

# The spread of blood parasitic diseases in dogs in Barnaul city

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**Abstract.** Most blood parasitoses are transmitted by means of carriers - ticks or insects, which bodies undergo certain development stages or transmission is carried out mechanically. *Dirofilariasis* is a zoonotic disease of animals and humans carried by mosquitoes. The reasons for *dirofilariasis* spread are the unrestricted movement of animals from one region to another. To diagnose *dirofilariasis*, a microscopy method of a fresh blood drop was used. Diagnosis for *babesiosis* in animals was made based on clinical traits and results of microscopic examination of peripheral blood smears stained according to Romanovsky-Gimza. The study of the ixodic ticks' prevalence as distribution sources of dog *babesiosis* was carried out in Barnaul in different parts of the city. The spring rise of *babesiosis* begins in late April and ends at the end of May, the summer period June-July is characterized by a low incidence rate. The autumn rise is from August to October, i.e., it coincides with ticks' activity during this period. The incidence of ticks in Barnaul is not uniform. The largest range of ticks' distribution is found in the highland part of the city.

## 1 Introduction

The Altai Krai is located in the south-eastern part of Western Siberia and borders with the following subjects of the Russian Federation: in the north - with the Novosibirsk region, on the north-east - with the Kemerovo region, in the south-east - with the Republic of Altai. In the south and south-west, the border of the Altai Krai coincides with the state border of Russia with the Republic of Kazakhstan [1].

The most warm and dry is the flat western part of the region, which creates favorable conditions for the existence of species diversity of ticks and insects - carriers of infections and development of natural and focal diseases [2, 3].

Most blood parasitoses are transmitted by means of carriers - ticks or insects, which bodies undergo certain development stages or transmission is carried out mechanically [4, 5].

Such diseases include *babesiosis* and *dirofilariasis* in dogs.

*Babesiosis* is a blood parasitic disease of domestic and wild mammals characterized by the phenomena of fever, anemia and yellowness of the mucous membranes, hemoglobinuria. Untimely treatment or its absence leads to the death of the animal [5, 6, 7].

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Dirofilariasis is a zoonotic disease of animals and humans carried by mosquitoes. The causes of dirofilariasis spread are the unrestricted movement of animals from one region to another, restriction of chemical protection usage against midges; In the city of Barnaul, *D. immitis* is recorded quite often [8].

**The aim of the work** was to study epizootology of blood parasitic diseases in the city of Barnaul.

The objectives of our research included:

- determine the spread of babesiosis and dirofilariasis in dogs in Barnaul.
- determine the species composition of ticks of the Ixodidae family and insects of the Culicidae family and the timing of their activity and distribution.

## 2 Materials and methods of research

Experimental studies were carried out at the Department of Microbiology, Epizootology, Parasitology and Veterinary and Sanitary Expertise of the Altai State University, as well as in the KSBI VB in Barnaul in the Central Veterinary Hospital. In the course of the work, the obtained data analysis of the animals' laboratory studies registration journal in the Central Veterinary Hospital in the period from 2012 to 2019 was carried out; in addition, 2,932 blood samples from dogs of different genders, ages and breeds were selected for the study.

Diagnosis in animals was made based on clinical traits and results of microscopic examination of peripheral blood smears stained according to Romanovsky-Gimza. To diagnose dirofilariasis, a microscopy method of a fresh blood drop was additionally used [8].

The study of the ixodic ticks' prevalence as distribution sources of dog babesiosis was carried out in Barnaul in different parts of the city. The collection of ixodic ticks was carried out with the help of white honeycomb cloth on the territory of forests, urban areas, parks, squares, in recreation areas, in landscaped yards, on animals' exercising areas. Also, mites were removed from animals admitted to the veterinary hospital of Barnaul. A total of 2,458 specimens of live ticks were collected. Species affiliation of ixodic ticks were determined with the help of the determinant by Kerbabaea E.B., Vasilevich F.I. (2000) [9].

Species composition of bloodsucking insects was studied in different areas of the forest-steppe zone of Barnaul. Insects' collection was carried out according to the technique of V.A. Polyakov (1990) in the morning, lunchtime and in the evening for 7 days. Mosquitoes were collected with entomological net by carrying out 8-10 swings. Insects were taken out of the net and placed in a jar with a lid. They were further placed on a foam mat. [10, 11] Insects' species affiliation was determined using the determinant by Plavilshchikov N.I. (1998) [12].

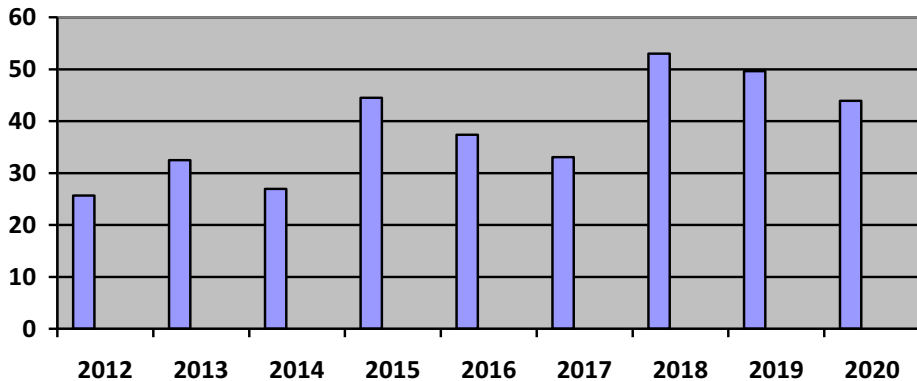
## 3 Results of the study

The studies have resulted in the following data presented in Table 1.

**Table 1.** Number of studied blood samples from dogs from 2012 to 2019

N o.	Disease name	Total samples studied	Negative reaction samples	Positive reaction samples	% of lesion
1.	Dirofilariasis	1419	1230	189	13,3
2.	Babesiosis	1513	898	615	40,6
	Total:	2932	-	-	-

Table 1 shows that the percentage of dog lesion with dirofilariasis in the city of Barnaul accounts for 13.3% of the number of samples studied, babesiosis - 40.6%, which confirms the wide spread of these diseases.



**Fig. 1.** Annual dynamics of detected babesiosis cases in the city of Barnaul.

Figure 1 shows the annual dynamics of detected disease cases in Barnaul, dogs' lesion with babesiosis by year amounts to 25.64%; 32.5%; 26.96%; 44.48%; 37.39%; 33.07%; 53.0%; 49.6%; 43.9 respectively. The largest percentage of animal lesions was observed in 2018 — 53.0% and in 2019 — 49.6%.

**Table 2.** Lesion of different dog breeds with ixodic ticks in the spring period for 2017-2020.

Dogs' breed composition	Q-ty if animals	Q-ty of ticks	Dermacentor marginatus		Dermacentor reticulatus		Ixodes persulcatus	
			Q-ty	%	Q-ty	%	Q-ty	%
Mongrel	30	69	24	34.8	31	44.9	14	20.3
Stafford	27	36	11	30.6	16	44.4	9	25.0
Labrador	12	21	7	33.3	9	42.9	5	23.8
American Spaniel	18	27	6	22.2	12	44.5	9	33.3
Corgi	9	15	4	26.7	8	53.3	3	20.0
East European Shepherd	36	51	14	27.5	26	51.0	11	21.5
Total	132	219	66	30.1	102	46.6	51	23.3

Analysis of table 2 shows that among the ticks collected from dogs, the species *Dermacentor reticulatus* predominates - 46.6%, subdominant species are: *Dermacentor marginatus* - 30.1% and *Ixodes persulcatus* - 23.3%.

**Table 3.** Seasonal dynamics of dog lesion with babesiosis

Month	Total samples	Negative samples	Positive samples	Lesion percentage
1	2	3	4	5
<b>2018</b>				
January	-	-	-	-
February	-	-	-	-
March	2	2	0	0
April	11	9	2	18.2
May	73	23	50	68,5

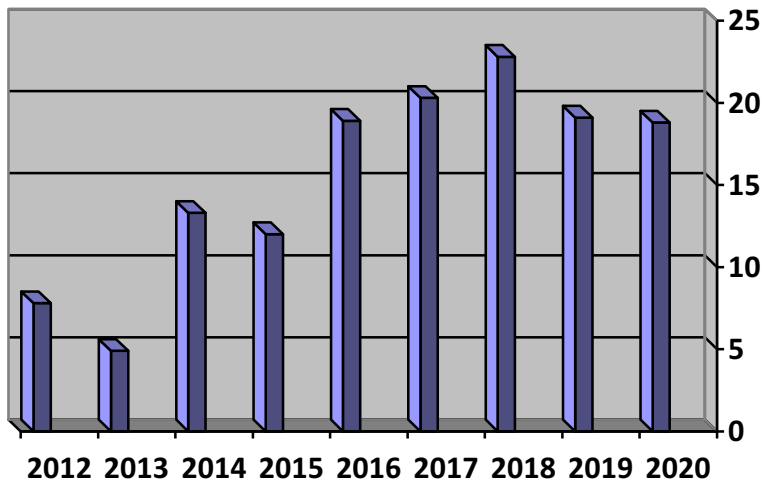
June	23	5	18	78.5
July	31	21	10	32.3
August	30	11	19	63.3
September	41	22	19	46,3
October	31	17	14	45.2
November	3	3	0	-
December	0	0	0	-
<b>Total</b>	<b>249</b>	<b>113</b>	<b>132</b>	<b>53.0</b>
<b>2019</b>				
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
January	-	-	-	-
February	-	-	-	-
March	3	3	0	0
April	45	19	26	57.8
May	38	15	23	60.5
June	19	18	1	5.3
July	10	9	1	10.0
August	31	14	17	54.8
September	69	26	43	62.3
October	31	18	13	41.9
November	6	5	1	16.7
December	0	-	-	-
<b>Total</b>	<b>252</b>	<b>127</b>	<b>125</b>	<b>49.6</b>
<b>2020</b>				
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
January	1	1	0	-
February	1	1	0	-
March	2	2	0	-
April	41	22	19	46,3
May	59	36	23	39.0
June	26	23	3	11.5
July	13	11	2	15.4
August	57	27	30	52.6
September	81	32	49	60.5
October	34	16	18	52.9
November	15	14	1	6.7
December	-	-	-	-
<b>Total</b>	<b>330</b>	<b>185</b>	<b>145</b>	<b>43,9</b>

The spring rise of babesiosis begins in late April and ends at the end of May, the summer period June-July is characterized by a low incidence rate. Autumn rise is from August to October, i.e., it coincides with the activity of ticks during this period (table 3).

When determining genera and species of ticks, we found that this disease is associated with the intensive spread of ixodic ticks in the territory of Barnaul.

The dominant species are ticks from the *Ixodes* genus: species *Ixodes persulcatus*; *Dermacentor* genus: *Dermacentor marginatus*, *Dermacentor reticulatus*, *Dermacentor corcinna*. Ticks of these genera are characterized by a seasonal double-peaked curve with spring and autumn activity peaks.

The incidence of ticks in Barnaul is not uniform. The largest ticks' distribution range is noted in the highland part of the city, where there is a stripe of coniferous forest and small rivers.



**Fig. 2.** Annual dynamics of detected dirofilariasis cases in the city of Barnaul.

Annual dynamics of the detected dirofilariasis cases in Barnaul is shown in Figure 2. The data obtained show that between 2012 and 2020, the percentage of dog lesion with dirofilariasis amounted to 7.8; 4.93; 3.37; 13.29; 12.06; 18.95; 20.3; 22.8; 19.1; 18.8%, respectively. The highest percentage of animal lesions with dirofilariasis was 22.8% in 2018, which indicates the prevalence of this disease. It should be noted that from 2017 to 2019, the number of cases of animal lesion with dirofilariasis is not decreasing but are at a fairly high level.

**Table 4.** Seasonal dynamics of dog lesion with dirofilariasis.

Month	Total samples	Negative samples	Positive samples	Lesion percentage
1	2	3	4	5
<b>2018</b>				
January	16	10	6	37.5
February	19	16	3	15.8
March	7	6	1	14.3
April	6	6	0	-
May	25	17	8	32.0
June	17	12	5	29.4
July	13	10	3	23.1
August	18	13	5	27.8
September	13	9	4	30.8
October	15	13	2	13,3
November	11	11	0	-
December	7	6	1	14.3
<b>Total</b>	<b>167</b>	<b>129</b>	<b>38</b>	<b>22.8</b>
<b>2019</b>				
1	2	3	4	5
January	9	9	0	--
February	16	10	6	37.5
March	22	19	3	13.6
April	19	17	2	10.5
May	22	15	7	31.8

June	16	12	4	25,0
July	18	16	2	11.1
August	13	11	2	15.4
September	19	16	3	15.8
October	11	7	4	36.4
November	10	9	1	10.0
December	13	11	2	15.4
<b>Total</b>	<b>188</b>	<b>152</b>	<b>36</b>	<b>19.1</b>
<b>2020</b>				
1	2	3	4	5
January	16	14	2	12.5
February	19	15	4	21.1
March	13	9	4	30.8
April	18	13	5	27.8
May	13	11	2	15.4
June	6	6	0	-
July	15	15	0	-
August	18	15	3	16.7
September	14	13	1	7.1
October	11	7	4	36.4
November	7	6	1	14.3
December	4	1	3	75.0
<b>Total</b>	<b>154</b>	<b>125</b>	<b>29</b>	<b>18.8</b>

Conducted retrospective analysis for 2018-2020 (table 4) of seasonal monthly dynamics did not reveal any pronounced changes due to the long-term larvae development in animals' bodies (6-7 months). Although in the spring and autumn period it is slightly higher.

There are 4 mosquito genera registered within the city of Barnaul: *Aedes*, *Culiceta*, *Culex*, *Anopheles*. *Aedes* genus accounts for 97.4% of the total genera. The dominant species of this genus are: *Aedes cinereus*, *Aedes flavescens*, *Aedes ciprius*, *Aedes excrucians*. Frequently found are *Aedes communis*, *Aedes punctor*, *Aedes vexans*, *Aedes caspius dorsalis*.

In the territory of Barnaul, we noticed mosquitoes' activity in the morning from 5.00 to 8.00 hours and in the evening from 19.00 to 23.00 hours, especially in warm cloudy weather and before the rain.

On average, 60 days of mass insects' flight are noted in the territory of Altai Krai. The first flight of mosquitoes begins around the 20th of May and ends at the end of August depending on the natural and climatic conditions causing their breeding period.

## 4 Conclusions

Thus, the average indicator of dog lesion with dirofilariasis amounts to 13.3%, babesiosis - 40.6%, which remains an urgent problem.

Spring babesiosis rise begins in late April, autumn - from August, i.e., it matches with the ticks' activity during this period. The incidence of ticks in Barnaul is not uniform. The largest ticks' distribution range is noted in the highland part of the city, where there is a stripe of coniferous forest and small rivers.

In the city of Barnaul, ixodofauna is represented by four species of two ticks' genera: *Ixodes persulcatus*, *Dermacentor marginatus*, *Dermacentor reticulatus*, *Dermacentor corcinna*.

The duration of mosquito flight averages 117 days. The first mosquitoes usually appear in the first decade of May, the last - in late August or in the first decade of September. Mass flight of mosquitoes last for an average of 48 days. It largely depends on weather

conditions in the spring period, which determines their breeding terms. Mosquitoes most actively attack in the morning and evening hours.

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