



Short communication

A survey of fleas on dogs in southern Italy

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Abstract

A survey aimed at studying the presence and distribution of fleas on dogs was conducted in an area of southern Italy. Between February 2005 and 2006, dogs were examined for fleas at four private veterinary clinics, with a twice-weekly frequency. Fleas were detected on 246 (17.9%) out of the 1376 tested dogs. A total of 960 fleas were sampled and two species were identified, namely *Ctenocephalides felis felis* (16.3% of the tested dogs) and *Ctenocephalides canis* (1.5% of the tested dogs). The results of the logistic regression model showed a significant association between the flea positivity and the following independent variables: housed with other dogs or cats and utilization, i.e. increasing prevalence from pets to guard, hunting, and stray dogs. Clinical symptoms (pruritus, alopecia, and flea allergic dermatitis) were also observed in some of the flea positive dogs. Flea infestation was detected throughout the year, although the prevalence was higher during the period between June and October.

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1. Introduction

More than 2000 flea species and subspecies have been described throughout the world (Borror et al., 1981); however, those of the genus *Ctenocephalides* are the ones that commonly affect dogs and cats. *Ctenocephalides felis felis* is the most common flea of dogs and cats in Europe and USA (Akucowich et al., 2002; Beck et al., 2006), whereas *Ctenocephalides canis* is largely confined to dogs and more restricted in its distribution (Marchiondo et al., 2007). The worldwide distribution of fleas, their role as vectors for a variety of pathogens, their involvement in flea allergy dermatitis (FAD) demonstrate

the need for investigations aimed at studying flea biology and epidemiology, and the factors that influence their occurrence and distribution (Beck et al., 2006). Several studies have been published regarding the distribution and prevalence of fleas on dogs from different parts of the world (Krämer and Mencke, 2001). However, limited epidemiological information is available regarding these ectoparasites on dogs in Italy. In order to address this lack of information, the present paper reports the results of a survey aimed at studying the presence and distribution of the different flea species on dogs from an area of southern Italy.

2. Materials and methods

Between February 2005 and 2006, dogs were examined for fleas at four private veterinary clinics located in the Campania region of southern Italy, with a twice-weekly frequency. All dogs brought to the clinics

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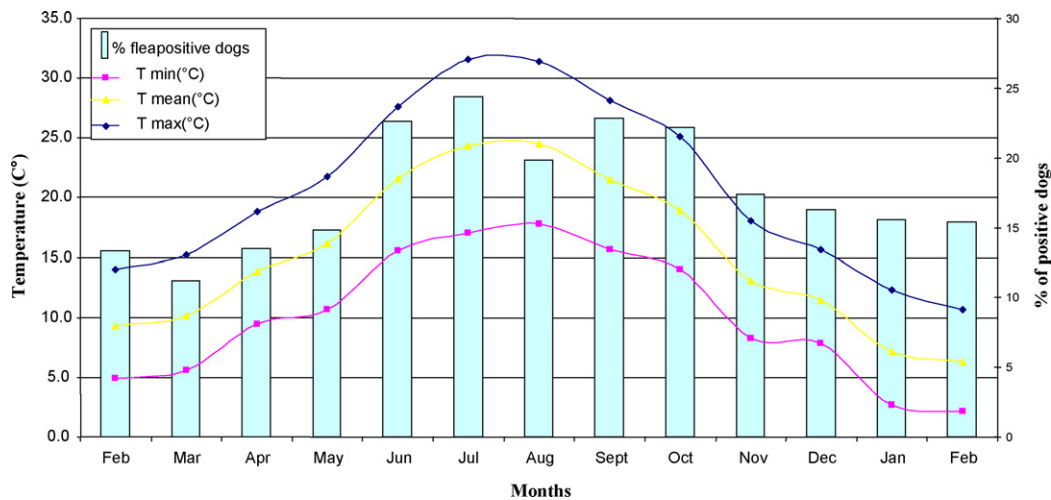


Fig. 1. Monthly prevalence (%) of fleas found on dogs from the Campania region (southern Italy) and monthly temperature data (minimum, mean, and maximum).

for veterinary consultation (including flea infestation problems) were examined. Each dog was registered as to sex, age, weight, hair length, utilization, housed with other dogs or cats, indoor/outdoor night status, date, geographical origin, and clinical symptoms related to flea infestation (pruritus, alopecia, and FAD). A questionnaire form was designed to record these data.

Each dog was thoroughly visually examined, going through all areas of the body for 15–20 min, in order to establish the presence/absence of fleas, as well as the intensity of infestation, ranked into three levels (1–5 fleas; 6–20 fleas; >20 fleas). From each positive dog, fleas (1–10) were collected in small plastic tubes containing alcohol at 70% and preserved at room temperature until the identification, performed utilizing the keys proposed by Berlinguer (1964).

Monthly records of minimum, mean, and maximum temperatures (°C) were obtained from eight meteorological stations located in the study area.

The dog profile data (all categorical) were analyzed by univariate (Pearson's χ^2 -test for independence) and multivariable (logistic regression) statistical analyses by using a dependent variable of the dog flea status (positive/negative). Only the independent variables that showed significance ($P < 0.01$) in the univariate test were used for the logistic regression model. If interaction between variables was suspected, logistic regression models were run with and without these variables in order to evaluate possible effect modification on their behalf (Hosmer and Lemeshow, 2000). All the statistical analyses were performed using SPSS 13 for Windows.

3. Results

Fleas were detected on 246 (17.9%, 95% CI = 15.9–20.0%) out of the 1376 tested dogs.

Fig. 1 reports the prevalence values by months as well as the monthly minimum, mean, and maximum temperature values recorded in the study area during the investigation. Although the flea prevalence was generally higher during the period between June and October (range = 19.8% in August to 24.4% in July), flea infestation on dogs was detected throughout the year.

Regarding the intensity of infestation, out of the 246 positive dogs, 79 (32.1%, 95% CI = 26.4–38.4%) were infested by 1–5 fleas; 89 (36.2%, 95% CI = 30.2–42.6%) by 6–20 fleas, and 78 (31.7%, 95% CI = 26.0–38.0%) by >20 fleas.

A total of 960 fleas were sampled and two species were identified, namely *C. felis felis* (258 males and 624 females) and *C. canis* (6 males and 72 females).

C. felis felis was the predominant species, found on 225 (16.3%, 95% CI = 14.5–18.4%) dogs; *C. canis* was found on 21 (1.5%, 95% CI = 1.0–2.4%) dogs. Mixed infection was not detected in any of the examined dogs. The results of the logistic regression model are reported in Table 1. The independent variables associated with the flea positivity were housed with other dogs or cats and utilization, i.e. the risk to be infected by fleas increased from pet to guard, hunting, and stray dogs.

The localization of the fleas in the different part of the dogs' body is reported in Fig. 2. A geographical information system (ArcGIS 8.3, ESRI) was used in order to organize the spatial information on the distinction of the different dog body parts regarding

Table 1
Results of the logistic regression model

Independent variables	Odds ratios	95% confidence intervals		Standard errors	P-values
		Inferior	Superior		
Housed with other dogs	1.53	1.08	2.17	0.178	0.017
Housed with cats	3.42	2.26	5.20	0.213	0.000
Utilization					
Guard dog vs. pet	2.87	1.62	5.08	0.291	0.000
Hunting dog vs. pet	3.77	1.95	7.30	0.337	0.000
Stray dog vs. pet	4.69	2.03	10.82	0.000	0.000

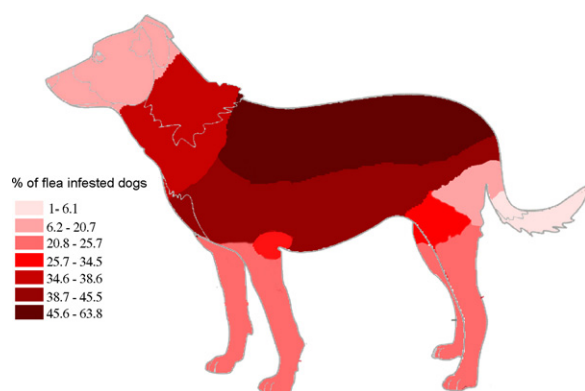


Fig. 2. Distribution of flea on the different parts of the dogs' body (data elaborated with GIS).

flea infestation. Regarding the clinical symptoms, 73 out of the 246 positive dogs (29.7%, 95% CI = 24.1–35.9%) showed pruritus, 27 (11.0%, 95% CI = 7.5–15.3%) alopecia, and 21 (8.6%, 95% CI = 5.5–12.9%) presented FAD.

4. Discussion

In recent years, following the discovery of a large market for the control of fleas in small animals, the interest in these minute insects has been resurrected (Roncalli Amici, 2004). It has been estimated that flea-related diseases are responsible to cover 50% of dermatological cases reported to veterinarians and 35% of total veterinarian effort (Rust and Dryden, 1997). In addition, this interest has also zoonotic implications because *Ctenocephalides* species can feed on human beings, and *C. felis felis* has been implicated in the zoonotic transmission of a number of diseases (Genchi, 1992). For the above reasons, studies aimed at studying flea epidemiology are needed (Beck et al., 2006). The findings of the present survey, first conducted in Italy, showed that *C. felis felis* was the predominant flea species found on dogs, in agreement with other studies

conducted in Europe and USA (Beck et al., 2006). The higher prevalence of *C. felis felis* than *C. canis* could also be due to the fact that the survey was conducted in urban areas, where the cat flea usually predominates (Alcaino et al., 2002; Gonzalez et al., 2004). Various levels of flea infestation and a higher number of females than males were found in agreement with other studies (Alcaino et al., 2002). The back and the abdomen resulted the most heavy infested zones of dog's body as shown in the dog silhouette elaborated with GIS, technologies that—in addition to their broad utility in epidemiology (Cringoli et al., 2005; Rinaldi et al., 2006) hold promise in organizing spatial information involving the distinction of anatomic relationships (Ganai et al., 2006). Once again it is clear that the use of GIS is important for veterinary practice, research, and teaching, in order to understand spatial health phenomena.

Housed with other dogs or cats and utilization (increasing risk from pet to guard, hunting, and stray dogs) were risk factors associated with flea infestations. Regarding utilization, the results could be explained by the fact that the guard, hunting, and stray dogs usually roam more freely than pets and may have therefore more opportunities to be infested. However, a major bias in the analysis is that no data were included on flea prophylaxis; there may be confounding with pet status and flea prophylaxis, because dogs in closer contact with humans could be more likely to be treated for fleas.

Clinical symptoms (pruritus, alopecia, and FAD) were also observed in some of the flea positive dogs; flea-associated dermatoses were also reported in dogs from Greece (Koutinas et al., 1995).

Seasonal studies regarding flea prevalence are underreported in the literature (Beck et al., 2006). The data of the present survey have shown that fleas occur over all seasons of the entire year in the Campania region of southern Italy, an area representative of the Mediterranean Basin; similar results have been also reported in a study conducted in different parts of Germany, i.e. a continental part of Europe where the

highest prevalence in dogs was detected between June and August (Beck et al., 2006). In our study, the peak was reached between June and October; however, it should be noted that temperatures in the studied year provided the outdoor environmental conditions suitable for flea development throughout the year.

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