

Ectoparasite infestations of urban stray dogs in Greece and their zoonotic potential

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Abstract. The presence of ectoparasites is very common in stray dogs worldwide. So far there are limited data on the spread of external parasites of dogs in Greece. Due to the potential risk of human infestation and/or transmission of zoonotic agents, knowledge of their abundance and distribution is essential in order to better define preventive measures. Therefore, the aim of this study was to assess the prevalence of external parasites of stray dogs from the area of Thessaloniki Greece. Out of a total of 242 stray dogs (85 males and 157 females) tested, the greatest percentages of infestation of 46.28% and 43.8% by fleas (*Ctenocephalides felis* and *Ctenocephalides canis*) and ticks (*Rhipicephalus sanguineus*) respectively were observed. Moreover, 15 dogs (6.20%) were found infested by *Sarcoptes scabiei var canis*, 8 (3.31%), by *Otodectes cynotis* while 4 (1.65%) dogs were infested by *Cheyletiella sp* and *Demodex canis*. Finally, three dogs (1.24%) were found infested by lice (*Trichodectes canis*). A statistically significant higher percentage of external parasites was detected in young dogs compared to adults ($P=0.0001$) and in males compared to females ($P<0.0001$), while this difference was not statistically significant in short haired compared to long haired and in small size compared to large size dogs ($P= 0.6938$ and $P=0.9934$, respectively). The results of this study support the assumption that stray dogs constitute a considerable source of ectoparasites and their infestation is indicative of the presence and abundance of ectoparasites in an area.

INTRODUCTION

Ectoparasite infestation of dogs is very common, in a variable form and extent though, worldwide. Depending on the ectoparasite involved and host immune competency, infestation results in a variety of clinical situations from a mild inconvenience, to severe skin diseases (Moriello, 2003). Moreover, ectoparasites are vectors of a wide variety of bacterial, virus or other parasitic

agents which cause serious diseases in dogs (Taylor *et al.*, 2007). Some ectoparasites can also cause clinical disorders as well as transmit zoonotic pathogens to humans (Weese and Fulford, 2011). They are also easily adapted to variable environmental conditions with long survival periods without feeding (Dantas-Torres, 2008).

A rough estimate of 480 million stray dogs worldwide roaming the streets has been reported in 2008 by the World Society for the

Protection of Animals (WSPA, 2008). Stray dog overpopulation is more frequent in socioeconomically disadvantaged countries but remain an important problem in Europe, despite the legislative measures against dog abandonment and the efforts of numerous animal welfare non-governmental organizations to improve this situation. Stray dogs are more prone to ectoparasites and the pathogens they transmit, due to poor body condition and lack of regular antiparasitic treatment. They also have increased chances to be infested as they roam over long distances, socialize with many other animals and live in groups.

Sometimes they have a close contact with people, mostly the puppies or while they enjoy occasional prevention or treatment of public and private initiatives.

So far there are limited data on the spread of external parasites in stray dogs in Greece where the environmental conditions are favorable for ectoparasites (Papa *et al.*, 2011), vector borne diseases are prevalent (Athanasidou *et al.*, 2012; Valiakos *et al.*, 2012), while economical restrictions resulted in minimizing preventative measures.

The aim of this study was to evaluate the current status of ectoparasite infestation in stray dogs in an urban area in Thessaloniki Greece and identify possible associations with their demographic data.

MATERIALS AND METHODS

A total of 242 stray dogs, collected by various animal welfare societies for neutering from December 2011 to December 2013, were examined for the presence of ectoparasites. Stray dogs were living at the greatest area of Thessaloniki the second largest city of Greece, on the northern side of the country (Latitude: 40°38.61722 N, Longitude: 22°55.85162 E). The city lies in a transitional climatic zone, displaying characteristics of a humid subtropical climate due to the Pindus rain shadow drying the westerly winds and a hot-summer Mediterranean climate.

With respect to age, dogs were divided into young dogs (<6 months) and adults based

on the state of their teeth, due to the fact that there were no records on the accurate age. Sex of each animal was also recorded. The majority of dogs were adults (158 - 65.29%) while 84 - 34.71% dogs were less than six months old. The dogs were also divided in two groups according to the length of their hair (105 short haired - less than 4cm- and 137 long haired - more than 4cm, dogs). Finally, dogs based on their bodyweight were divided in those with a bodyweight less than 10 kg (small size dogs) and those equal or more than 10 kg (large size dogs). Medical history including antiparasitic treatment administration was unknown. The presence of ectoparasites was detected according the following procedure. At first an overview of the skin of each dog took place. Then, multi skin scraping (minimum 10 superficial and deep) were performed in order to collect specimens for the presence of mites. Special attention was paid on suspicious areas of the skin. The next step was to collect all ticks carefully from each infested dog while the method of the adhesive strip was conducted on many skin areas. Finally, for assessing the presence of ear mites, material was collected from both ear canals using sterile cotton buds. For the identification of all collected ectoparasites previously published morphological keys for fleas (Hopkins and Rothschild, 1953), lice (Zlotorzycza *et al.*, 1974), mites (McDaniel, 1979), and ticks (Walker *et al.*, 2000) were used.

Chi-square test was run to determine the significance of the difference of positive group' percentages among the levels of all categorical parameters (age, sex, hair length and body size) employing appropriate software MedCalc® v. 9.1.2.0 for statistical analysis. P values <0.05 were considered significant.

RESULTS

In a total population of 242 examined dogs four species of mites were identified, *Sarcoptes scabiei var canis* in 15 (6.20%), *Otodectes cynotis* in 8 (3.31%), *Cheyletiella sp* and *Demodex canis* were identified in 4 (1.65%) dogs (Table 1). A great percentage of

46.28% and 43.8% of dogs were infested with fleas (*Ctenocephalides felis* and *Ctenocephalides canis*) and ticks (*Rhipicephalus sanguineus*) respectively (Table 1). Finally, three dogs (1.24%) were infested with lice (*Trichodectes canis*) (Table 1).

A statistically significant higher percentage of 24% (13.25-33.22 95% Confidence Interval-CI) ectoparasite infestation was observed in young dogs compared to adults (P=0.0001). Similarly, prevalence of infestation differs statistically significant between male and female dogs (P<0.0001). Although percentages of infestation in long hair and large size dogs were higher than that in short hair and small size dogs these differences were not statistically significant (P=0.6938 and P=0.9934, respectively).

DISCUSSION

In the present study fleas were the most prevalent ectoparasites (35.12%) in stray dogs followed by the tick *Rhipicephalus sanguineus* (27.69%) whereas in Tehran, Iran (Jamshidi *et al.*, 2012) it was recorded that ticks were the greater majority of ectoparasites found (36.4%) followed by higher prevalence of fleas and mites (29.4% and 25.9% respectively). Interestingly, *Rhipicephalus sanguineus* is reported as the most prevalent tick in Brazil (Dantas-Torres, 2008) as in other tropical countries while in Europe *Ixodes ricinus* and *Dermacentor reticulatus* are referred as the most prevalent ticks (Klimpel *et al.*, 2010).

In Albania a slightly decreased spread of infestation for *R. sanguineus*, (23.8%) and a significant increase of fleas (75.7% for *C.*

Table 1. Percentages of ectoparasite infestation in stray dogs in the urban area of Thessaloniki Greece

	<i>Cheyletiella</i> <i>sp</i>	<i>Demodex</i> <i>canis</i>	<i>Otodectes</i> <i>cynotis</i>	<i>Sarcoptes</i> <i>scabiei</i>	<i>Rhipicephalus</i> <i>sanguineus</i>	<i>Trichodectes</i> <i>canis</i>	<i>Ctenocephalides</i> <i>canis/felis</i>	
Total Dogs % positive	1.65	1.65	3.31	6.20	27.69	1.24	35.12	
Young % positive	1.19	3.57	8.33	5.95	33.33	3.57	36.90	
Age	Adults % positive	1.90	0.63	0.63	6.33	24.68	0.00	34.18
	P-value	0.9068	0.2384	0.0049	0.8703	0.2003	0.0752	0.7791
Gender	Male % positive	2.35	1.18	3.53	9.41	34.12	1.18	43.53
	Female % positive	1.27	1.91	3.18	4.46	24.20	1.27	30.57
	P-value	0.9195	0.9180	0.8171	0.2131	0.1347	0.5834	0.0608
Hair length	Short hair % positive	0.95	2.86	1.90	8.57	23.81	0.00	37.14
	Long hair % positive	2.19	0.73	4.38	4.38	30.66	2.19	33.58
	P-value	0.8094	0.4359	0.4796	0.2843	0.3005	0.3473	0.6606
Body size	Small size % positive	4.61	1.53	7.69	3.07	23.07	3.07	32.30
	Large size % positive	0.56	1.69	1.69	7.34	29.37	0.56	35.59
	P-value	0.1044	0.6290	0.0562	0.3572	0.4186	0.3624	0.7458

canis) was recorded (Xhaxhiu *et al.*, 2009) while a similar prevalence of fleas (35.42%) and a significantly decreased spread of *R. sanguineus* (6.25%) was observed in Erzerum region (Turkey) (Aldemir, 2007). Similar results have been also recorded from Nigeria (Omudu *et al.*, 2010) where a high prevalence of dogs (39.91%) infested with fleas was found, followed by infestation rates of 12.9% for ticks and mites and 10.6% for lice, respectively. In contrast, in northeast Brazil's (Fortaleza) (Klimpel *et al.*, 2010) the highest prevalence of 100% for *R. sanguineus* in examined dogs was reported and a prevalence of 56.5% for fleas. Finally, in Gwang-ju City, Republic of Korea (Chee *et al.*, 2008), *Otodectes cynotis* was found to be the most frequent parasite (22.3%, 23 / 103), followed by *Sarcoptes scabiei var canis* (19.4%, 20 / 103), *Ctenocephalides canis* (6.8%, 7 / 103), *Demodex canis* (4.9%, 5 / 103), and *Trichodectes canis* (1.0%, 1 / 103).

The infestation rate by overall ectoparasites was higher in male than in females. This is in agreement with previous studies (Chee *et al.*, 2008; Jamshidi *et al.*, 2012; Mosallanejad *et al.*, 2012) and it could be attributable to behavioural factors specific to females such as less socializing during pregnancy rather than any sex predisposition. However, this is in contrast with the results in a similar study in Turkey (Aldemir, 2007), where infestation was more prevalent among females because for their confinement in certain heavily infested areas, undergoing therefore frequent re-infestations.

Moreover, a higher percentage of infestation was observed in younger animals which has been attributed in previous studies to the lack of acquired immunity in puppies compared to adult dogs (Mosallanejad *et al.*, 2012).

Although, the study was performed in an urban area where environmental conditions are considered as less favorable for the survival of ectoparasites than in rural areas (Dantas-Torres *et al.*, 2009; Wells *et al.*, 2012), the town is surrounded by a forest and therefore stray dogs can easily be exposed to ticks.

This survey demonstrates that ectoparasitosis is not a rare event in stray dog populations. Since ectoparasites of dogs can affect both animals and humans control strategies are strongly advisable. Parasite control should be also applied when neutering stray dogs for stray dog population control. It is obvious that pet abandonment has enormous impact from both the veterinary and public health standpoints. Veterinary practitioners, public health services and education system should promote effective and regular parasite control and educate the public about the potential risk of zoonotic parasites.

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