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ORIGINAL PAPER

Ectoparasites of dogs and cats in Albania

Dashamir Xhaxhiu · Ilir Kusi · Dhimiter Rapti · Martin Visser · Martin Knaus · Thomas Lindner · Steffen Rehbein

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Abstract One hundred eighty-one dogs and 26 short-hair cats from suburban areas around Tirana, Albania were examined for ectoparasite infestation. The dogs were examined on several occasions from 2005 through 2009 representing three seasons: winter (December–February), spring (March–May), and summer (June–August); the cats were examined in late autumn (November). In addition, deep ear swab specimens of 30 dogs were examined for ear mites. The arthropod ectoparasite fauna of the dogs included two tick species (*Rhipicephalus sanguineus* and *Ixodes ricinus*), three mite species (*Sarcoptes scabiei* var. *canis*, *Otodectes cynotis*, and *Demodex canis*), three flea species (*Ctenocephalides canis*, *Ctenocephalides felis*, and *Pulex irritans*), and one louse species (*Trichodectes canis*). In the dogs, rates of infestation were 23.8% for *R. sanguineus*, 0.6% for *I. ricinus*, 4.4% for *S. scabiei* var. *canis*, 6.7% for *O. cynotis*, 0.6% for *D. canis*, 75.7% for *C. canis*, 5.0% for *C. felis*, 8.3% for *P. irritans*, and 6.6% for *T. canis*. Mixed infestation with two or three species of ectoparasites was recorded on 38.1% of the dogs. Fleas infested 75.7% dogs (geometric mean, 3.96; range, 1–80) and were observed in winter, spring, and summer with increasing prevalences of 64.3%, 75.9%, and 100%. Ticks parasitized 24.3% of the dogs (geometric mean, 0.41; range, 1–331). *R. sanguineus* ticks were recorded on 34.2% and 50% of the dogs examined in spring and summer, respectively, but were absent on the dogs during winter except for a single *I. ricinus* specimen observed. Prevalence of infestation with *R. sanguineus*, *S. scabiei* var. *canis*, *C. felis*, *P. irritans*, and *T. canis* did not differ between dogs ≤6 months and dogs >6 months of age; however, prevalence of infestation with *C. canis* was significantly ($p<0.01$) higher in dogs >6 months old. There was no difference between the sexes for the prevalences of infestation with those parasites. The examination of the cats revealed infestation with only one species of ectoparasite, *C. felis* (prevalence, 100%; geometric mean, 2.5; range, 1–9).

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Introduction

In many areas of the world, fleas (Siphonaptera) and hard ticks (Ixodidae) are considered the most common and most important external parasites infesting dogs and cats. Studying the species infesting ticks and fleas of dogs and cats is important for several reasons. Infestation with these ectoparasites can cause in considerable discomfort and dermatological reactions as they affect their hosts directly by feeding blood and cause dermatitis and other allergic reactions. Ticks, after mosquitoes, are the second most important arthropods that may transmit pathogens like viruses, bacteria including rickettsiae, protozoa, and filarial

nematodes to other animals and humans. While ticks are notorious as vectors of disease agents, fleas can also transmit pathogens, such as the agents of flea-born rickettsioses, and can serve as intermediate hosts of some species of cestodes.

Different species of ticks and fleas may infest dogs and cats in different geographical regions. These geographical differences may influence the risk of arthropod-borne disease agents and parasite transmission, not only between animals but also between animals and humans, and they may have implications for the measures used to control these ectoparasites.

Scarce information is available on the parasites of dogs from Albania, and in most cases, it dates back to papers published in the 1960s and 1970s (Moskvin 1958; Danielova 1960; Prokopič 1960; Rosický and Gjini 1960; Rosický et al. 1960; Luli 1963; Gina 1973; Gina and Kastrati 1974; Gina et al. 1975; Adhami and Murati 1977), except for some recent reports on canine arthropod-borne diseases, and in particular leishmaniosis, because of its association to human visceral leishmaniosis (Kero and Xinxho 1998; Cicko et al. 1999; Sotira 2000; Cani et al. 2001; Dhamo et al. 2006; Lazri et al. 2008).

As the ectoparasites of dogs in Albania were not studied since the 1970s, this paper reports the results of the identification of arthropod parasites collected from dogs and cats in Tirana, Albania from 2005 through 2009.

Materials and methods

In total, 181 dogs (179 mixed breed dogs, one Pitbull cross, and one German shepherd; 71 males, one male castrated, 109 females; approximately 2 months to 10 years old: 111≤6 months, 70>6 months), and 26 short-hair cats (ten males, 16 females; approximately 3 months to 8 years old) from suburban areas of Tirana were examined for ectoparasite infestation at the Institute of Veterinary Research Tirana, the Veterinary Faculty of the Tirana Agricultural University, or a private small animal veterinary practice in Tirana. The dogs were examined on several occasions which were blocked to three seasons: winter (December–February), 70 dogs; spring (March–May), 79 dogs; and summer (June–August), 32 dogs; the cats were examined in late autumn (November).

The animals were examined for ectoparasite infestation by a body search, and the whole body was combed with a stainless steel fine-toothed flea comb (Zakson et al. 1995). Ticks were manually removed and collected together with any fleas and lice in the comb. For the 32 dogs examined in the summer season, the ectoparasite load for ticks and fleas was determined by a whole body comb; however, only up to five specimens each of ticks and fleas were collected for identification from the dogs. The ticks, fleas, and lice removed from the animals were stored in 70% ethanol until they were identified. When lesions suspicious of mite infestation (characterized by scaling, scores, dermal encrustations, and hair loss) were observed during the body search, scrapings were taken from the altered skin.

Deep ear swab specimens were obtained from both ears from 30 of the 70 dogs sampled during the winter season and examined for the presence of ear mites.

For identification and determination of sex using a binocular microscope, the ticks, fleas, and lice were cleared in 10% potassium hydroxide. Skin scrapings and ear swabs were placed in 10% potassium hydroxide and gently heated to macerate scales, crusts, and hair or aural material. Thereafter, the material was centrifuged, and the sediment was microscopically examined for mites.

Ectoparasites were identified using descriptions and/or keys (Jancke 1938; Peus 1938; Babos 1964; Hiepe and Ribbeck 1982; Estrada-Peña et al. 2004).

The following parasitological parameters were evaluated: percentage prevalence (proportion of hosts infested with an ectoparasite taxon), intensity (arithmetic mean count of ectoparasites of a taxon on infested hosts), and abundance (geometric mean count of ectoparasites of a taxon on examined hosts; Bush et al. 1997). Chi-squared tests were used to compare the prevalence of ectoparasite infestation between the dogs' ages and sexes. To determine significant association for seasonality of collection and infestation rates for dogs, chi-squared test for 3×2 contingency table was used. Ectoparasite intensity was compared using the Mann–Whitney *U* test for two independent groups and the Kruskal–Wallis test for multiple comparisons.

Results

Total prevalence and intensity of external parasite infestation recorded by body search including whole body comb and examination of skin scrapings from suspicious skin areas are given in Table 1. Using these techniques, arthropod ectoparasites were found on 143 dogs (79.0%) and 26 cats (100%). Two species each of ticks, *Rhipicephalus sanguineus* (adults and nymphs) and *Ixodes ricinus* (one adult female); and mites, *Sarcoptes scabiei* var. *canis* and *Demodex canis*; three species of fleas, namely *Ctenocephalides canis*, *Ctenocephalides felis*, and *Pulex irritans*; and one biting louse, *Trichodectes canis*, were identified on the dogs. Only one species of flea, *C. felis*, was recorded on the cats.

In addition, examination of ear swabs obtained from 30 dogs during the winter season revealed the presence of ear mites, *Otodectes cynotis*, in two dogs which did not carry any other ectoparasite.

The most common ectoparasites were fleas which were recorded on 137 dogs (75.7%) and on all cats, with total

Table 1 Prevalence and intensity of ectoparasite species on dogs and cats with either single or mixed-species infestation

	Body search including whole body comb and examination of skin scrapings					
	Dogs (n=181)			Cats (n=26)		
	Prevalence total (%)	Intensity, AM (range)[a]	Abundance, GM[b]	Prevalence total (%)	Intensity, AM (range)	Abundance GM
R. sanguineus	43 (23.8)	–	–	–	–	–
I. ricinus	1 (0.6)	–	–	–	–	–
Total ticks	44 (24.3)	11.5 (1–331)	0.41	–	–	–
S. scabiei var. *canis*	8 (4.4)	–	–	–	–	–
D. canis	1 (0.6)	–	–	–	–	–
C. canis	137 (75.7)	–	–	–	–	–
C. felis	9 (5.0)	–	–	26 (100)	–	–
P. irritans	15 (8.3)	–	–	–	–	–
Total fleas	137 (75.7)	12.0 (1–80)	3.96	26 (100)	2.9 (1–9)	2.5
T. canis	12 (6.6)	–	–	–	–	–

AM arithmetic mean, *GM* geometric mean

[a] Infested animals

[b] All animals

individual flea counts ranging from one to 80 in the dogs and from one to nine in the cats. In the dogs, *C. canis* was the predominant species identified on any flea-infested dog, while *C. felis* and *P. irritans* were recorded occasionally only as single specimens and concurrently with *C. canis*. Apart from one dog carrying 331 *R. sanguineus* ticks, individual tick counts ranged from one to 18.

A total of 69 (38.1%) dogs were infested with two (29.8%) or three (8.3%) species of ectoparasites. *R. sanguineus* plus *C. canis* infestation was the most common combination (Table 2).

Rates of infestation with *R. sanguineus*, *S. scabiei* var. *canis*, *C. felis*, *P. irritans*, and *T. canis* was not different ($p>0.1$) between dogs ≤6 months and dogs >6 months of age; however, the rate of infestation with *C. canis* was significantly ($p<0.01$) higher in dogs >6 months old. There was no difference ($p>0.1$) between the sexes for the rates of infestation with those parasites (Table 3).

Testing *R. sanguineus* and total flea counts vs host age revealed no difference ($p=0.686$) for ticks between dogs ≤6 months and dogs >6 months of age (geometric mean tick counts 0.41 and 0.40, respectively), while the older dogs carried significantly ($p<0.0001$) more fleas than the younger ones (geometric mean flea counts 7.48 and 2.54, respectively). There was no difference in the male and female dogs' *R. sanguineus* counts (all dogs: $p=0.281$, geometric mean tick counts 0.52 and 0.33, respectively; dogs >6 months: $p=0.207$, geometric mean tick counts 0.52 and 0.31, respectively) and total flea burdens (all dogs: $p=0.636$, geometric mean flea counts 3.70 and 4.15, respectively; dogs >6 months: $p=0.750$, geometric mean flea counts 7.31 and 7.65, respectively).

The seasonality of the ectoparasites infesting the dogs in Tirana is given in Table 4. Infestation rates for *R. sanguineus* and fleas showed a significant variation among seasons of collection ($p<0.001$). *R. sanguineus* ticks were recorded on 34.2% and 50% of the dogs examined in spring and summer, respectively, but they were absent in winter. Flea infestation, however, was observed in winter, spring, and summer with increasing prevalences of 64.3%, 75.9%, and 100%, respectively (Fig. 1).

Using the score described by Marchiondo et al. (2007), approximately two thirds of the *R. sanguineus* infested dogs carried a low level infestation of up to three ticks, and the tick load of one sixth each of the dogs was moderate (four to ten ticks/animal) or high (>10 ticks/animal). Using the score described by Marchiondo et al. (2007) to categorize the infestation level of fleas on dogs and cats, 42.4% of the dogs carried a low level infestation of up to five fleas each, and the infestation level was moderate (six to 20 fleas/animal) and high (>20 fleas/animal) in 37.2% and 20.4% of the dogs, respectively. Nearly 90% of the cats carried a low level flea infestation, and the remaining cats showed a moderate level of infestation. For the dogs, infestation level scores for *R. sanguineus* and fleas in relation to season are shown in Table 5 and Fig. 2. Similarly to prevalence, geometric mean *R. sanguineus* and flea counts of the dogs varied significantly between seasons (Table 6).

A total of 956 fleas were collected from the dogs and cats examined in winter plus spring or autumn, respectively.

Table 2 Occurrence of mixed ectoparasite infestations in the dogs from Tirana (n=181)

Mixed-species ectoparasite infestation	Prevalence, total (%) [69 (38.1)]
Three species	
R. sanguineus+*D. canis*+*C. canis*	1 (0.6)
R. sanguineus+*C. canis*+*C. felis*	4 (2.2)
R. sanguineus+*C. canis*+*P. irritans*	3 (1.7)
R. sanguineus+*C. canis*+*T. canis*	3 (1.7)
S. scabiei var. *canis*+*C. canis*+*T. canis*	1 (0.6)
C. canis+*C. felis*+*P. irritans*	1 (0.6)
C. canis+*C. felis*+*T. canis*	1 (0.6)
C. canis+*P. irritans*+*T. canis*	1 (0.6)
Two species	
R. sanguineus+*C. canis*	28 (15.5)
I. ricinus+*C. canis*	1 (0.7)
S. scabiei var. *canis*+*C. canis*	6 (3.3)
C. canis+*C. felis*	4 (2.2)
C. canis+*P. irritans*	9 (5.0)
C. canis+*T. canis*	6 (3.3)

Sex ratios of the three flea species were female-biased (Table 7).

Discussion

In the dogs and cats from Tirana, nine species of arthropod ectoparasites were identified. All of them represent common parasites of canines and felines in many areas of the world, but only *R. sanguineus*, *I. ricinus*, *C. canis*, and *P. irritans* had been previously recorded on dogs in Albania (Rosický and Gjini 1960; Rosický et al. 1960; Luli 1963; Gina 1973; Gina and Kastrati 1974; Gina et al. 1975). During a parasite survey conducted by researchers from the former Czechoslovak Academy of Sciences 1958 in Albania (Rosický 1958, 1960), *Hippobosca equina* was collected from a dog in Shkodër (Danielova 1960).

In Albania, 14 species of ixodid ticks belonging to the genera *Ixodes*, *Dermacentor*, *Haemaphysalis*, *Hyalomma*, *Rhipicephalus* (*Rhipicephalus*), and *Rhipicephalus* (*Boophilus*) were recorded in the past parasitizing cattle, water buffalo, sheep, goats, horses, donkeys, dogs, rodents, wild birds, and/or reptiles (Enigk 1947; Černý and Rosický 1960; Rosický et al. 1960; Luli 1963; Gina 1973, 1983; Gina and Kastrati 1974; Gina et al. 1975; Zanaj et al. 2002) or collected from the vegetation (Christova et al. 2003; Lika and Bërxholi 2004). In addition, the description of fowl spirochetosis in Albania (Carpano 1938) suggests the presence of the vector, argasid ticks. *R. sanguineus* and *I. ricinus* have been found on dogs in Albania in earlier surveys: *R. sanguineus* on dogs in Tirana and in the districts of Shkodër and Saranda and *I. ricinus* on dogs in the city and district of Tirana (Rosický et al. 1960; Luli 1963; Gina 1973; Gina and Kastrati 1974).

Table 3 Prevalence of ectoparasite infestation in relation to age and sex of the dogs (n=181)

Ectoparasite	Prevalence, total (%)					
	Age		Significance (chi-square test; p)	Sex[a]		Significance (chi-square test; p)
	≤6months (n=111)	>6months (n=70)		Male (n=71)	Female (n=109)	
R. sanguineus	25 (22.5)	18 (25.7)	>0.1	19 (26.8)	23 (21.1)	>0.1
S. scabiei var. *canis*	7 (6.3)	1 (1.4)	>0.1	3 (4.2)	5 (4.6)	>0.1
C. canis	75 (67.6)	62 (88.6)	<0.01	51 (71.8)	85 (78.0)	>0.1
C. felis	5 (4.5)	4 (5.7)	>0.1	5 (7.0)	4 (3.7)	>0.1
P. irritans	10 (9.0)	5 (7.1)	>0.1	3 (4.2)	12 (11.0)	>0.1
T. canis	9 (8.1)	3 (4.3)	>0.1	5 (7.0)	6 (5.5)	>0.1

[a] One male castrated dog excluded from analysis

Table 4 Seasonal occurrence of ectoparasites on dogs

Season (number of dogs examined)	Dogs infested with different parasites, total (%)						
	R. sanguineus	*S. scabiei* var. *canis*	*C. canis*	*C. felis*	*P. irritans*	Total fleas	*T. canis*
Winter (n=70)	0	6 (8.6)	45 (64.3)	3 (4.3)	7 (10.0)	45 (64.3)	3 (4.3)
Spring (n=79)	27 (34.2)	1 (1.3)	60 (75.9)	2 (2.5)	8 (10.1)	60 (75.9)	1 (1.3)
Summer (n=32)	16 (50)	1 (3.1)	32 (100)	4 (12.5)	0	32 (100)	8 (25.0)

R. sanguineus, a three-host tick with endophilous behavior, is a typical representative of the ixodid tick fauna of the Mediterranean basin area. This species, as well as the exophilous, a more cold-tolerant but desiccation-vulnerable *I. ricinus*, have been recorded on dogs and ungulates in several countries of the southern Balkan peninsula apart from Albania: Greece (Enigk 1947; Papadopoulos et al. 1996; Jensen 2003; Papazahariadou et al. 2003; Pavlidou et al. 2008), the former Yugoslav Macedonia (Schulze 1918; Oswald 1938; Angelovskii 1957), Kosovo (Mekuli 1959; Heneberg et al. 1968; Milutinović et al. 1997; Fournier et al. 2003), Montenegro (Petroviћ and Borђoški 1955; Tomaševiћ 1962), Serbia (Kulisic et al. 2000; Milutinović and Radulović 2002; Pavlović et al. 2002), Bosnia and Herzegovina (Omeragić et al. 2003; Omeragić 2008), and littoral Croatia (Cvetanović 1956; Mikačić 1965; Tovornik and Vesenjak-Hirjan 1988, 1989). These ticks can feed on a wide range of hosts; however, all stages of *R. sanguineus* are primarily associated with dogs (Dantas-Torres 2008). Cases of human parasitism by *R. sanguineus* and *I. ricinus* have been reported from southeastern Europe too, i.e., from Bosnia and Herzegovina, Kosovo, and Greece (Fournier et al. 2003; Omeragić 2008; Chaligiannis et al. 2009). Both *R. sanguineus* and *I. ricinus* have been implicated as vectors for a range of pathogens in Europe with some of them causing zoonoses with the potential to cause considerable public health problems (Estrada-Peña and Jongejan 1999; Shaw et al. 2001; Parola 2004; Parola et al. 2005; Brouqui et al. 2007; Rovery et al. 2008). The presence of several of those tick-borne disease agents in Albania has been proven through serological surveys or direct detection of the antigens in hosts or ticks, e.g., tick-borne encephalitis and Mediterranean spotted fever (Bárdoš et al. 1959; Gina et al. 1986; Eltari et al. 1993; Berxholi et al. 1995; Christova et al. 2003), granulocytic anaplasmosis, canine monocytic ehrlichiosis, babesiosis, and hepatozoonosis (Christova et al. 2003; Petrovec et al. 2003; Dhamo et al. 2006; Hamel et al. 2008; Lazri et al. 2008).

The tick numbers observed on the dogs from Tirana were consistent with the *R. sanguineus* counts reported from Greece, including the reporting of rare cases of infestation with several hundreds of ticks (Papadopoulos et al. 1996; Papazahariadou et al. 2003).

Although our sampling allows only limited conclusions as to the seasonality of tick infestation, comparable to observations in previous studies from Albania (Luli 1963; Gina 1973), littoral Croatia (Cvetanović 1956; Mikačić 1965), Bosnia and Herzegovina (Omeragić 2008), and Greece (Papadopoulos et al. 1996; Pavlidou et al. 2008), *R. sanguineus* was present in spring and summer with increasing prevalence and absent in winter when *I. ricinus* was seen. A similar seasonal pattern of the two species of ticks has been reported from central Italy (Stella et al. 1988; Principato et al. 1989).

Not surprisingly, no ticks were found on the cats which originated from the same area as the dogs but were examined in November. In general, the domestic cat belongs to the range of hosts which is rarely parasitized

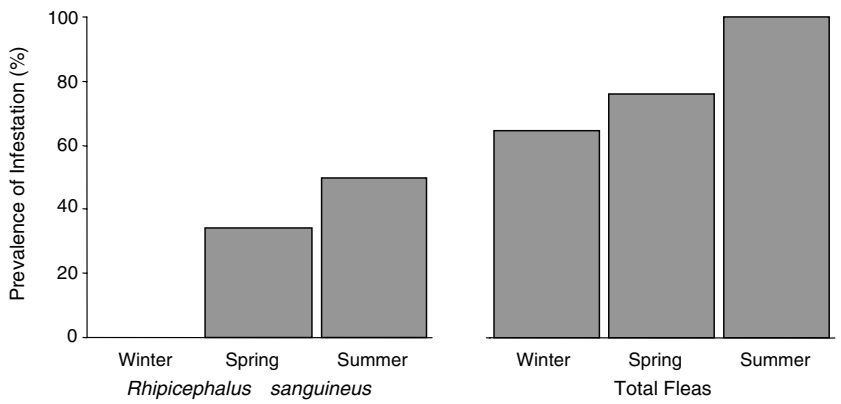

Fig. 1 Prevalence of *Rhipicephalus sanguineus* and flea infestation of dogs in Tirana

Table 5 Infestation intensity of *Rhipicephalus sanguineus* and fleas on dogs in relation to season

Season (number of dogs examined)	Prevalence of infestation level according to Marchiondo et al. (2007), total (%)							
	Rhipicephalus sanguineus				Fleas			
	0	Low (1–3)	Moderate (4–10)	High (>10)	0	Low (1–5)	Moderate (6–20)	High (>20)
Winter (n=70)	70 (100)	0	0	0	25 (35.7)	23 (32.9)	16 (22.9)	6 (8.6)
Spring (n=79)	52 (65.8)	19 (24.0)	7 (8.9)	1 (1.3)	19 (24.1)	35 (44.3)	22 (27.8)	3 (3.8)
Summer (n=32)	16 (50)	10 (31.3)	0	6 (18.7)	0	0	13 (40.6)	19 (59.4)

by *R. sanguineus*, especially in the presence of dogs (Dantas-Torres 2008). However, cases of parasitism have been recorded in Italy (Sobrero and Manilla 1988; Manfredi et al. 1999). To the best of our knowledge, there is no specific data regarding infestation of cats with ticks from the Balkan countries. In western Europe and Hungary, however, cats were reported parasitized by *I. ricinus* (predominating species), *Ixodes hexagonus*, and *Ixodes canisuga*, including cases of *R. sanguineus* parasitism of cats in Spain and France (Liebisch et al. 1985; Supperer and Hinaidy 1986; Cornely and Schultz 1992; Raschka et al. 1994; Farkas and Földvári 2001; Larsen et al. 2001; Losson et al. 2003; Zenner and Drevon 2003; Asensi 2007; Nijhof et al. 2007).

In contrast to the infestation with ticks, the flea fauna of domestic animals in the countries of southern part of the Balkan peninsula is much less well documented. *C. canis* and *P. irritans* were observed on dogs and *P. irritans* on goats in Albania (Rosický and Gjini 1960). An earlier paper from the former Yugoslavia (Wagner 1939) reported the frequent occurrence of *C. canis* and *C. felis* on dogs and cats, respectively, and also mentioned the occasional occurrence of *C. felis* on dogs. In Bosnia and Herzegovina, *C. canis* was identified on dogs and *C. felis* on cats

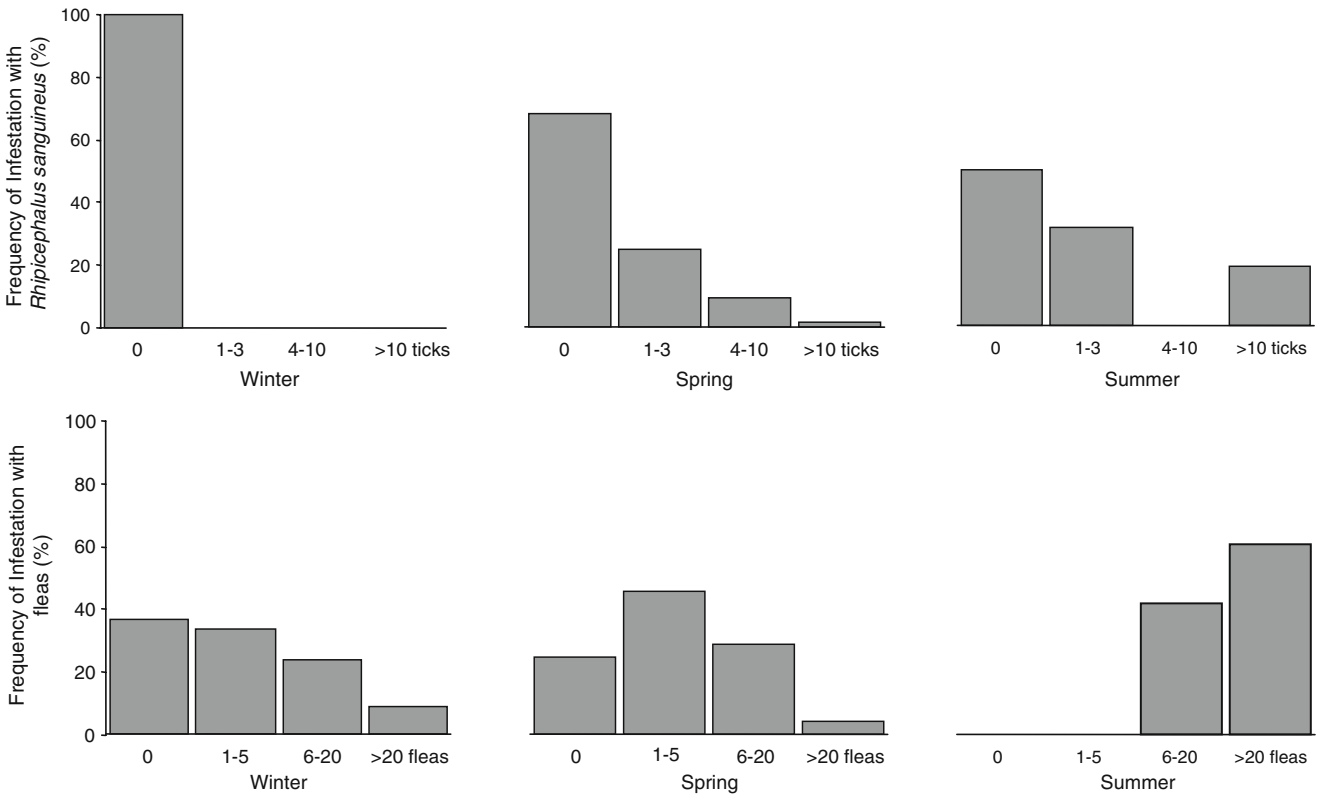

Fig. 2 Levels of infestation with *Rhipicephalus sanguineus* and fleas of dogs according to the score described by Marchiondo et al. (2007)

Table 6 Abundance of *Rhipicephalus sanguineus* and fleas on dogs in relation to season

Parasite	Season	Infestation			Significance (Kruskal–Wallis test; p)
		Prevalence	Range	Abundance (geometric mean)	
Rhipicephalus sanguineus	Winter	0%	–	0a	<0.0001
	Spring	34.2%	0–15	0.53b	
	Summer	50%	0–331	1.40b	
Fleas	Winter	64.3%	0–80	2.49a	<0.0001
	Spring	75.9%	0–37	2.70a	
	Summer	100%	8–62	21.28b	

Values with different letters were significantly different at $p<0.05$

(Omeragić et al. 2003). In a recent study from western Romania, the most common flea in both dogs and cats was *C. felis*, followed by *C. canis* and *P. irritans* (Morariu et al. 2006). Examination of dogs and cats in Greece revealed the presence of four species of fleas: *C. canis*, *C. felis*, *P. irritans*, and *Xenopsylla cheopis* were recorded on dogs and *C. felis* and *C. canis* on cats (one case of a mixed infestation; Haralampides 1978; Koutinas et al. 1995; Christodoulopoulos et al. 2006). Despite being not as prominent as in the dogs from Tirana, *C. canis* was more prevalent than *C. felis* in the dogs examined in Greece. Although still not well understood, our findings support observations from several regions throughout Europe and elsewhere that the higher frequency of *C. canis* is usually associated with inhabiting rural settings, living in kennels, or being kept outdoors, in contrast to dogs from residential habitats. Thus, the prevalence rate may be less dependent upon the general climatic conditions than upon habitats (Piotrowski and Połomska 1975; Haarløv and Kristensen 1977; Kristensen et al. 1978; Müller and Kutschmann 1985; Müller 1986; Koutinas et al. 1995; Rudzińska and Sulgostowska 1996; Alcaíno et al. 2002; Durden et al. 2005; Gracia et al. 2008).

While *X. cheopis* and *P. irritans* were collected just from one dog each by Koutinas et al. (1995), the latter species was observed more frequently than *C. canis* by Christodoulopoulos et al. (2006) who examined dogs in 64 farms in central and southern Greece that had a history of *P. irritans* infestation in their goats (Christodoulopoulos and Theodoropoulos 2003). *P. irritans* has the potential to cause severe infestations in dogs and man (Gracia et al. 2000; Knoppe et al. 2003). Although occurring in small numbers only, *P. irritans* was the second most prevalent species of flea on the dogs from Tirana recovered from 8.3% of all dogs examined or 10.9% of the flea-positive dogs. *P. irritans* infestation was, therefore, higher than the findings reported in most other surveys in Europe where this flea was recorded (Haarløv and Kristensen 1977; Kristensen et al. 1978; Müller and Kutschmann 1985; Müller 1986; Hinaidy 1991; Koutinas et al. 1995; Beck et al. 2006; Morariu et al. 2006; Bond et al. 2007; Gracia et al. 2008) apart from the prevalences reported by Baker and Hatch (1972) in Ireland (24%), Piotrowski and Połomska (1975) in Poland (22%), and by Christodoulopoulos et al. (2006) who examined dogs in farms with a history of *P. irritans* infestation in their goats in Greece (40.7%).

The mean flea burden of the dogs from Tirana was comparable to the flea load reported in a study from Poland (Piotrowski and Połomska 1975) but higher than the densities observed in surveys of dogs in Denmark, Germany, and France (Haarløv and Kristensen 1977; Müller and Kutschmann 1985; Bourdeau and Blumstein 1995; Franc et al. 1998; Beck et al. 2006; Gilles et al. 2008a, b).

Similar to other studies from southern regions of Europe with a milder, warmer climate (Koutinas et al. 1995; Rinaldi et al. 2007; Gracia et al. 2008), our data from Albania indicate flea infestations of dogs occurring year

Table 7 Fleas recovered from the dogs ($n=149$) and cats ($n=26$) during winter plus spring or autumn, respectively

	Total number of fleas collected (male, female)	Percentage of total	Sex ratio: male/female
Dogs			
C. canis	859 (199, 660)	97.6	1/3.32
C. felis	5 (2, 3)	0.6	1/1.50
P. irritans	16 (7, 9)	1.8	1/1.29
Cats			
C. felis	76 (26, 50)	100	1/1.92

round. However, as observed more distinctly in European regions with temperate climates (Piotrowski and Połomska 1975; Rudzińska and Sulgostowska 1996; Beck et al. 2006), phenology of prevalence and intensity of flea infestation seem to be correlated to the seasonality of environmental conditions.

Consistent with all prior reports of feline pulicosis, the species of flea most abundant by far throughout Europe irrespective of the history of the cats or environmental conditions was the cat flea, *C. felis*, while the other species observed (i.e., *Archaepsylla erinacei*, *Ceratophyllus gallinae*, *Ceratophyllus garei*, *C. canis*, *Ctenophthalmus assimilis*, *Hystrichopsylla talpae*, *Monopsyllus sciurorum*, *Nosopsyllus fasciatus*, *P. irritans*, *Spilopsyllus cuniculi*, *Typhloceras poppei*, and *X. cheopis*) were recorded much less frequently (Niak 1972; Beresford-Jones 1974, 1981; Haarløv and Kristensen 1977; Haralampides 1978; Kristensen et al. 1978; Liebisch et al. 1985; Kral 1986; Supperer and Hinaidy 1986; Zarzèrè 1988; Canestri Trotti et al. 1990; Hinaidy 1991; Kalvelage and Münster 1991; Raschka et al. 1994; Bourdeau and Blumstein 1995; Chesney 1995; Koutinas et al. 1995; Wall et al. 1997; Clark 1999; Cadiergues et al. 2000; Visser et al. 2001; Beck et al. 2006; Morariu et al. 2006; Asensi 2007; Bond et al. 2007; Gilles et al. 2008a, b).

The mean flea burden of the cats from Tirana was comparable to the mean flea load reported in recent surveys of cats in France and Germany (Cadiergues et al. 2000; Beck et al. 2006; Gilles et al. 2008a, b).

The female-biased sex ratio in the flea species parasitizing dogs and cats observed in this study is a common feature which has been observed in numerous other surveys (e.g., Piotrowski and Połomska 1975; Müller 1986; Hinaidy 1991; Bourdeau and Blumstein 1995; Chesney 1995; Rudzińska and Sulgostowska 1996; Franc et al. 1998; Alcaíno et al. 2002; Durden et al. 2005; Rinaldi et al. 2007).

While both ticks and fleas on dogs and cats received significant attention for several reasons in the recent years, much less is known about the prevalence of other canine and feline ectoparasites in general. Based on a review of the available data on the epidemiology of ectoparasites of dogs and cats in Europe, it was concluded that the countries "of the Balkan peninsula are the most poorly covered" (Piotrowski 1979). Apart from the studies on ticks and fleas mentioned before, only a few other papers reporting about other ectoparasitic infestations of dogs and cats in Greece, Bosnia and Herzegovina, Croatia, Slovenia, and Romania have been published (e.g., Haralampides 1978; Sabolić 1997; Sotiraki et al. 2001; Omeragić et al. 2003; Dărăbuş 2003; Rataj et al. 2004), which emphasizes the need for more surveys in order to address this lack of basic epidemiological information.

Documentation of parasite fauna through survey and inventory is the first step in defining the relationship of endemic parasites and their potential and real impact on domestic animals and humans. The present results, including the implications of transmission of pathogens by ticks and fleas, suggest that further studies should be conducted in Albania, especially to estimate the potential risk of relevant arthropod-borne diseases.

References

Adhami J, Murati N (1977) Leishmanioza e qenit dhe rezervuari i leishmaniozës viscerale në vendin tonë. Buletini i Shkencave Mjekësore 17(4):69–74

Alcaíno HA, Gorman TR, Alcaíno R (2002) Flea species from dogs in three cities of Chile. Vet Parasitol 105:261–265

Angelovskii T (1957) Prilog poznavaњu piroplazmoza u NR Makedoniji. Acta Vet (Beogr) 7:91–100

Asensi GD (2007) Parasitofauna del gato doméstico (*Felis catus*) en el municipio de Murcia. Repertorio de Tesis Doctorales 2007, Univ Murcia, p 129

Babos S (1964) Die Zeckenfauna Mitteleuropas. Akadémiai Kiadó, Budapest

Baker KP, Hatch C (1972) The species of fleas found on Dublin dogs. Vet Rec 91:151–152

Bárdoš V, Adamcová V, Dedei S, Gjini N, Rosický B, Šimková A (1959) Neutralizing antibodies against some neurotropic viruses determined in human sera in Albania. J Hyg Epidemiol Microbiol Imunol 3:277–282

Beck W, Boch K, Mackensen H, Wiegand B, Pfister K (2006) Qualitative and quantitative observations on the flea population dynamics of dogs and cats in several areas of Germany. Vet Parasitol 137:130–136

Beresford-Jones W-P (1974) The fleas *Ctenocephalides felis felis* (Bouché 1833), *Ctenocephalides canis* (Curtis, 1826), and the mite *Cheyletiella* (Canestrini, 1886) in the dog and cat: their transmissibility to humans. In: Soulsby EJL (ed) Parasitic Zoonoses. Clinical and experimental studies. Academic, London, pp 383–390

Beresford-Jones W-P (1981) Prevalence of fleas on dogs and cats in an area of central London. J Small Anim Pract 22:27–29

Berxholi K, Byku B, Kießig ST, Süss J (1995) Einige Daten zur Epidemiologie der Früsommer-Meningoenzephalitis sowie zum Nachweis des Hantaan- und des Krim-Kongo-Virus in Albanien. In: Süss J (ed) Durch Zecken übertragene Erkrankungen: FSME und Lyme-Borreliose. WissenschaftsVerl. A. Weller, Schriesheim, pp 33–36

Bond R, Riddle A, Mottram L, Beugnet F, Stevenson R (2007) Survey of flea infestation in dogs and cats in the United Kingdom during 2005. Vet Rec 160:503–506

Bourdeau P, Blumstein P (1995) Flea infestation and *Ctenocephalides felis* in the dog and the cat: parasitological, biological and immunological aspects in the west of France. Ann Congr Eur Soc Vet Dermatol, 01–03 Sept 1995, Barcelona, Spain, Proc, pp 1–6

Brouqui P, Parola P, Fournier PE, Raoult D (2007) Spotted fever rickettsioses in southern and eastern Europe. FEMS Immunol Med Microbiol 49:2–12

Bush AO, Lafferty KD, Lotz JM, Shostak AW (1997) Parasitology meets ecology on its own terms: Margolis et al., revisited. J Parasitol 83:45–52

Canestri Trotti G, Corradini L, Visconti S (1990) Indagine parassitologia in un rifugio per gatti a Ferrara. Parassitologia 32 (Suppl. 1):42–43

Cani E, Myrseli T, Petrela R, Minarolli P, Pano K (2001) Leishmanioza visherali—zoonoze me rrezik potenzial në Shqipëri. Rev Vet (Tirana) 5:81–92

Cadiergues MC, Deloffre P, Franc M (2000) Répartition des espèces de puces rencontrées chez le chat en France. Rev Med Vet 151:447–450

Carpano M (1938) Spirochetosi dei volatili in Albania ciclo degli spirocheti negli invertebrati ematofagi trasmettitori. Riv Parassitol 2:165–182

Černý V, Rosický B (1960) *Ixodes candavius*, a new tick species from Albania. Ceskoslov Parasitol 7:17–19

Chaligiannis I, Sotiraki S, Xanthopoulou K, Papa A (2009) Ticks parasitizing humans in North-east Greece. 7th Ann Meet Eur Vet Parasitol Coll & 10th Bienn Symp Ectoparasites in Pets (ISEP), 03–05 June 2009, Toulouse, France, Proc, p 76

Chesney CJ (1995) Species of flea found on cats and dogs in south west England: further evidence of their polyxenous state and implications for flea control. Vet Rec 136:356–358

Christodoulopoulos G, Theodoropoulos G (2003) Infestation of dairy goats with the human flea, *Pulex irritans*, in central Greece. Vet Rec 152:371–372

Christodoulopoulos G, Theodoropoulos G, Kominakis A, Theis JH (2006) Biological, seasonal and environmental factors associated with *Pulex irritans* infestation of dairy goats in Greece. Vet Parasitol 137:137–143

Christova I, Jvd P, Velo E, Schouls L (2003) Identification of *Borrelia burgdorferi* sensu lato, *Anaplasma* und *Ehrlichia* species, and spotted fever group rickettsiae in ticks from Southeastern Europe. Eur J Clin Microbiol Infect Dis 22:535–542

Cicko Z, Zanaj S, Kusi I, Cani E (1999) Kërkime mbi leishmaniozën kanine në Shqipëri. Buletini i Shkencave Bujqësore 3:109–113

Clark F (1999) Prevalence of the cat flea *Ctenocephalides felis* and oocyte development during autumn and winter in Leicester City, UK. Med Vet Entomol 13:217–218

Cornely M, Schultz U (1992) Zur Zeckenfauna Ostdeutschlands. Angew Parasitol 33:173–183

Cvetanović V (1956) O vrstama, rasprostranjenosti i sezonskom javljanju krpelja u Dalmaciji sosvrtom na javljanje tick-paralize. Veterinaria (Sarajevo) 5:589–595

Danielova V (1960) Krovososuŝie dvukrylye (Fam. Tabanidae, Hippoboscidae, Hypodermatidae) iz sborov èkspedicii ČSAN v Albanii. Ceskoslov Parasitol 7:37–40 in Russian

Dantas-Torres F (2008) The brown dog tick, *Rhipicephalus sanguineus* (Latreille, 1806) (Acari: Ixodidae): from taxonomy to control. Vet Parasitol 152:173–185

Dărăbuş G (2003) Incidenţa dermatomicozelor şi a altor afecţiuni cutanate, la câine şi pisică, în vestul României. Rev Sci Parasitol 3:9–13

Dhamo G, Rapti D, Bizhga B, Llazari A (2006) Kërkime hematologjike paraprake mbi babezionën e qenve. Rev. Shqiptare e Shkencave Bujqësore 5(8):115–119

Durden LA, Judy TN, Martin JE, Spedding LS (2005) Fleas parasitizing domestic dogs in Georgia, USA: species composition and seasonal abundance. Vet Parasitol 130:157–162

Eltari E, Gina A, Bitri T, Sharofi F (1993) Some data on arboviruses, especially tick-borne encephalitis, in Albania. Giorn Malattie Infett Parassit 45:404–411

Enigk K (1947) Zur Kenntnis der Zeckenfauna von Süd- und Osteuropa. Monatsh Veterinarmed 2:75–81

Estrada-Peña A, Jongejan F (1999) Ticks feeding on humans: a review of records on human-biting Ixodoidea with special reference to pathogen transmission. Exp Appl Acaraol 23:675–715

Estrada-Peña A, Bouattour A, Camicas J-L, Walzer AR (2004) Ticks of domestic animals in the Mediterranean region. A guide to identification of species. University of Zaragoza, Zaragoza

Farkas R, Földvári G (2001) A kutyák és a macskák kullancsosságának hazai vizsgálata. Magyar Allat Lapja 123:534–539

Fournier P-E, Durand J-P, Rolain J-M, Camicas J-L, Tolou H, Raoult D (2003) Detection of Astrakhan fever rickettsia from ticks in Kosovo. Ann New York Acad Sci 990:158–161

Franc M, Choquart P, Cadiergues MC (1998) Répartition des espèces de puces rencontrées chez le chien en France. Rev Méd Vét 149:135–140

Gilles J, Just FT, Silaghi C, Pradel I, Lengauer H, Hellmann K, Pfister K (2008a) *Rickettsia felis* in fleas, France. Emerg Infect Dis 14:684–686

Gilles J, Just FT, Silaghi C, Pradel I, Passos LMF, Lengauer H, Hellmann K, Pfister K (2008b) *Rickettsia felis* in fleas, Germany. Emerg Infect Dis 14:1294–1296

Gina A (1973) Të dhëna faunistike mbi rriqnat e familjes Ixodidae në rrethin e Tiranës. Buletini i Shkencave te Natyrës 2(3/4):73–86

Gina A (1983) Rezultatet e kërkimeve parazitologjike, pjesë përbërëse në sqarimin e epidemiologjisë të sëmundjeve me vatra natyrore. Rev Mjek 2:5–13

Gina A, Kastrati B (1974) *Ixodes ricinus* (L.) vektor i mundshëm i encefalitit ixodik. Buletini i Shkencave te Natyrës 3(3):63–71

Gina A, Suta K, Kastrati B, Azemi D (1975) Shërndarja e riqnave (Familija Ixodidae) në vëndin tonë e parë në prizmin e rëndësisë epidemiologjike. Buletini i Shkencave Mjekësore 2:63–71

Gina A, Sharofi F, Bashari V, Kastrati B, Bebej S (1986) Encefaliti iksodik-sëmundje me vatër natyrore infeksioni në vendin tonë. Rev Mjek 5:22–29

Gracia MJ, Lucientes J, Castillo JA, Peribáñez MA, Latorre E, Zárate J, Arbea I (2000) *Pulex irritans* infestation in dogs. Vet Rec 147:748–749

Gracia MJ, Calvete C, Estrada R, Castillo JA, Peribáñez MA, Lucientes J (2008) Fleas parasitizing domestic dogs in Spain. Vet Parasitol 151:312–319

Haarløv N, Kristensen S (1977) Beiträge zur Dermatologie von Hund und Katze. 3. Flöhe von Hunden und Katzen in Dänemark. Tierarztl Prax 5:507–511

Hamel D, Silaghi C, Rapti D, Kusi I, Pfister K (2008) Beitrag zur Kenntnis Vektor-übertragener Erkrankungen bei Hunden aus Albanien. 42. Jahrestag Österr Ges Tropenmed Parasitol, Innsbruck, 20.-22. 11. 2008, Kurzfass Vorträge:17

Haralampides ST (1978) Contribution to the study of cat's parasites and their public health importance. Hell Vet Med 21:117–119

Heneberg N, Heneberg D, Milošević J, Dimitrijević V (1968) Rasprostranjenost krpelja u Autonomnoj pokrajini Kosovu i Metohiji. Poseban osvrt na *Hyalomma plumbeum plumbeum* Panzer—rezervoara i vektora krimske hemoragične groznice čoveka. Zb Vojnomed Akad 1967:30–36

Hiepe T, Ribbeck R (1982) Veterinärmedizinische Arachno-Entomologie. Lehrbuch der Parasitologie, Bd 4. Verl G Fischer, Jena

Hinaidy HK (1991) Beitrag zur Biologie des *Dipylidium caninum*. 2. Mitteilung. J Vet Med Ser B 38:329–336

Jancke O (1938) Flöhe oder Aphaniptera (Suctoria). In: Dahl F (ed) Die Tierwelt Deutschlands und der angrenzenden Meeresteile nach ihren Merkmalen und nach ihrer Lebensweise, 35 Teil. Verl G Fischer, Jena, pp 1–42

Jensen JJF (2003) Untersuchungen zur Epizootiologie von im Blut nachweisbaren arthropogenen Infektionen beim Hund in Griechenland. Veterinary Dissertation. University of Leipzig, Germany

Kalvelage H, Münster M (1991) Die *Ctenocephalides-canis*- und *Ctenocephalides-felis*-Infestation von Hund und Katze. Tierarztl Prax 19:200–206

Kero A, Xinxho A (1998) Epidemiological characteristics of leishmaniasis in Albania in the period 1984–1996. Giorn Ital Med Trop 3:55–57

Knoppe T, Beck W, Gall Y, Pfister K, Pothier F, Stanneck D, Hellmann K (2003) Prävalenzen von Floharten bei Hunden.

DVG-Tag "Epidemiologie und Bekämpfung von Parasitosen", 20–21 Mar 2003, Leipzig, Germany, Abstr, p 37

Koutinas AF, Papazahariadou MG, Rallis TS, Tzivara NH, Himonas CA (1995) Flea species from dogs and cats in northern Greece: environmental and clinical implications. Vet Parasitol 58:109–115

Kral B (1986) Parasitenbefall der Katzen in einem Tierheim. Veterinary Dissertation. Veterinary University, Vienna

Kristensen S, Haarløv N, Mourier H (1978) A study of skin diseases in dogs and cats. 4. Pattern of flea infestation of dogs and cats in Denmark. Nord Vet-Med 30:401–413

Kulisic Z, Janjic D, Misic Z, Simic S (2000) Role of ticks in the prevalence of babesiosis at dogs in Krusevac area. Acta Parasitol 45:220–221

Larsen KS, Shaw SE, Kenny MJ, Day MJ, Lerga AI, Birtles RJ, Schiønning S (2001) A survey of tick species found on pet dogs and cats in Denmark (2000). 6th Int Symp Ectoparasites Pets, 12–15 May 2001, Westport, Co Mayo, Ireland, Proc, p 165

Lazri T, Duscher G, Edelhofer R, Bytyci B, Gjino P, Joachim A (2008) Infektionen mit arthropodenübertragenen Parasiten bei Hunden im Kosovo und in Albanien unter besonderer Berücksichtigung der Leishmanieninfektionen. Wien Klin Wochenschr 120(Suppl. 4):54–58

Liebisch A, Brandes A, Hoppenstedt K (1985) Zum Befall von Hunden und Katzen mit Zecken und Flöhen in Deutschland. Prakt Tierarzt 66:817–824

Lika M, Bërxholi K (2004) *Ixodes ricinus* dhe ethja Q në kafshë dhe quemësht. Buletini Matematika dhe Shkencat e Natyrës 1:58–66

Losson B, Baar D, Maréchal F, Barbé M, Mignon B (2003) Hard ticks (Acarina, Ixodidae) found on domestic carnivores in Belgium: a survey conducted during three consecutive years. 19th Int Conf World Assoc Adv Vet Parasitol, 10–14 Aug 2003, New Orleans, USA, Abstr, p 239

Luli M (1963) Rriqnat e familjes Ixodidae që parazitonjë në kafshët shtëpijake në Shqipëri. Buletini i Shkencave Bujqësore 2(1):108–137

Manfredi MT, Dini V, Piacenza S, Genchi C (1999) Tick species parasitizing people in an area endemic for tick-borne diseases in north-western Italy. Parassitologia 41:555–560

Marchiondo AA, Holdsworth PA, Green P, Blagburn BL, Jacobs DE (2007) World Association for the Advancement of Veterinary Parasitology (W.A.A.V.P.) guidelines for evaluating the effectsof parasiticides for the treatment, prevention and control of flea and tick infestation on dogs and cats. Vet Parasitol 145:332–344

Mekuli E (1959) Prilog poznavanju piroplazmoza domaćih životinja na Kosovu i Metohiji. Acta Vet (Beogr) 9:103–112

Mikačić D (1965) Krpelji primorskog pojasa Jugoslavije. 3. Rasprostranjenost i dinamika pojedinih vrsta u toku godine. Vet Arh 35:155–170

Milutinović M, Pavlović I, Kulisić Z (1997) Fauna of ticks (Acari: Ixodidae) of south-east Kosovo. Acta Vet (Beogr) 47:167–170

Milutinović M, Radulović Z (2002) Ecological notes on ticks (Acari: Ixodidae) in Serbia (central regions). Acta Vet (Beogr) 52:49–58

Morariu S, Dărăbus G, Oprescu I, Mederle N, Moraru EG, Morariu F (2006) Etiologia infestației cu purici la câini şi pisici din trei județe ale României. Rev Sci Parasitol 6:67–73

Moskvin SN (1958) Gel'mintofauna domačnyh životnyh Narodnoj Respublikii Albanii. Trudy Moskovsk Vet Akad 27:172–189 (in Russian)

Müller J (1986) Das aktuelle Flohspektrum (Siphonaptera) auf Stadthunden. Wiss Zschr Univ Leipzig, Math-Natwiss Reihe 35:653–659

Müller J, Kutschmann K (1985) Flohnachweise (Siphonaptera) auf Hunden im Einzugsbereich der Magdeburger Poliklinik für kleine Haus- und Zootiere. Angew Parasitol 26:197–203

Niak A (1972) The prevalence of *Toxocara cati* and other parasites in Liverpool cats. Vet Rec 91:534–536

Nijhof AM, Bodaan C, Postigo M, Nieuwenhujs H, Opsteegh M, Franssen L, Jebbink F, Jongejan F (2007) Ticks and associated pathogens collected from domestic animals in the Netherlands. Vector-borne Zoonotic Dis 7:585–596

Omeragić J (2008) Istraživanje krpelja familije Ixodidae na području Bosne i Hercegovine. Dissertation, Fak. Vet., University of Sarajevo, Bosnia i Herzegovina

Omeragić J, Jažič A, Zuko A (2003) Paraziti pasa i mačaka na području Bosne i Hercegovine ustanovljeni do 2002. godine. Veterinaria (Sarajevo) 52:157–164

Oswald B (1938) O vrstama, pojavi i rasprostranjenosti krpelja u Jugoslaviji, s osobitim obzirom na Južnu Srbiju. Jugoslov Vet Glasnik 18:54–61

Papadopoulos B, Morel PC, Aeschlimann A (1996) Ticks of domestic animals in the Macedonia of Greece. Vet Parasitol 63:25–40

Papazahariadou MG, Saridomichelakis MN, Koutinas AF, Papadopoulos EG, Leontides L (2003) Tick infestation of dogs in Thessaloniki, northern Greece. Med Vet Entomol 17:110–113

Parola P (2004) Tick-borne rickettsial diseases: emerging risks in Europe. Comp Immunol Microbiol Infect Dis 27:297–304

Parola P, Dovoust B, Raoult D (2005) Tick- and flea-borne rickettsial emerging zoonoses. Vet Res 36:469–492

Pavlidou V, Gerou S, Kahrimanidou M, Para A (2008) Ticks infesting domestic animals in northern Greece. Exp Appl Acarol 45:195–198

Pavlović I, Milutinović M, Petrović D, Terzin D, Terzin V (2002) Epizootiological research of canine babesiosis in the Belgrade district. J Protozool Res 12:10–15

Petrovec M, Sixl W, Marth E, Bushati N, Wüst G (2003) Domestic animals as indicators of *Anaplasma* species species infections in northern Albania. Ann New York Acad Sci 990:112–115

Petroviћ Z, Borђoški A (1955) Prilog poznavanju faune krpelja NR Crne Gore. Acta Vet (Beogr) 5:35–41

Peus F (1938) Die Flöhe. Verl P Schöps, Leipzig

Piotrowski F (1979) Ectoparasites of dogs and cats, their importance and distribution in Europe. Wiad Parazytol 25:387–397

Piotrowski F, Połomska J (1975) Pasożyty zewnętrzne psa domowego (*Canis familiaris* L.) z terenu Gdańska. Wiad Parazytol 21:441–451

Principato M, Di Guiseppe S, Camerlengo L, Liottier B (1989) Étude préliminare sur la distribution saisonniere de certains Ixodidae (Acarina, Ixodoidea) d'intérêt sanitarie dans la province de Perouse (Italie centrale). Bull Soc Franc Parasitol 7:269–276

Prokopič Â (1960) Rezultaty gel'mintologičeskih issledovanij sobak i košek v Albanii. Ceskoslov Parasitol 7:139–149 (in Russian)

Raschka C, Ribbeck R, Haupt W (1994) Untersuchungen zum Ektoparasitenbefall bei streunenden Katzen. Monatsh Veterinarmed 49:257–261

Rataj AA, Posedi J, Bidovec A (2004) Ectoparasites: *Otodectes cynotis, Felicola subrostratus* and *Notoedres cati* in the ear of cats. Slov Vet Res 41:89–92

Rinaldi L, Spera G, Musella V, Carbone S, Veneziano V, Iori A, Cringoli G (2007) A survey of fleas on dogs in southern Italy. Vet Parasitol 148:375–378

Rosický B (1958) Parasitologická expedice ČSAV v Albánské Lidové Republice. Vestnik Ceskoslov Akad Ved 67:638–643

Rosický B (1960) Résultats des recherches faites par l'expedition parasitologique de l'Academie des sciences tchécoslovaque en Albanie. Ceskoslov Parasitol 7:5–16

Rosický B, Gjini N (1960) Blohi (Aphaniptera) i ih hozâeva, najdennye parazitologičeskoj èkspediciej Čehoslovackoj Akademii Nauk v Albanii. Ceskoslov Parasitol 7:5–16 (in Russian)

Rosický B, Černý V, Luli M (1960) Contribution à l'étude sur la présence, la distribution et la bionomie des tiques (Ixodoidea) en Albanie. Ceskoslov Parasitol 7:159–188

Rovery C, Brouqui P, Raoult D (2008) Questions on mediterranean spotted fever a century after its discovery. Emerg Infect Dis 14:1360–1367

Rudzińska M, Sulgostowska T (1996) Pchły pasożytujące u psów z dwóch warszawskich schronsik, miejskiego i podmiejskiego. Wiad Parazytol 42:229–234

Sabolić M (1997) Najčešće bolesti kože u pasa i mačaka s posebnim osvrtom na raširenost, dijagnostiku i liječenje—veterinarska stanica Varaždin (u razdoblju od 1994. do 1996.). Vet Stn 28:329–335

Schulze P (1918) Ein Beitrag zur Zeckenfauna Mazedoniens. Sitzungsber Ges Naturforsch Freunde Berlin: 61–66

Shaw SE, Day MJ, Birtles RJ, Breitschwerdt EB (2001) Tick-borne infectious diseases of dogs. Trends Parasitol 17:74–80

Sobrero L, Manilla G (1988) Aggiornamenti sulle zecche d'Italia. Bonifica 4, Suppl. 2

Sotira B (2000) Zoonotic diseases of major concern in Albania. WHO mediterranean zoonoses control centre. Inf Circular 49:6–8

Sotiraki ST, Koutinas AF, Leontides LS, Adamama-Moraitou KK, Himonas CA (2001) Factors affecting the frequency of ear canal and face infestation by *Otodectes cynotis* in the cat. Vet Parasitol 96:309–315

Stella E, Khoury C, D'Amato FR, Rivosecchi L (1988) Nuovi dati sulla biologia di *Rhipicephalus sanguineus* (Ixodidae) nella periferia di Roma. Riv Parassitol 49:3–12

Supperer R, Hinaidy HK (1986) Ein Beitrag zum Parasitenbefall der Hunde und Katzen in Österreich. Dtsch Tierarztl Wschenschr 93:383–386

Tomaševiћ T (1962) Prilog poznavaњu piroplazmoza domaћih životiња i faune krpelјa Crne Gore. Acta Vet (Beogr) 12:64–72

Tovornik D, Vesenjak-Hirjan J (1988) A revision of ticks belonging to the *Rhipicephalus sanguineus* complex (Latreille), collected in the Yugoslav coastal region. Biol Vestn 36:77–84

Tovornik D, Vesenjak-Hirjan J (1989) Invazija iksodidnih krpelja iz kompleksa *Rhipicephalus sanguineus* (Latreille) na domaće životinje na otoku Mljetu. In: Kesić B, Vesenjak-Hirjan J (eds) Otok Mljet. Ekološke i zdravstven prilike. Jugoslavenska akademija znanosti i umjetnosti. Razred zu medicinske znanosti, Zagreb, pp 71–82

Visser M, Rehbein S, Wiedemann C (2001) Species of flea (Siphonaptera) infesting pets and hedgehogs in Germany. J Vet Med Ser B 48:197–202

Wagner J (1939) Beiträge zur Kenntnis der Aphinapterenfauna Jugoslaviens. Glasnik Skopskog Naučn Društva 20:155–163

Wall R, Shaw SE, Penaliggon J (1997) The prevalence of flea species on cats and dogs in Ireland. Med Vet Entomol 11:404–406

Zakson M, Gregory LM, Endris RG, Shoop WL (1995) Effect of combing time on cat flea (*Ctenocephalides felis*) recovery from dogs. Vet Parasitol 60:149–153

Zanaj S, Malaj Z, Koidheli A (2002) Rivlerësim i ixodidofaunës së dhenëve. Rev Vet (Tirana) 2:74–85

Zarzèrè K (1988) Dannye o ètiologii parazitarnoj invazii mel'kih životnyh. Arch Vet 18:47–85 (in Russian)

Zenner L, Drevon E (2003) Etude épidémiologique des populations de tiques rencontrées dans 12 clientèles de l'Ain et de la Haute-Savoie. Rev Med Vet 154:225–230