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The Parasites of Cats in Türkiye

Türkiye'de Görülen Kedi Parazitleri

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ABSTRACT

Cats have an important and different place due to their close relationships with humans. Since most of the parasites they carry are zoonotic, it is important to detect them. According to the research, *Dipylidium caninum, Joyeuxiella pasqualei, Toxocara* spp., *Toxascaris leonina, Giardia* spp., *Isospora* spp., and *Toxoplasma* sp. were found to be higher in cats compared to other parasites. It has been determined that scabies and flea infestations are common as ectoparasites. This review aims to present the reported parasites and their prevalence rates in cats in Türkiye.
Keywords: Cat, helminth, ectoparasite, protozoan, Türkiye

ÖZ

Kediler, insanlarla olan yakın ilişkileri nedeniyle önemli ve farklı bir yere sahiptir. Taşıdıkları parazitlerin birçoğunun zoonoz olması sebebiyle bu parazitlerin tespit edilmesi önemlidir. Yapılan çalışmalar incelendiğinde, kedilerde *Dipylidium caninum*, *Joyeuxiella pasqualei, Toxocara* spp., *Toxascaris leonina, Giardia* spp., *Isospora* spp. ve *Toxoplasma* sp.'nin, diğer parazitlere göre yüksek oranda bulunduğu görülmüştür. Ektoparazitler açısından değerlendirildiğinde, uyuz etkenleri ve pire enfestasyonlarının yaygın olduğu tespit edilmiştir. Bu derlemede, Türkiye'de kedilerde bugüne kadar bildirilmiş parazitler ve yaygınlık oranlarının verilmesi amaçlanmıştır.
Anahtar Kelimeler: Kedi, helmint, ektoparazit, protozoon, Türkiye

INTRODUCTION

Many historical findings regarding the domestication of cats have been recorded. Although it has yet to be determined periodically, it is estimated that it reached the period when agriculture started 9.500 years ago. Looking at the 5.300-year-old cat fossils found in China, it was seen that cats were more common in agricultural areas. Based on these findings, it is suggested that farmers cooperate with cats to protect their fields from pests such as mice (1,2).

According to the findings obtained in a recent study, a cat's bone was found next to a human skeleton in Cyprus and showed that these cats have adapted to human lives since ancient times (3).

Cats have become integral to human life and are considered family members. These animals, which have developed an emotional bond with us, are considered harmless and cute, even if they are looked after and fed on the streets. However, such coexistence paves the way for the transmission of many diseases. Parasitic diseases cover many of the conditions found in cats. They are essential for public health because some are zoonotic, and some parasites carry pathogenic agents with zoonotic properties.

Doğanay (4) made a similar review on cat parasites in Türkiye in the intervening 30 years, but many new studies have been conducted from that time to today, and new parasites have been recorded. Therefore, this compilation has been made to provide up-to-date information, and the parasites seen in cats in Türkiye are given in Tables (1-5).

METHODS

References used in this review article; were obtained by searching the archive data of various journals and publications in electronic media such as PubMed,

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Scopus, and Google Scholar. Communication was made with the relevant publishing houses for all the articles whose full text could not be reached.

While searching the literature, general terms such as cat, helminth, parasite, protozoan, and ectoparasite were used, and then the research was deepened by using more specific words.

This review was written using the articles cited in the references. In the tables prepared, helminths reported in cats are in Table 1, ectoparasites are in Table 2, and protozoans are in Table 3. While parasitic prevalences are indicated in the table, the number and percentages of animals written in the source articles are added.

Table 1. Trematode species in cats

Trematode species	City	Prevalence	Method	Reference
Dicrocoelium dentriticum	İstanbul	2.35%	Fecal examination	(5)
Dexiogonimus ciureanus (Sin.: *Metagonimus ciureanus*)	Bursa	+	Necropsy	(6)
Fasciola hepatica	İstanbul	1.76%	Fecal examination	(5)
*Metagonimus yokogawai**	Kars	5.8% (1/17) ***	"	(7)
*Metorchis albidus** (Sin.: *M. bilis*)	Bursa	14% (14/100)	"	(8)
Opisthorchis tenuicollis * (Sin.: *O. felineus*)	Ankara	0.66%	Necropsy	(9)
	"	+	"	(10)
	Elazığ	1%	"	(11)
	"	16.6%	"	(12)
	Van	+	"	(13)
Platynosomum fastosum	Bitlis	+	Fecal examination/eggs	(14)

Table 2. Cestode species in cats

Cestode species	City	Prevalence	Method	Reference
*Dipylidium caninum**	Bursa	65% (65/100)	Necropsy	(8)
	Elazığ	33%	"	(11)
	"	22.2%	"	(12)
	Konya	28%	Necropsy	(15)
	Ankara	+	Experimental infection	(16)
	"	46%	Necropsy	(17)
	Hatay	12.5%	"	(18)
	Van	5.94% (4/140)	Fecal examination	(19)
	İzmir	0.21% (1/465) ***	"	(20)
Diplopylidium noelleri	Bursa	12% (12/100)	Necropsy	(8)
	Elazığ	19%	"	(11)
	"	33.3%	"	(12)
	Konya	5%	"	(15)
	Ankara	6%	"	(17)
Echinococcus granulosus *	Ankara	+	"	(21)
	Van	+	"	(104)
Hymenolepis sp.*	İzmir	0.21% (1/465)***	Fecal examination	(20)
Joyeuxiella spp.	Bursa	33% (33/100)	Necropsy	(8)
	Elazığ	64%	"	(11)
	Van	11.9% (8/140)	"	(19)
	"	7.84% (4/51)	Fecal examination	(22)
	Kırıkkale	4.2%	"	(23)
Joyeuxiella echinorhynchus (Sin.: *J. echinorhynchoides*)	Elazığ	2.7%	Necropsy	(12)
	Ankara	1%	"	(17)

Table 2. continued

Cestode species	City	Prevalence	Method	Reference
Joyeuxiella pasqualei	Elazığ	36.1%	Necropsy	(12)
	Konya	58%	"	(15)
	Ankara	36%	"	(17)
	Hatay	50%	"	(18)
	Ankara	+	"	(24)
	İstanbul	7.6% (2/26)***	Fecal examination	(25)
Mesocestoides sp.*	Elazığ	20%	Necropsy	(11)
	Hatay	12.5%	"	(18)
	Ankara	+	Operation	(26)
*Mesocestoides lineatus**	Elazığ	19.4%	Necropsy	(12)
*Tetrathyridium elongatus**	"	8.3%	"	(12)
Taenia sp.	Van	7.84%	Fecal examination	(22)
	Ankara	5.3%	Necropsy	(27)
	Elazığ	5%	Fecal examination	(28)
Taenia taeniaeformis	Bursa	3% (3/100)	Necropsy	(8)
	Elazığ	59%	"	(11)
	"	44.4%	Necropsy	(12)
	Konya	10%	"	(15)
	Ankara	11%	"	(17)
	Hatay	25%	"	(18)
	Van	+	"	(22)

Table 3. Species of nematodes identified in cats

Nematode species	City	Prevalence	Method	Reference
Aelurostrongylus abstrusus	İstanbul	+	Fecal examination	(29)
	Kırıkkale	+	Necropsy	(30)
	Balıkesir	+	Fecal examination & radiography	(31)
Ancylostomidae*	Van	11.9% (8/140)	Fecal examination	(19)
	Kırıkkale	4.2%	"	(23)
Ancylostoma sp.*	Hatay	12.5%	Fecal examination	(18)
	Van	7.84% (4/51)	"	(22)
*A. tubaeforme**	Kırklareli	+	Necropsy	(32)
Ascarit sp.*	Ankara	2.7%	Necropsy	(27)
Capillaria sp.	"	4%	"	(17)
Capillaria aerophila	Elazığ	4%	"	(11)
	Ankara	3.3%	Necropsy	(33)
Ollulanus tricuspis	Bursa	9% (9/100)	Necropsy	(8)
	Elazığ	19.4%	"	(12)
	Ankara	17%	"	(17)
	Van	+	"	(22)
Physaloptera sp.	İstanbul	0.58%	Fecal examination	(33)
Physaloptera praeputialis	Bursa	3% (3/100)	Necropsy	(8)
	Elazığ	6%	"	(11)
	"	8.3%	"	(12)
	Konya	2%	"	(15)
	Ankara	3%	"	(17)

Table 3. continued

Nematode species	City	Prevalence	Method	Reference
Strongyloides sp.*	Antalya	+	Fecal examination	(33)
	Bursa	+	"	(33)
	İstanbul	0.58%	"	(33)
Toxocara spp.*	İzmir	3.01% (14/465)***	"	(20)
	Kırıkkale	48.9%	"	(23)
	Elazığ	43%	"	(28)
	Samsun	27.8%	"	(34)
	Ankara	13.3%	Egg control on the t hair	(35)
*Toxocara cati** (Sin.: *T. mystax*)	Bursa	54% (54/100)	Necropsy	(8)
	Elazığ	5%	"	(11)
	"	47.2%	"	(12)
	Konya	47%	"	(15)
	Ankara	47.6%	"	(17)
	Hatay	62.5%	"	(18)
	Van	37% (28/140)	Fecal examination	(19)
	"	+	Necropsy	(22)
	"	36.29% (18/51)	Fecal examination	(22)
	İstanbul	27.6%	"	(33)
	Ankara	93.76%	"	(36)
	"	95.6% (22/23)	Fecal examination & necropsy	(37)
	"	+	Fecal examination	(38)
	"	49.3%	Necropsy	(39)
*Toxocara canis**	Elazığ	2.7%	"	(12)
	Ankara	24.6%	"	(39)
*Toxascaris leonina**	Elazığ	5.5%	"	(12)
	Ankara	3%	"	(17)
	Van	7.46% (5/140)	Fecal examination	(19)
	"	25.53% (12/51)	"	(22)
	Elazığ	1%	"	(28)
	İstanbul	20.5%	"	(33)
	Samsun	1.8%	"	(34)
	Ankara	6.25%	"	(36)
	"	3.3%	Necropsy	(39)
Trichuris spp.*	Hatay	12.5%	Fecal examination	(18)
	İstanbul	0.58%	"	(33)
	Samsun	3.2%	"	(34)
Troglostrongylus brevior	Samsun	+	Necropsy	(40)
*Unciaria stenocephala**	Elazığ	1%	"	(11)
	Elazığ	2.7%	"	(12)
	Ankara	+	Experimental infection	(41)

Table 4. Ectoparasite speces in cats

Main groups	Parasite species	City	Number of examined cats	Prevalence	Reference
Mites	Scabies	Ankara	300	5%	(42)
	*Notoedres cati**	Elazığ	36	2.7%	(12)
		Ankara	150	2.6%	(39)
		Ankara	1	+	(43)
		Van	8	37.5%	(44)
		İstanbul	2.200	6.6%	(45)
		Aydın	1	+	(46)
	Otodectes cynotis	Elazığ	36	8.3%	(12)
		Ankara	150	6%	(39)
	*Cheyletiella blakei**	Ankara	1	+	(47)
		"	8	+	(48)
		Elazığ	100	14%	(49)
		İstanbul	1	+	(50)
		Kırıkkale	2	+	(51)
Ticks	*Haemaphysalis otophila**	**	**	+	(56)
	*Ixodes ricinus**	**	**	+	(56)
	*Rhipicephalus sanguineus**	Elazığ	100	3%	(49)
Lice	*Felicola subrostratus*	Kocaeli	1	+	(52)
Fleas	*Ctenocephalides canis*	Elazığ	36	5.5%	(12)
		"	5	10%	(53)
		Antalya	23	1.06%	(54)
		İstanbul and Hatay	15	12%	(25)
		Hatay	50	36%	(55)
	Ctenocephalides felis	Ankara	100	9%	(17)
		Antalya	23	98.94%	(54)
		Elazığ	36	8.3%	(12)
		Elazığ	100	41%	(49)
		"	5	10.4%	(53)
		Hatay	50	64%	(55)
		İstanbul and Hatay	15	88%	(25)
	*Pulex irritans**	Elazığ	5	12%	(53)
	Xenopsylla cheopis	"	5	8.3%	(53)
Diptera	*Lucilia sericata** (1st stage larvae)	Aydın	1	+	(57)
	Lucilia sericata (2nd and 3rd stage larvae)	Konya	1	+	(58)
	Lucilia sericata (3rd stage larvae)	Afyon	1	+	(59)
		Konya	1	+	(60)
	*Phormia regina**	Samsun	3	+	(61)
Pentastomida	*Linguatula serrata** (nimf)	Elazığ	100	1%	(49)

Table 5. Protozoon species in cats

Protozoan species	City	Number of examined cats	Prevalence	Method	Reference
*Anaplasma phagocytophilum**	Tekirdağ	167	7.2%	PCR	(62)
*Anaplasma platys**	"	"	30.5%	"	(62)
*Babesia microti**	"	"	2.4%	"	(62)
Babesia canis canis	"	"	24%	"	(62)
Babesia felis	Van	120	10.8%	Blood smear	(63)
Cryptosporidium sp.*	Kırıkkale	100	1%	Flotation, Giemsa stain	(23)
	"	140	10.44%	Flotation, sedimentation, carbol-fuchsin stain	(19)
	Van	46	13.0%	Formol-ether sedimentation method	(64)
	Van	100	2.1%	PCR	(65)
*Cryptosporidium felis**	Kırıkkale	1	+	PCR	(66)
Cytauxzoon felis	Tekirdağ	167	6.6%	PCR	(62)
	Van	120	7.5%	Blood smear	(67)
Ehrlichia canis	Burdur	1	+	IFAT	(68)
Giardia cati	Ankara	100	4%	Giemsa stain, flotation	(17)
*Giardia duodenalis** (Sin.: *G. intestinalis*)	Burdur	1	+	ZnS04 centrifuge flotation method, Giemsa stain	(69)
	Central Anatolia region	102	68.6%	PCR	(70)
	Kayseri, Samsun	100	8%	PCR	(71)
Hepatozoon canis	Aydın	1	+	PCR	(72)
Hepatozoon felis	Tekirdağ	167	10.8%	PCR	(62)
Isospora sp.	Van	140	43.28%	Flotation, sedimentation, carbol-fuchsin stain	(19)
	"	51	19.61%	Flotation	(22)
	Kırıkkale	100	31%	Fecal examination	(23)
	Samsun	187	1.8%	Flotation	(34)
Isospora felis (Sin.: *Cystoisospora felis*)	Ankara	100	43%	Giemsa stain, flotation	(17)
	"	5	40%	Flotation	(36)
	Elazığ	36	5.5%	Sporulation	(12)
	"	100	20%	Parasitological examination	(49)
	"	3	+	Flotation	(74)
	İstanbul	212	18.9%	Flotation, sedimentation	(73)
Isospora rivolta	Ankara	100	21%	Giemsa stain, flotation	(17)
	İstanbul	212	2.8%	Flotation, sedimentation	(73)
	Elazığ	36	16.6%	Sporulation	(12)
	"	3	+	Flotation	(74)
Isospora bigemina	İstanbul	212	2.3%	Flotation, sedimentation	(73)

Table 5. continued

Protozoan species	City	Number of examined cats	Prevalence	Method	Reference
*Leishmania infantum**	Adana, Mersin	22	4.5%	PCR	(75)
	İzmir, Aydın, Muğla, Manisa	147	8.84%	PCR	(76)
	İzmir	1101	10.8% ELISA 15.2% IFAT	IFAT, ELISA	(77)
	İzmir	19	5.2%	IFAT, PCR	(78)
	Aydın	1	+	PCR	(79)
	Aydın, Muğla, İzmir, Manisa	386	2.3% PCR 15.6% IFAT	IFAT, PCR	(80)
Sarcocystis sp.	Ankara	100	8%	Giemsa stain, flotation	(17)
*Tritrichomonas foetus**	Samsun	100	0%	PCR	(81)
	Ankara	45	8.8%	PCR	(82)
	İstanbul	1	+	Giemsa stain	(83)
*Toxoplasma gondii**	Ankara	77	23.4%	SFDT	(84)
	"	300	0.3%	Necropsy, histopathology	(27)
	"	248	0.4%	Flotation	(86)
	"	2	+	Necropsy, histopathology	(87)
	"	65	43%	SFDT	(90)
	"	99	40.3% SFDT 34.3% IFAT	SFDT IFAT	(93)
	"	14	100%	USG, PCR, ELISA	(98)
	"	129	66.6%	SFDT	(101)
	"	2	+	ELISA	(102)
	Sivas	50	78%	IHA	(88)
	Kırıkkale	53	69.8%	IHA	(89)
	Elazığ	36	55.5%	SFDT	(91)
	Van	140	16.41%	Flotation, sedimentation, carbol-fuchsin stain	(19)
	"	62	8.06%	IFAT	(92)
	İzmir	1.121	34.2% IFAT 35.6% ELISA	IFAT, ELISA	(94)
	"	465	0.43%	ELISA, SFDT	(103)
	Kars	102	44.1%	SFDT	(95)
	Niğde	72	76.4%	SFDT	(96)
	Kırıkkale, Ankara	102	48.03%	PCR	(97)
	Kars	100	65%	SFDT	(99)
	İstanbul	26	42.3%	ELISA	(100)

+: Only case records are given, *: Zoonotic parasites,**: There is no information about this section in the references, ***: Prevalence rates calculated, ELISA: Enzyme-linked immunosorbent assay, IFAT: Indirect fluorescent antibody test, IHA: Indirect hem agglutination, PCR: Polymerase chain reaction, SFDT: Sabin-Feldman dye test, USG: Ultrasonography

CONCLUSION

To date, 68 parasite species have been reported in cats, including 13 ectoparasites, 33 helminths, and 22 protozoan species in Türkiye. Parasites and the diseases they cause are a point to be considered for public health since some have zoonotic properties (marked with an asterisk).

The most common parasites are *Dipylidium caninum* in Bursa and Elazığ; *Joyeuxiella pasqualei* in Konya and Hatay; *Toxocara* spp. in Ankara, and Hatay; *Toxascaris leonina* in Van, and İstanbul; *Giardia* spp. in Central Anatolia; *Isospora* spp. in Van, and Ankara; *Toxoplasma* sp. in Ankara, Sivas, Kırıkkale, and Kars were found to be high in provinces. As ectoparasitic, scabies agents and flea infestations were more common in Van, Antalya, İstanbul, and Hatay provinces. This evaluation does not have a meta-analysis feature and is based on reporting existing data.

Since there are veterinary faculties in all of the provinces with parasitic density, the research may have been concentrated in these regions. For this purpose, if it is desired to create a table throughout Türkiye, conducting studies in the regions outside these provinces will be important.

As a result, this review will facilitate the studies to be carried out to determine the parasitic fauna in cats in Türkiye and also to find the prevalence rates collectively. At the same time, by specifying the methods of parasite detection, it compares different results in different examination methods.

*** Ethics**

Peer-review: Internally peer-reviewed.

*** Authorship Contributions**

Concept: Ö.B., T.T., E.B.G.T., Ş.U., Design: Ö.B., T.T., E.B.G.T., Ş.U., Data Collection or Processing: Ö.B., T.T., E.B.G.T., Ş.U., Analysis or Interpretation: Ö.B., T.T., E.B.G.T., Ş.U., Literature Search: Ö.B., T.T., E.B.G.T., Ş.U., Writing: Ö.B., T.T., E.B.G.T., Ş.U.

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