	$\frac{5,2}{3-7}$	$\frac{4,8}{1-6}$	$\frac{2,9}{2-4}$	+	+
Spirocerca arctica Petrow,1927	$\frac{18,7}{2-8}$	$\frac{19,8}{2-9}$	$\frac{14,6}{2-5}$	-	+	-
Sp.lupi Rudolphi, 1809	$\frac{9,1}{3-5}$	$\frac{9,6}{2-5}$	$\frac{4,5}{7}$	-	+	-
Physaloptera praeputiale Linstow,1888	$\frac{18,9}{2-7}$	$\frac{21,7}{2-9}$	$\frac{12,4}{1-5}$	$\frac{9,7}{2-5}$	+	+
Ph. sibirica Petrow et Gorbunow,1931	$\frac{10,9}{8-17}$	$\frac{9,1}{5-12}$	-	-	+	-
Rictularia affinis Jagerskiold,1904	$\frac{15,7}{6-19}$	-	$\frac{9,1}{10-15}$	-	+	-
R.cahirensis Jagerskiold, 1904	$\frac{11,4}{3-5}$	-	$\frac{13,5}{5-9}$	-	+	+
Dirofilaria repens Railliet et Henry,1911	$\frac{7,9}{1-7}$	$\frac{17,2}{1-12}$	$\frac{18,1}{5-12}$	-	+	+
Total: 36	**34**	**24**	**35**	**17**	**32**	**23**

Remark: *above figures refers to percentage of infection, the below figures refers to prevalence (from min to max)*



Trematodes ——— **; Cestodes - - - - ; Nematodes** · — · — · —

Fig. Seasonal dynamics of the degree of infection of domestic carnivores by helminths in Azerbaijan.

The following species of helminths infected domestic carnivores mainly in spring, summer and autumn. These include *D.caninum, Physaloptera sibirica, Rictularia cahirensis, Dirofilaria repens,* which intermediate hosts are various species of invertebrates; *Joyeuxiella rossicum, Mesocestoides lineatus, H. taeniaeformis, H. krepkogorski, Trichinella spiralis* which intermediate hosts are rodents; and *Spirometra erinacei-europei, Diplopylidium nolleri, D. skrjabini* which intermediate hosts are small reptiles.

The degree of infection of domestic carnivores by *D. caninum* constituted 31.2% in spring, 37.9% in summer, and 48.8% in autumn; by *M. lineatus* 16.5% in spring, 35.9% in summer and 41.2% in autumn; by *H. taeniaeformis* 30.2% in spring, 41.2% in summer and 49.9% in autumn.

The reason as we have mentioned is the favorable climatic conditions for the growth of helminths and their eggs in spring, summer, and autumn, and the animals the constant contact with rodents, reptiles, insects and snails, which are intermediate hosts of these trematodes. During winter time, because of dry and cold weather conditions some helminths' eggs are destroyed in the soil and the weakening or interruption of the contact between animals and intermediate hosts (rodents, reptiles, and insects) are very poor, and sometimes never happened.

It has been recorded that domestic carnivores are infected with nematodes in all seasons of the year in high intensity.

Infection of animals with nematodes is characterized by the 1-peak curve. Infection of animals started from 30.2% in spring months and reached its peak of 43.2 in summer, then again dropped to 18.7% in winter due to the absence of optimal temperatures needed for the development of helminths and their eggs.

As nematodes are geohelminths and their development and distribution depend on environmental abiotic factors. Eggs of geohelminths survive for about 17 months in soil (Guliyeva, 1989). When the temperature and humidity are favorable, the egg could switch to an invasive state and cause infection to animals in any season of the year.

In the studied areas, the most frequently found geohelminths were *A. caninum* - `16.8% in winter, 23.3% in spring, 36.1% in summer, 47.8% in autumn, *U. stenocephala* - 17.4% in winter, 28.5% in spring, 37.2% in summer, 49.6% in autumn, *T. leonina* - 18.3% in winter, 24.8% in spring, 39.1% in summer, 50.3% in autumn.

In various animal nurseries in Russia, a considerable difference in the degree of helminth infection of dogs between the spring season (April – 64.5%) and winter season (20.7%) was observed (Malykhin, Vasilevich, 2004; Trunova, Nurmagomedova, 2017; Zakharov, 2000).

As a result of the research, it has been found that there is a considerable difference in the baseline of seasonal spreading and growth of helminths. Because of the impact of abiotic factors in the area, it is necessary to give predictions on helminth infections for each area individually and at different times, and the control measures should be based on it.

So, by studying the seasonal dynamics of dominant helminths of carnivores in the territory of Azerbaijan, it is possible to make predictions about the extent, season, and dangerous period of infection of animals with helminths and to take preventive measures.

REFERENCES

Guliyeva R. (1989) Epidemiological basics of prevention and larval toxocariasis (on the example of Baku city agglomeration). *Authoreferate of cand. diss*. Baku: 21 pp.

Ibragimova R. (2017) The role of intermediate hosts in the distribution of helminths of domestic carnivorous animals in Azerbaijan. *Journal of the Belarusian State University. Biology,* **No3:** 94-100.

Kozlov D. (1977) Determinant of helminths carnivores of USSR. M.: Nauka, 275 p.

Malykhin Ye., Vasilevich F. (2004) Helminthofauna of dogs in Moscow city. *Materials of International scientific-practical conference of young scientists "Contribution of young scientists to the agrarian Science in XXI century*. Ryazan: p. 429-431.

Rzayev N. (2006) Study of biology of Mollusks *Gyraulus albus* (Miller, 1774), intermediate hosts of paramfistomaty in Lankaran Natural Area. *Tr. Institute of Zoology of Azerbaijan NAS,* **XXVIII:** 766-780.

Sadıgov I., Yolchuyev M., Ibrahimova R. (2001) Ecological properties of main helminthiasis agents of carnivorous animals in Absheron and adjacent south-eastern regions. "*The study and protection of fauna at the end of XX century*", dedicated to 80th anniversary of *Academician M.A. Musayev,* Baku: p. 191-193.

Sadıgov I., Yolchuyev M., Ibrahimova R. (2003) The study of effect of residential areas on helminth fauna of homeless dogs in Azerbaijan. 1st *conference of Azerbaijan Zoologists Society,* Baku: p.126-129

Skryabin K. (1928) Methods of full helminthological examination of the vertebrates, including human. M.: Publishing house of Moscow State University, 45 p.

Trunova S., Nurmagomedova S. (2017) Seasonal dynamics of helminth infection of dogs in the plain zone of Dagestan. *Russian Parasitological Magazine.* **4 (42):** 358-360.

Visotskaya S., Daniel M. (1973) Parasitological research methods. L.: Nauka, 70 p.

Yolchuyev M., Ibrahimova R. (2012) Seasonal and age dynamics of helminths of wild and domestic carnivorous animals in Shirvan region. *Proceedings of ANAS Institute of Zoology,* **30(2):** 93-98

Zakharov P. (2000) Helminthiasis in guard dogs in the territory of megalopolis. *8-th International Congress on the problems of the veterinary medicine of small animals.* Moscow: p. 184 – 185.

Azərbaycanda əhli ətyeyən heyvanların helmintlərlə yoluxmasının fəsil dinamikasi

İbrahimova Reyhan Şöhlət qızı

AMEA-nın Zoologiya İnstitutu, Bakı, Azərbaycan

Məqalə əhli ətyeyən heyvanların fəsillər üzrə helmintlərlə yoluxma dinamikasına həsr edilmişdir. Tədqiqat zamanı müəyyən edilmişdir ki, trematodlarla yoluxması yalnız yaz və payız aylarında 2 zirvəli əyri ilə; sestodlarla - yaz, yay və payız aylarında 1 zirvəli; nematodlarla ilin bütün fəsillərində yoluxaraq 1 zirvəli əyri ilə xarakterizə olunur və yoluxmaları da uyğun olaraq yazda 32,3%, yayda 34,1%, payızda 18,7%, qışda isə 12,4% təşkil etmişdir. Əhli itkimi və pişikkimilərin geniş yayılmış helmintlərlə fəsillər üzrə yoluxmasını müəyyən etməklə, heyvanların helmintlərlə hansı fəsildə yüksək ekstensivliklə yoluxması və yoluxmanın təhlükəli dövrləri barədə əvvəlcədən proqnoz vermək və onlara qarşı qabaqlayıcı tədbirləri hazırlamaq olar.

Açar sözlər: *Əhli ətyeyən heyvanlar (sahibsiz itlər, ev pişikləri), trematodlar, sestodlar,nematodlar, fəsillər*

Сезонная динамика степени зараженности гельминтами домашних плотоядных животных в Азербайджане

Ибрагимова Рейхан Шохлат кызы

Институт зоологии НАН Азербайджана, Баку, Азербайджан

Статья посвящена изучению сезонной изменчивости степени зараженности гельминтами домашних плотоядных животных. В ходе исследования были получены следующие результаты: животные заражаются гельминтами в большей степени весной, летом и осенью и в значительно меньшей степени зимой. Заражение трематодами происходит только весной и осенью и характеризуется двупиковой кривой; при цестодах заражение наблюдается весной, летом и осенью – кривая при этом однопиковая; зараженность нематодами наблюдается в течение всех сезонов года, при этом форма кривой также однопиковая. В процентном выражении зараженность нематодами составляет весной 32,3%, летом 34,1%, осенью 18,7% и зимой 12,4%. Изучение сезонной динамики степени зараженности гельминтами домашних плотоядных животных позволит прогнозировать опасные периоды заражения и разработать профилактические меры борьбы против них.

Ключевые слова: *Домашние плотоядные (бродячие собаки, домашние кошки), трематоды, цестоды, нематоды, сезон*