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Fleas parasitizing domestic dogs in Spain

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Abstract

In addition to their importance to veterinary clinical practice as ectoparasites, fleas of domestic dogs are of special concern because they can be vectors of disease, including zoonoses. Flea assemblages parasitizing domestic dogs usually comprise several flea species whose distribution is determined by factors acting at several scales. Knowledge of these factors will aid in assessment of the distribution patterns of flea parasitism, and is an important tool in developing control strategies and in evaluation of flea-borne disease risk in dogs and humans. In this survey we used data from 744 domestic dogs from 79 localities in Spain to explore the associations between the abundance of flea species, host-dependent factors (sex and age), and host habitat factors including abode (farm, house with garden, apartment), location (urban or rural), the presence of other pets, and dog activity (measured as the frequency with which dogs left their abode). We also considered environmental factors including the time of year and mean annual temperature and rainfall. Variations in flea community structure at infracommunity and component community levels were also explored. Four flea species were found parasitizing dogs. *Ctenocephalides felis* was the most abundant (88.02% of fleas identified), followed by *Ctenocephalides canis* (10.38%), *Pulex irritans* (1.47%) and *Echidnophaga gallinacea* (0.13%). Overall flea abundance was higher on dogs living on farms than in apartments, as was the abundance of *Ct. felis*, *Ct. canis* and *P. irritans*. *Ct. felis* was more abundant on dogs living in houses than in apartments, but the reverse was found for *P. irritans*. Overall flea abundance and *Ct. canis* abundance were highest in rural areas, whereas the presence of other pets sharing the abode was associated with higher overall flea abundance and *Ct. felis* abundance. Only *P. irritans* abundance was positively related to the activity of dogs. *Ct. canis* and *P. irritans* abundances were higher during the warm period of the year. Mean annual temperature was negatively correlated with overall, *Ct. canis* and *P. irritans* abundances, but positively related to *Ct. felis* abundance. Annual rainfall was negatively correlated with *Ct. canis* and *P. irritans* abundances. Variations in the number of flea species found on a dog reflected the abundance distribution patterns for each species and their associations with host habitat and environmental factors. At the component community level, flea species richness was inversely related to annual mean temperature. The structure of flea assemblages on dogs was mainly associated with host habitat and environmental variables, and not with host-dependent variables. However, a large amount of variation in flea abundance remained unexplained, suggesting the effect of other non-controlled factors.

Keywords: Dog; Flea abundance; Parasite distribution; Spain

1. Introduction

Some arthropod species play important roles in causing clinical disorders in humans and domestic animals, as well as acting as vectors of important

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diseases. Traditionally, interest in fleas in pet clinical practice has been related to anaemia and skin disease caused by flea bites. However, fleas harboured by pets can serve as the intermediate host for the nematode, *Acanthocheilonema reconditum*, and the dog tapeworm, *Dipylidium caninum* (Soulsby, 1982), both of which can parasitize humans. Moreover, the capacity of fleas to act as vectors for several microparasites is recognized, and has important implications for human health. For example, fleas are known to transmit the etiologic agent of bubonic plague, *Yersinia pestis*, from dogs to humans (Rust et al., 1971). In addition, fleas have been implicated in the transmission of the main etiologic agent of cat-scratch zoonosis (Comer et al., 2001; Chomel et al., 2006), several species of *Rickettsia* (Shaw et al., 2004; Schloderer et al., 2006), and several trypanosomatids (Zanatta-Coutinho and Marcos-Linardi, 2007).

Interest in fleas and the diseases they transmit has increased during recent years. Surveys of flea species found on dogs have recently been conducted, and it has been shown that there are differences in the spectrum of flea species related to geographical areas. Thus, the prevalence of particular species has been recorded in Germany (Visser et al., 2001), France (Franc et al., 1998), Greece (Koutinas et al., 1995), the United Kingdom (Chesney, 1995; Bond et al., 2007; Wall et al., 1997), the USA (Harman et al., 1987; Durden et al., 2005), Chile (Alcaíno et al., 2002) and other countries. In some of these studies, differences have been found in the occurrence of several flea species between rural or urban areas (Kristensen et al., 1978; Muller and Kutschman, 1985; Durden et al., 2005), or between outdoor or indoor environments (Franc et al., 1998). The annual population dynamics of several flea species have been investigated in Germany (Beck et al., 2006) and the USA (Durden et al., 2005).

As different fleas may parasitize dogs in different geographical areas, assessing the geographical distribution (and factors associated with it) of flea species on domestic dogs is important in developing flea control strategies, and in assessment of the occurrence of flea-borne diseases in dogs, humans and other companion animals such as cats (Durden et al., 2005; Marquez et al., 2006).

Despite the importance of knowing the distribution of flea species on dogs and the factors affecting their distribution, no investigation of this nature has previously been conducted in Spain. Therefore, we examined fleas from flea-infested dogs presenting to veterinary clinics throughout Spain to determine the flea species involved, and to assess species distribution as a function of host, host habitat and environmental factors.

2. Material and methods

We obtained flea samples from 744 dogs presenting to 150 veterinary practices at 79 localities in 32 Spanish provinces, including the Balearic and Canary islands. The veterinary practices collaborated voluntarily in the survey. Sampling occurred from January 2002 to December 2004, and the number of sampled dogs ranged from 2 to 16 per practice.

Only dogs parasitized by fleas were sampled. Veterinary practitioners performed an initial inspection of dogs brought to their practices. When fleas were detected the dog was confined in a box and a single oral dose of the systemic adulticide nitenpyram (Capstar®, Novartis Animal Health) was administered. Dogs less than 11.0 kg body weight were treated with tablets containing 11.4 mg active ingredient, whereas dogs with body weights between 11.1 and 57 kg were treated with tablets containing 57 mg active ingredient. After 2 h, dead fleas were collected from the soil in the box and by combing the coat of the dog. The collected fleas were stored in 70% ethanol and transferred to the Department of Animal Pathology (Zaragoza University, Spain) where the fleas were sexed and identified to species using the key of Beaucournu and Launay (1990).

Among the 744 dogs sampled there were 398 males, 342 females, and the sex of four was not determined. Of the 713 dogs whose age was known, 139 (19.49%) were 1–12-month old, 505 (70.82%) were between 1- and 9-year old, and 69 (9.68%) were 10–15-year old. In addition to sex and age, a range of other habitat variables was recorded for each dog. *Abode*: where the dog was housed. This comprised three categories including apartment, house with garden, and farm. Farms included commercial livestock breeding facilities and places where small groups of other animal species were kept as a hobby. *Location of the abode*: considered urban when located in a town or in the centre of a village, or surrounded entirely by urbanized area; considered rural when located in the country or in partially urbanized areas. *Other pets*: whether the abode was shared with other mammal pets such as dogs or cats. *Activity*: measured as the number of times that the dog, either with its owner or not, left the abode. Activity was recorded as (0) never, (1) once per month, (2) at least once per week, (3) several times per week, (4) at least once per day, or (5) the dog was housed in the abode only for resting or feeding.

The following environmental variables were also recorded. *Period of the year*: whether the dog was sampled in the warm period (May–October, the period